A FINGER ON THE PULSE:

analysis of site location patterns in subcoastal Southeast Queensland.

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I

INTRODUCTION

The research documented here is an exercise in applied archaeology. It has two objectives:

1. to contribute to the understanding of prehistoric adaptations in Southeast Queensland
2. to afford information of direct utility to the management of archaeological resources in this and other regions.

To achieve these goals the paper develops a predictive polythetic set of site location criteria (Clarke 1968:34, Williams *et al.* 1973) aimed towards the streamlining of site survey procedures.

Rationale

This work augments the Moreton Region Archaeological Project (MRAP), which was initiated in 1976 to systematically uncover the region's prehistory (Hall 1980). The rationale behind MRAP's parochial approach is simple. In the formative phase of the project researchers felt that Southeast Queensland as a whole would prove archaeologically interesting. These feelings drew their strength from evidence of the biogeographical peculiarities of the area (see Chapter Two). More directly relevant was the fact that burgeoning development throughout the region was destroying sites with research potential.

Due to conservation and salvage priorities emphasis to date has been placed on finely focussed enquiries into coastal prehistory (e.g. Donoghue 1979, Draper 1978, Richardson 1979, Robins and Hall 1981, Walters 1979). The results of these projects are presently being consolidated to provide a foundation for further work. The ethnohistoric picture is one of a semi-sedentary population which, although not entirely marine oriented, had "no need at any time of year ... to move far from the coastal strip" (Hall in press). As yet the archaeology has yielded no evidence to the contrary. This view is of interest with regard to debate surrounding coastal adaptations in eastern Australia. It largely agrees with the interpretations of Coleman (1978) and Lampert (1971a,b), but contrasts with Poiner's (1976) and McBryde's (1974) arguments that there was a seasonal movement of coastal people into inland or subcoastal areas. Clearly there is a need for better resolution of the problem of coastal - inland (*cum* subcoastal) dichotomies in adaptive strategies. Both my earlier study (1978) and the present paper address questions of subcoastal prehistory in an effort to illuminate regionally specific problems arising from this debate.

Strengthening our understanding of the region's human past should also help researchers and resource managers to cope better with increasing pressure on what remains of the archaeological record. However, the potential value of such research to the conservation process cannot be fully realized unless management implications are explicitly investigated. Of primary concern in this context are the exigencies of contract work, particularly site surveys, and the contribution of management studies to the greater body of archaeological knowledge (cf. Bowdler 1981a) These concerns prompted the orientation of this paper.

The initial stimulus to subcoastal research was the construction of a massive dam and powerhouse complex at Wivenhoe (Fig. 1). A large proportion of future work will be done by consulting archaeologists in response to further development in the area. This project presented an opportunity to consider several specific applications of research results to preempt some of the demands of these studies.

The Problem

Previous Research

In 1978 I raised a model of recent prehistoric adaptations in the subcoastal lowlands. The argument was founded on historical evidence and current environmental data and focussed on the problem of a winter coalescence of people along major subcoastal waterways. All the earliest explorers travelled through the lowlands in August and September and all reported groups of 25-40 individuals in various locations along the rivers. Some also saw large camps, one of which would have housed about 100 people and another about 45 people (Table 1). The paper tendered two competing hypotheses in explanation. Both were centred on the following arguments:

1. water was relatively scarce in winter, the most reliable sources being the major streams,

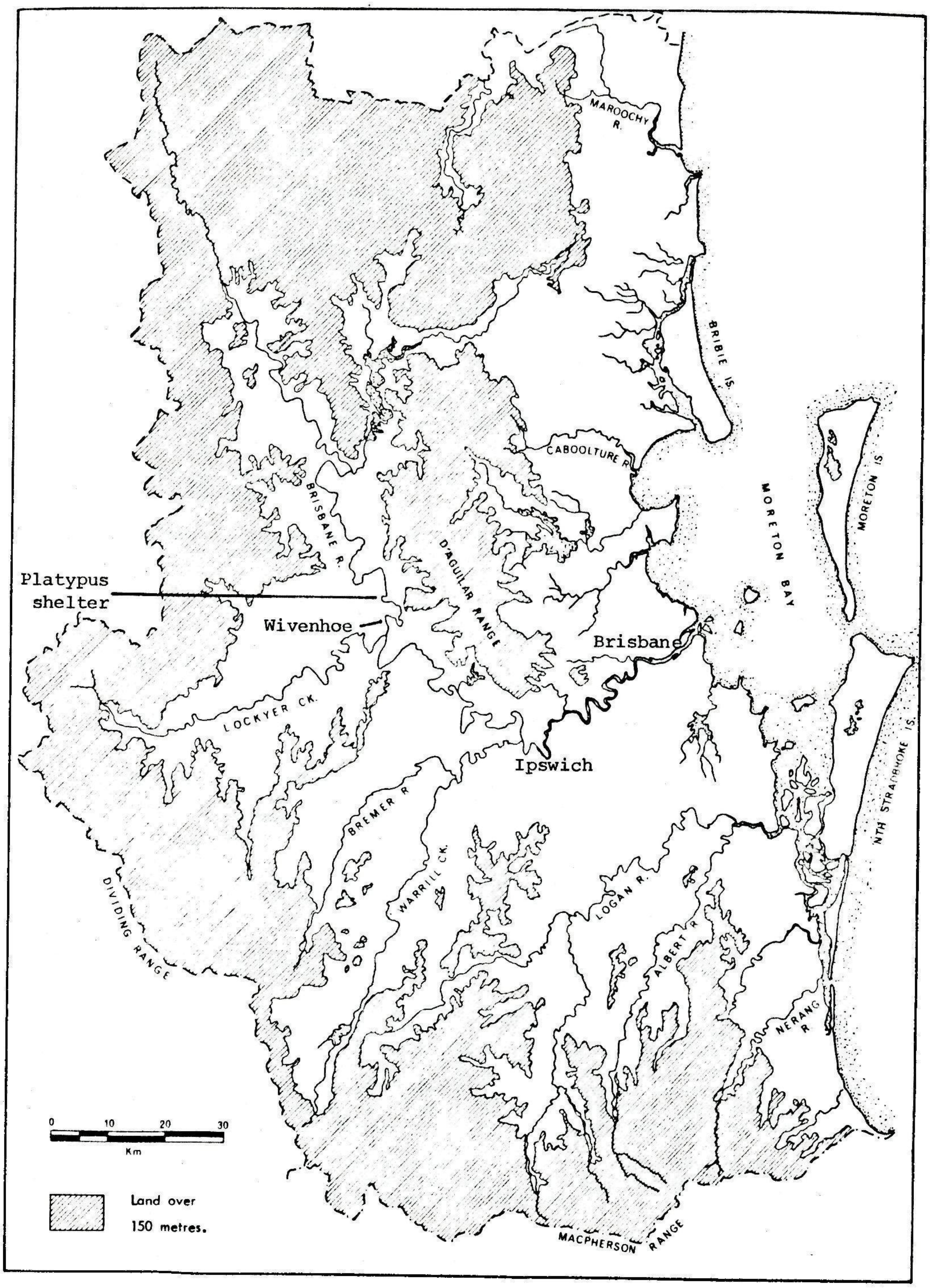


Figure 1. Location map showing the Moreton Region, Southeast Queensland, with major topographic features and places mentioned in text.

OBSERVER /	DATE	COMMENT AND REFERENCE
Oxley	23/9/1824	Pine Mountain area. "The country did not seem ill-peopled, fires being seen in every quarter from the eastern ranges...to the most distant west" (in Steele 1972:145).
	25/9/1824	The party "passed a family of natives" (in Steele 1972:146, see Cunningham, same date, below).
Cunningham	20/9/1824	The party could see "smokes, the indications of Natives, rising from the interjacent vallies or lower grounds" (in Steele 1972:162).
	25/9/1824	The explorers saw "a small fire around which were seated...a Man, some Women and Children,...a group of six persons" (in Steele 1972:171).
Lockyer	23/9/1825	Confluence of the Brisbane and Stanley Rivers. "Here I was in hope of falling in with a large tribe of natives - 9 huts being directly opposite where we landed...we saw several kangaroo and fish bones" (in Steele 1972:197).
	25/9/1825	"From the marks of their fires, their empty huts and the number of trees barked, I should think them very numerous in this neighbourhood" (in Steele 1972:197).
	3/10/1825	Fernvale area. The party saw "two men, a woman and three children" (in Steele 1972:201).
Cunningham	18/6/1829	Laidley area. While setting up evening camp the party saw "two women and some children", and later in the same place "two men..., two boys and a young woman" (in Steele 1972:314).
	30/6/1829	Hansford's Plain. Near a large lagoon the party "numbered upwards of twenty frames of huts" (in Steele 1972:324).
	3/7/1829	Esk area. The explorer saw "a small native family...resting at their little fires" (in Steele 1972:326).
	8/7/1829	Upper Brisbane River. When setting up camp, the party was approached by "a man, two women, a youth and three children" (in Steele 1972:332).
	13/7/1829	The explorer saw several columns of smoke rising from the river bank, and saw a small group of people near the river. A little further on, he saw another small group, which joined the first, "making a body of about twenty-four persons" (in Steele 1972:339).
	14/7/1829	Confluence of the Brisbane and Stanley Rivers. The party saw a group of "about twenty persons" and, a little further on, another "much larger party" of about thirty individuals (in Steele 1972:340-341).
	16/7/1829	Sandy - Middle Creeks area. The explorer saw several huts "of ancient construction" that appeared to have been recently used (in Steele 1972:343).
Simpson	1843	In documenting the "mountain tribes", he noted "they are very numerous, perhaps not less than 1500, and are divided into small tribes". He numbered the "river dwellers" at about 200 individuals (Langevad 1979:13).
Mathew	1910	"The family, consisting of husband and wife, or wives, with their children, constituted a distinct social unit. They occupied the same gunyah..., they ate together, they travelled together" (:153).
	"	"A few families claiming the same territory usually camped and travelled together, sometimes in smaller, sometimes in larger groups. I characterize such groups as communities" (:128-129).
Winterbotham	1957	"The number of persons in the Dungidau area varied from time to time, as they were always on the move - therefore the number of people in a camp also varied for the different groups would combine and then separate" (:72).

Table 1 . Selected historical references to the subcoastal population, with emphasis on groups size and composition.

2. fishing was primarily a winter activity, and
3. food resources were concentrated around the rivers in winter, but dispersed at low density throughout the study area in summer.

One hypothesis postulated that the lowland population lived near the major streams throughout the year, coping with seasonal changes in resource availability by synchronously altering exploitative strategies. Any movement of population was restricted to linear and/or circular migrations along or around the rivers and lagoons. The second suggested that the seasonal fluctuations in resource distribution engendered a pulsatory movement of population. Migrations were centripetal in winter, resulting in grouping on the rivers, and centrifugal in summer, resulting in the fragmentation of winter groups and population dispersal.

The first hypothesis was rejected. It was argued that the nature of the riverine resource base would have made it difficult for large groups to maintain themselves without exceeding normal energy expenditure patterns and/or accepting a monotonous and perhaps nutritionally inadequate diet. The second model was favoured because pulsatory movement could overcome the problems inherent in the first strategy and could thereby have allowed the population to maintain itself more effectively. The study intended to test the predictive capacity of the model against the results of trial excavations in Platypus Rockshelter (Fig. 1). However the results available at the time did not permit adequate verification. It was suggested that further work be undertaken to enable more conclusive experimentation.

Approach

The ultimate aim of this project is to predict subcoastal site locations. As King and Hickman point out (1977:362), "the trick is to make the predictions reliable". To this end, the paper takes a straightforward deductive approach in keeping with current concerns for procedural rigour (cf. Watson *et al.*1971). An analogue model of late Holocene subsistence-settlement patterns is constructed, its implications are statistically tested against independent site location data, and a set of propositions is offered for use and/or further refinement.

The model is a revised version of the pulsation hypothesis discussed above. The earlier argument suffered a number of inadequacies. It did not encompass all of the subcoastal zone; only the lowlands were considered. Several aspects of the resource base were neglected and conclusions pivoted on the assumption that there was only one exploitative strategy used in the area. This study introduces new evidence covering the entire subregion. To determine whether the idea of a single procurement strategy remains valid it has been necessary to revise the environmental reconstruction, reexamine the question of population organization *vis-a-vis* the resource base and reconsider the evidence bearing on subsistence technologies and camp types and locations.

The premise of the model is that hunter-gatherer domestic camps are primarily sited to facilitate satisfier subsistence strategies. This premise has its roots in formalist economic anthropology (cf. LeClair and Schneider 1968) and has been accepted by most researchers (e.g. Binford 1980, Clarke 1968:503-505, Jochim 1976:12-13, Peterson 1973, Smith 1975, Yellen 1977:73-75). Four main historical sources provide cornerstones for the arguments presented. These include Thomas Petrie's reminiscences of the early life around the Moreton Bay settlement, as recorded by his daughter (C. Petrie 1975), Mathew's account of life with two "tribes" in the region (1910), a compilation of information given by an elderly Aboriginal to Dr. L.P. Winterbotham, founder of the Queensland University Anthropology Museum (Winterbotham 1957), and the letters of Dr. S. Simpson, Crown Lands Commissioner and Protector of the Aborigines from 1842-1853 (transcribed by Langevad 1979). These documents are supplemented with the incidental observations of Aborigines made by the first European explorers, the anthropological literature, and other scientific sources, in an attempt to project as accurate a picture as possible from the limited data available.

Discussion is limited to the late Holocene in an attempt to avoid some of the pitfalls of direct historical modelling (cf. Ascher 1961:319 ff, Binford 1967, Chang 1967:229-230, Rhoads 1980). There is a substantial body of information bearing on clear changes in the Australian archaeological record after the last marine transgression. It is generally accepted that there were changes in stone tool technologies and exploitative patterns, and an intensification of site use (Bowdler 1981a Hughes and Djohadze 1980, Lampert 1971a) There is also evidence of more recent changes in adaptive strategies, most noticeably in technology and perhaps in subsistence-settlement patterns (cf. Mulvaney 1975:238-248). As discussed in the next chapter, there is a possibility that environmental fluctuations influenced these later changes. For this reason it is stressed that the reconstructive arguments tendered below apply only to the most recent period of relative environmental stability, namely the last 2,500 years.

The fieldwork design was also intended to reflect the importance of methodological precision. The recent literature has revealed an increasing preoccupation with regional sampling techniques. Many authors have strongly argued for the use of probability sampling as a rigorous, cost effective alternative to traditional judgement or haphazard sampling (e.g. Flannery 1976, Goodyear *et al.* 1978, Mueller 1975, Plog 1968, Thomas 1971). However, proponents of randomized sampling spend few words discussing the limitations of their methods. Most writers acknowledge that problems exist, especially in humid, forested areas with low visibility and/or where sites are unobtrusive or clustered (cf. Read 1975:45-47, Schiffer *et al.* 1978:1-2). Lovis (1976, see also Nance 1979) has experimented with point sampling to circumvent some of these difficulties, but the method is labour intensive and time consuming. Few others have explored workable alternatives in accessible publications. My attempt to execute a probability sample failed and "old" archaeology had to retrieve the situation. The reasons for this and its ramifications are discussed more fully later in the paper.

The analysis attempts to objectively assess the nature of subcoastal site distribution. A number of scholars are developing a wide variety of locational analysis techniques (Clarke 1977, 1968: 490-511, Gumerman 1971, Hodder 1978, Hodder and Orton 1976, Plog 1968).

Many quite sophisticated methods have been borrowed from geographers (e.g. Hagget 1965), but are only applicable when a large and relatively sound data base is available. There are few methods that have been shown to produce results from the ephemeral remains of hunter-gatherers, except in some regions where archaeologists have been operating for much longer than they have in Australia. In this country generally, and Southeast Queensland in particular, location studies are in their infancy. Consequently there are few, if any, precedents to this study (cf. Sullivan 1980, 1976). For these reasons a cautious analytical approach is taken. The experiments are as much an exploration of techniques as they are of the archaeological record *per se*.

A number of simple non-parametric tests are used to distil patterning in site locations without overextending the data base. The main aim of the tests is to monitor:

1. consistent associations between the presence of archaeological remains and a number of environmental variables, and
2. variation in these relationships through space.

Several rules are followed throughout to produce suitably conservative results:

1. in all tests the critical level of statistical significance is .05. This is relatively severe given the small size of the sample population,
2. all univariate analyses use corrected Chi^2 or Kolmogorov-Smirnov tests, which are inherently conservative, and
3. all bivariate and multivariate tests of association include determinations of both statistical significance and strength of association.

The work was done in two parts. Analysis of subsamples was completed by hand using a Canon statistical calculator with printout facility (Canola F-20P). Tests involving all the sites were done on the University of Queensland PDP10 computer using SPSS subprogrammes.

I have attempted to introduce an element of (somewhat optimistic) realism into the discussion of management implications. An hypothetical consulting project based on personal experience and the advice of State Government planners is used to illustrate the various points raised.

II

SUBCOASTAL ADAPTATIONS

The Environmental Setting

The subcoastal environment has been documented at a general level in several government reports (Anon. 1974, Anon. 1972, Cranfield *et al*. 1976, Mather 1976) and was discussed in my previous work (1978:6-23). The background information in the sections below has been abstracted from these sources. Other specific information has been drawn from a variety of specialized publications (as cited). This section is intended solely to acquaint the reader with the study area. Arguments concerning past use of this environment are put forward later in the chapter.

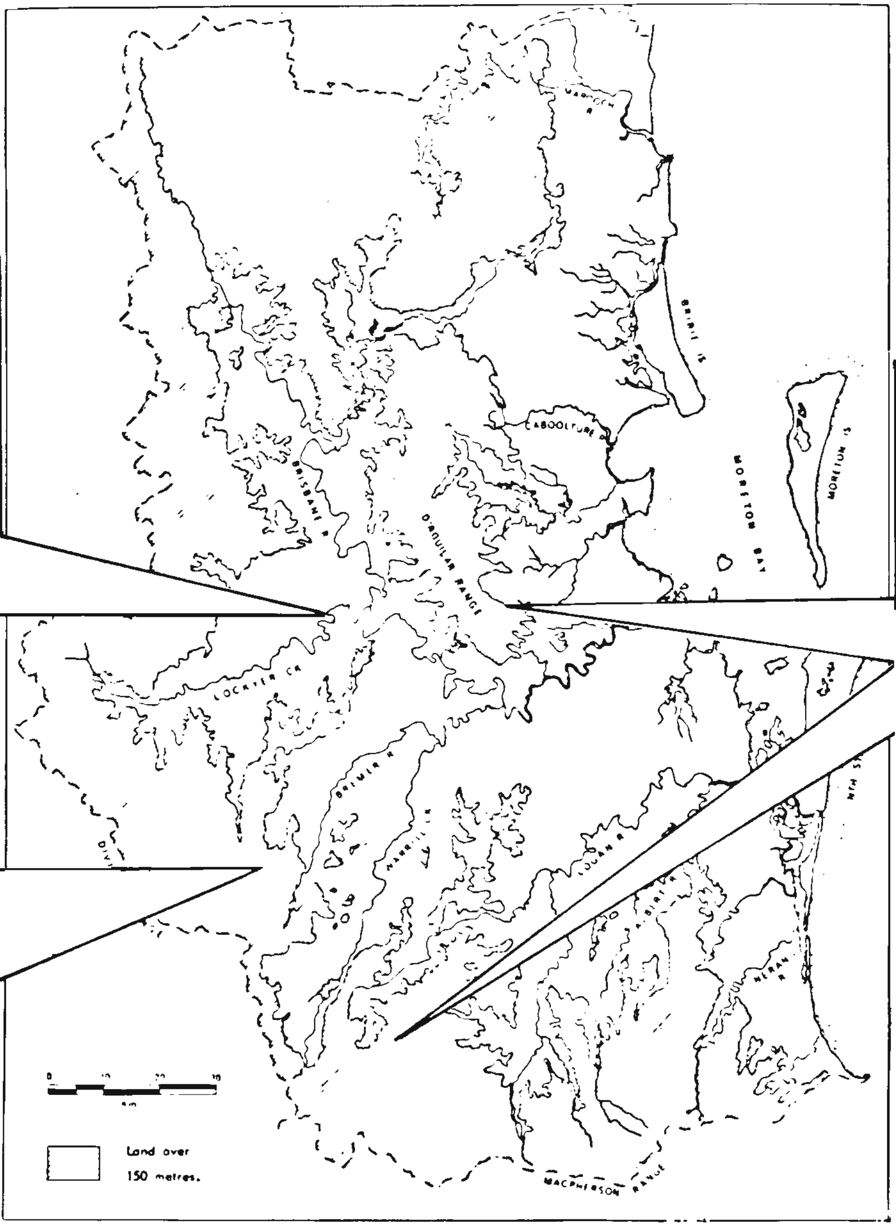
Topography, Geology and Soils

The subcoastal zone consists of that part of the Brisbane River drainage basin west of Ipswich and the subcoastal ranges. The study area encompasses three geographical units (Figs. 1 and 2):

1. the subcoastal lowlands
2. the subcoastal highlands, and
3. the Eastern Escarpment.

Unit 1. SUBCOASTAL LOWLANDS

flat-undulating; local relief
rarely over 30m a.s.l.
northern sector: Permian sediments, volcanics; duplex soils
and deep alluvial loams
southern sector: Mesozoic sediments; duplex soils and alluvial
clays
lowland open forest dominant,
gallery forest, some closed forest.



Unit 2. SUBCOASTAL HIGHLANDS

northern sector: D'Aguilar Range
elevations 300-600m a.s.l.
metamorphics, phyllites, silicified
sediments; shallow leached loams
and sands
southern sector: Beechmont Range
elevations 500-1000m a.s.l.
marine sediments and volcanics;
shallow loams and clays
upland forest dominant, closed
forest, some lowland forest.

Unit 3. EASTERN ESCARPMENT

elevations 400-600m a.s.l.
northern sector: pre-Permian
marine sediments, volcanics
and Permian metamorphics;
structured earths, duplex soils
and leached loams
southern sector: pre-Permian
marine sediments, volcanics;
clay soils
lowland forest dominant, some
upland closed and upland open
forest.

Figure 2. Annotated location map showing the major geographical subdivisions of the study area.

Unit 1 occupies the largest portion of the study universe. The terrain is generally flat to undulating with local relief rarely exceeding 30m a.s.l. Minor ranges occur in the central-south of the unit, attaining elevations of 300-400m a.s.l. The geological structure of the lowlands is relatively simple. The southern half is formed by part of the Moreton Basin, an extensive area of Mezozoic sediments. The northern half corresponds with the Esk Trough, a graben-like depression formed in the late Permian and containing continental sediments and minor volcanics. Duplex soils dominate the non-riverine areas, with the mottled yellow and grey subsoil groups occuring most frequently. Riparian soils include deep alluvial loams in the north and clayey deposits in the central and southern parts.

Unit 2 is divided into two major subunits, the Conondale-D'Aguilar Ranges in the north and northeast and the Darlington-Beechmont Ranges in the south and southeast. These ranges form the eastern boundary of the study area. They are extremely rugged, being characterized by extensively dissected plateaux separated by deep valleys. Elevations range from 300-600m a.s.l. in the north and 500-1000m a.s.l. in the south. The northern ranges are formed by the D'Aguilar Block, a paleozoic feature incorporating regionally metamorphosed igneous rocks, phyllites and silicified sediments. The Darlington-Beechmont Ranges are formed by the Beenleigh Block, which contains marine sediments and volcanics similar to those found to the north. Soils on the D'Aguilar Block consist mainly of shallow leached loams and sands, while in the southern ranges shallow loams and clays predominate.

Unit 3 is formed by the Great Dividing Range and marks the western boundary of the subcoastal zone. Rugged outliers of the Escarpment extend into the western half of the area, with elevations ranging from 400-600m a.s.l. The northern part of the Escarpment-outlier zone is formed by the Yarraman and Cressbrook-Buaraba Blocks. The southern extremities incorporate part of the Texas Block, and the Moreton Basin continues west through the centre. Not a great deal is known about any of these Block formations. The Texas Block is composed of pre-Permian marine sediments and minor volcanics. The Yarraman Block contains pre-Permian marine sediments and the Cressbrook-Buaraba Block consists of metamorphosed Permian sediments and volcanics. There are extensive areas of clay soils in the south and mostly leached loams, structured earths and red duplex soils in the north.

Climate

The study area has a relatively moist subtropical climate similar to that influencing most of Australia's central east coast (cf. Gentilli 1972). There are only two recognizable seasons: a hot moist summer (October-March) and a cool, dry winter (April-September). (Note: the terms summer and winter, as defined here, will be used throughout this paper in discussions of seasonality, etc.) Rainfall is highly variable. There is more than 20% variation from average trends, usually on the lower side, as summer cyclones periodically inflate annual means. Temperatures are mild, ranging through 13-30°C in summer and 6-25°C in winter. Frosts occur infrequently, with most areas frost-free for about 10 months per year. Humidity is high, with a range of 60-75%.

Water Resources

Despite an average rainfall that is comparatively high by Australian standards, the subcoastal zone is not as well watered as it might seem. The marked summer dominance in the rainfall regime and high evapotranspiration rates result in a long dry period in winter. Prior to the introduction of modern water control techniques the winter rainfall deficiency led to a considerable reduction in the amount of surface water available in non-riverine areas. Most subcoastal waterways did not have large flowing volumes at any time of year, and most either stopped flowing or dried up completely during the winter months (Figs. 3,4). Even the Brisbane River stopped flowing on several occasions in historical times (Mr. G. Cossins, B.C.C. Dept of Water Supply and Sewerage, pers comm. 1978).

There are large reserves of underground water in the study area. Sandstone aquifers occur in some areas and considerable storages are held in the alluvial gravels associated with most large watercourses. Most of these storages are at considerable depths and most of the water is not considered fit for day to day human consumption (per Qld Water Resources Commission, see Table 2).

The journals of early explorers support the picture of very dry winters. During September 1824, Oxley noted several times that the area through which he was travelling bore "the marks of severe drought", and that "all the northern and southern watercourses are dry" (Steele 1972:141-145). Cunningham, accompanying Oxley, observed that "such have been the effects of the drought of the year that the vegetation appears in a state of inactivity" (Steele 1972:165). A few days later they were caught in severe late winter thunderstorms, as was Lockyer

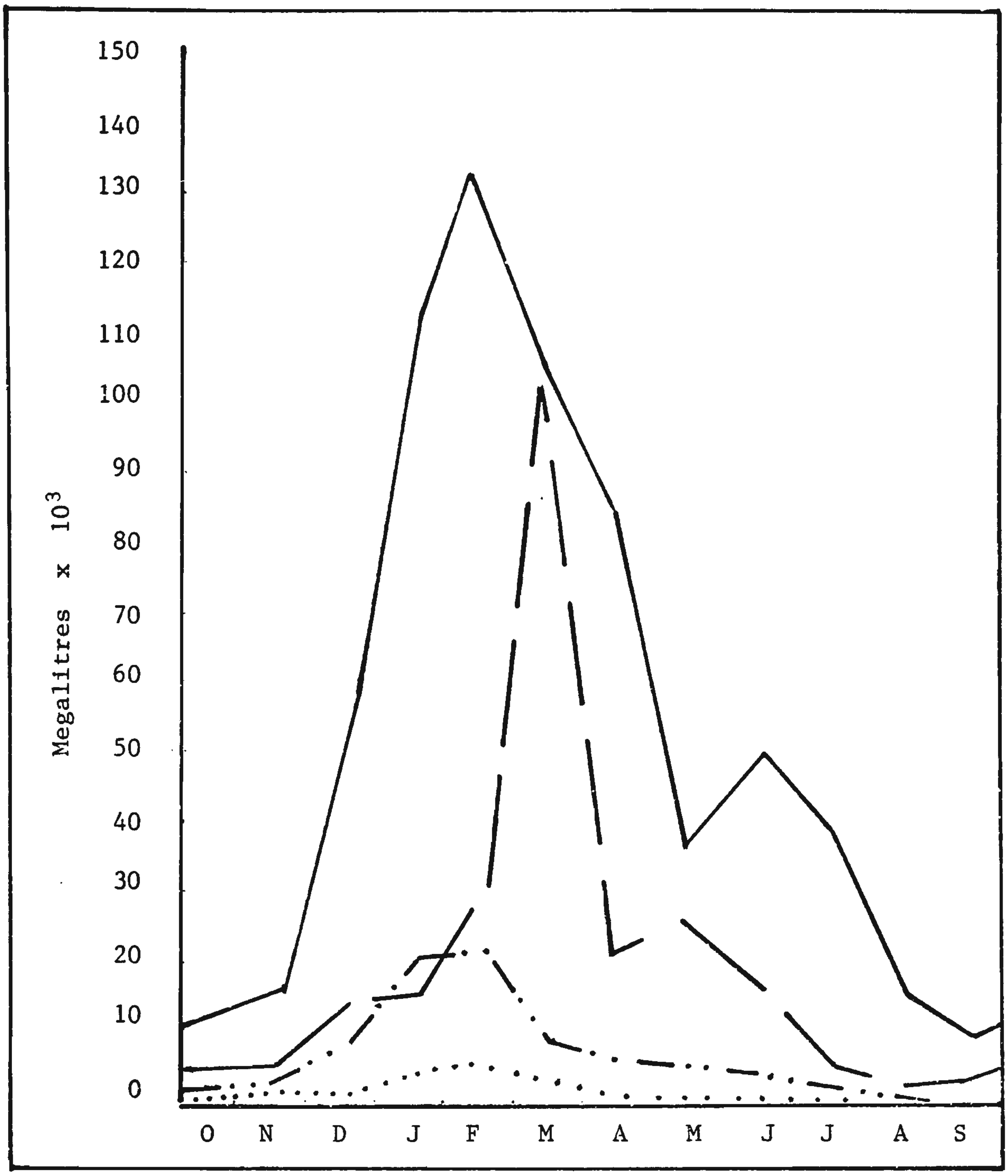


Figure 3 . Monthly flow volumes for selected major subcoastal streams (per information from Queensland Water Resources Commission 1980).

Legend.

______	Brisbane River pre Somerset Dam (mid catchment)
__ __	Stanley River pre Somerset Dam (mid catchment)
-··-··	Lockyer Creek (lower catchment)
······	Bremer River (upper-mid catchment)

Month	Max. Inflow
Oct.	75 255
Nov.	256 555
Dec.	287 704
Jan.	729 305
Feb.	653 166
Mar.	581 899
Apr.	484 797
May	232 315
June	388 361
July	463 026
Aug	57 129
Sept.	16 691

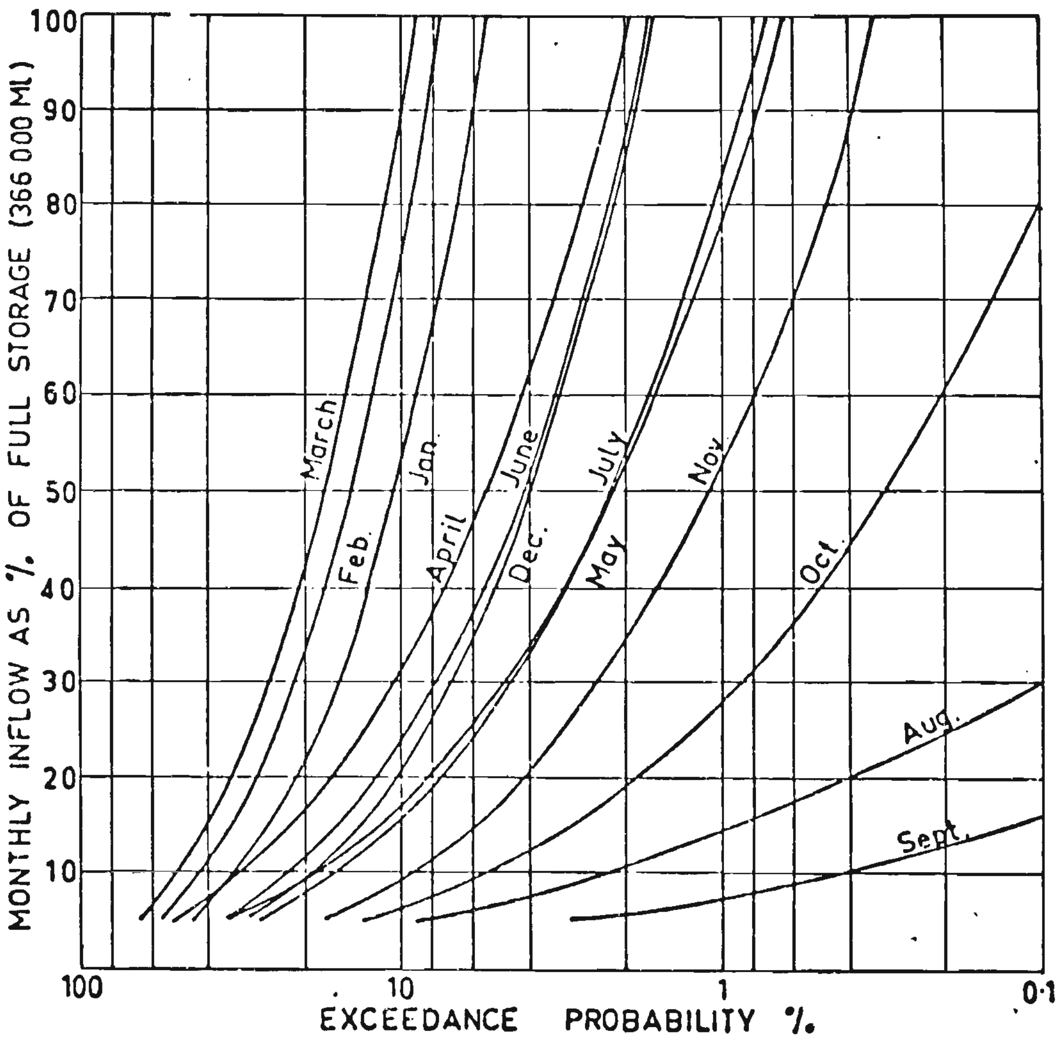


Figure 4 . Probability of Monthly Inflow into Somerset Dam.
(per G. Cossins, Investigating Engineer, Brisbane City Council
Dept. of Water Supply and Sewerage, 1978)

STREAM	SALTS mg/l	Min depth	Normal	Max depth
Laidley Ck	1100	6m	8m	9m
Tenthill Ck	680	11m	13m	14m
Lockyer Ck	1200	10m	12m	13m
Ma Ma Ck	2700	2m	5m	8m
Flagstone Ck	1800	10m	12m	15m
Sandy Ck	2600	8m	10m	16m
Franklin Vale Ck	790	1m	4m	4m
Brisbane R	400	7m	10m	12m

Table 2 . Depths and dissolved salts levels for selected subcoastal acquifers. Note:the figures for minimum depths are rarely achieved (information per Queensland Water Resources Commission).

Guide to Salts levels and drinkability:

5000 mg/l gives noticeable salt taste
1500 mg/l emergency use only
1000 mg/l infrequent use only
500 mg/l suitable for human use

in September 1825 (Steele 1972:193). (Note: throughout this paper references to explorers' journals will list Steele's edited transcriptions as the source. Those microfilms of the original documents that were available in this State were consulted to confirm Steele's text. They are listed in the references section. Steele is used here for convenience in, and standardization of, in-text referencing.)

Flora and Fauna

The Moreton Region as a whole occupies an intermediate position between tropical and temperate biogeographical provinces (Keast 1981). As a consequence the region harbours an unusual diversity of both tropical and subhumid flora and fauna. This mixing was first documented by Oxley and Cunningham in 1824. In addition to making extensive notes on a range of open and gallery forest plants Cunningham "procured many new ... species ... hitherto believed only to exist in the tropics" (Steele 1972:145, 155-156). Oxley was impressed that there would have been "no shortage of food" for an Aboriginal population (Steele 1972:145-146).

Although the pre-contact vegetation has been extensively cleared and the structure and distribution of animal communities radically altered, it is possible to reconstruct a reasonably accurate picture of the subcoastal biota immediately prior to European entry into the area. Four broad habitat zones can be distinguished:

1. fringing or gallery forests,
2. subcoastal lowland open forest,
3. subcoastal highland open forest, and
4. upland closed forests.

Fringing forests occupied by far the smallest proportion of the subcoastal area, being restricted to the land immediately contiguous with watercourses. The floristic structure and composition of these forests is partially dependent on the nature of the surrounding vegetation, but they usually retain a distinctive character. For the purposes of this paper, the area within 2.5m on either side of a stream is regarded as fringing forest. This is an arbitrary average based on personal observation. In most cases, the most extensive areas are restricted to the lower and middle reaches of major streams, whereas in upper catchments in the ranges fringing forests are usually continuations of surrounding upland vegetation.

Gallery forests and the associated aquatic zone harboured a variety of animals. Many terrestrial mammals found in other areas also frequented riparian forests, particularly in drier seasons. All waterbirds, fish and aquatic invertebrates were restricted to this zone.

Eucalypt open forests covered the greater part of the undulating lowlands, foothills, and lower ranges. These forests contain at least 250 plant species. A high degree of community differentiation occurs within the two broadly delineated forest types. Many of the associations are sensitive to microenvironmental changes which can result in small areas containing a wide variety of specific habitats (Anon. 1974, Pryor 1976:40-47). Open forests provided the primary habitats for the majority of mammals, birds, reptiles, and amphibians represented in the study area.

Upland closed forests were limited in their distribution, primarily by edaphic factors (Webb 1956). However, various closed forest types did occur in a number of places in the subcoastal zone. Tall closed forests, floristically the most complex of all the habitats considered here, occupied high summer rainfall areas in the subcoastal ranges and parts of the Main Ranges. Hoop Pine forests were found in less well-watered, less fertile hilly areas, such as the foothills of the major ranges and in the minor ranges in the central-western sector. Closed forests did not contain as great a variety of animals as either open forests or gallery forests.

Discussion

The foregoing has described the subcoastal environment as a naturally defined unit, incorporating three major subunits, which harbours an unusually diverse flora and fauna. In general terms, the bio-physical units are aligned north-south; moving east or west from the central watercourses, riverine flats and terraces give way to undulating, open forested lowlands and foothills, and finally to the more heavily vegetated perimetric uplands. The biotic diversity and lack of physical barriers suggests that the subcoastal zone as a whole would have been comparatively favourable for hunter-gatherer adaptation. The only apparent limitation to exploitation seems to be the overall variability and marked seasonal differences in effective precipitation. As demonstrated below, available evidence suggests that this general situation has obtained for at least the last 2,500 years, possibly for the last 5,000 years.

The bulk of Australian paleoenvironmental research has been undertaken in either temperate southern areas or in tropical zones to the north of the Moreton Region. When it is recalled that the region is a recognized junction between tropical and temperate zones, the difficulty of extrapolating from these studies should be apparent.

Nonetheless, if discussion is restricted to the Holocene, it can be seen that past environments in southeast Queensland were broadly similar to those elsewhere.

Most studies indicate that from 10,000-5,000 years BP the climate was wetter and probably hotter than at present. All accounts suggest that this "early-mid Holocene humid period" (Bowler *et al.* 1976:390) was reflected in a marked absence of sclerophyllous forest. Kershaw's work in North Queensland (1974,1971,1970) and Bell's solitary pollen core from the Moreton Region (1979) suggest that angiosperm vineforests dominated most of the Queensland coast during that time (Bowler *et al.* 1976:366-367). The presence of relict lowland vineforests and slightly more extensive upland vineforests bear witness to the past dominance of non-eucalypt vegetation in the study area.

Evidence of further environmental change in the time between the end of the last transgression and about 2,500 years BP is rapidly accumulating. Palynological data from a number of areas throughout Australia highlight the onset of a comparatively dry period accompanied by a spreading of eucalypt forest (Churchill 1968, Dodson 1974a, 1974b, Hope 1974, Martin 1973). Although there is no pollen evidence for this period from the Moreton Region, other geological evidence from the area supports this general picture and provides some further details.

Data obtained from relict beaches and other geomorphological features around Brisbane show that there may have been a one metre fall in sea level about 3,000-3,400 years BP (Flood 1980). There was also a marked change in the specific composition of fringing reefs in Moreton Bay; clean water species gave way to mud-resistant self cleaning types about 2,000-3,000 years BP. Hekel *et al.*(1979:17) argue that in addition to sea level regression, a change in the course of the Brisbane River and a climatic change may have been important factors underlying changes in the coral facies. They suggest that the climate became less humid and/or more markedly seasonal. Extrapolating from the studies mentioned previously, it is possible that such climatic change could have brought about further biotic variation, with eucalypt open forest and associated faunal communities becoming the dominant biotic feature of the landscape.

In brief, the data currently available indicate that prior to the last post-glacial sea level rise the Moreton Region as it exists today (excluding for argumentative purposes the area beyond the present coastline) was probably influenced by an equable humid climate and was characterized by widespread vineforests in both upland and lowland areas. Between about 5,000 and 3,000 years BP sea level fell to its present position and the climate became drier and more seasonal. At the same time biotic changes resulted in a retreat of the vineforests and a resurgence of eucalypt open forests, stabilizing in a mixed configuration similar to that documented by the first European explorers. The details of Aboriginal adaptations to this environment are the substance of the rest of this chapter.

The Resource Base

Of the three factors underlying the pulsation hypothesis the first was originally formulated with the whole subcoastal area in mind and warrants only brief reconsideration at this point. The data suggest that finding adequate supplies of potable water would not have been a problem in summer, whilst in the dry season it may have been difficult to predict the location of reliable water sources away from the larger central watercourses or lagoons. Stagnant pools may have supported small groups for short periods. I argue, however, that people are likely to have moved to better watered areas rather than suffer shortages unnecessarily. In other words, groups would have converged onto the major watercourses and lagoons during winter. Supportive evidence bearing on food resources and raw materials is presented in the following sections.

The second factor is also readily substantiated. All historical references to, and early papers on, non-marine fishing in Southeast Queensland specify that fishing was a shallow-water activity and/or describe non-discriminatory shallow-water technologies (e.g. Hamlyn-Harris 1916, see also Tables 5 and 6, pg 55,56). I argued elsewhere that such techniques would be most profitably used in winter, when water levels were reduced (Lilley 1978:34).

Further inquiries into the breeding behaviour of various Australian freshwater fishes show that the optimal breeding times in the study area are in late summer and late winter-early summer. At these times the correct water temperatures and flow rates obtain and the number of shallow food-bearing ephemeral pools increases (Anderson *et al.* 1971, Lake 1967, Llewellen 1973). It can be reasonably postulated that sub-coastal fishing methods would have been most effective when these short-term storages were drying up and the fish populations were largest and most concentrated. This contention is buttressed by several reports in the literature (Bowdler 1976, Limp and Reidhead 1979, McCarthy and McArthur 1960, Roth 1901, 1897, Smith 1975:121).

Together, the first two arguments furnish a partial explanation of winter aggregations on the rivers; people were attracted by reliable water and accessible, abundant fish. The third argument was originally raised as a plausible corollary of the first, in an attempt to reconcile this proposition with the fact that a diet of fish and water would be monotonous and nutritionally inadequate (McCarthy and McArthur 1960). It focussed almost entirely on animal resources and relied on extrapolations from ecological reports completed elsewhere in Australia (e.g. Briggs 1977, Frith and Calaby 1969, Tyndale-Biscoe 1973). I maintain that the extrapolations hold true, particularly those concerning the seasonal movement of waterfowl and larger macropods. In summer, prey populations would have been dispersed at low density throughout the study area, while in the dry season they would have congregated on or near the major watercourses. The picture was marred by a lack of detailed attention to plant foods and raw materials. In the succeeding sections, attention will be paid to all aspects of the resource base.

Plant Foods

The information obtained on plant foods is summarized in Table 3 and Figures 5 and 6 (refer also to Appendix A). It should be noted that apparent inconsistencies in the tabulated data are due to the presence of the same product in several zones and/or the fact that several species provide a multiplicity of products.

Looking first to the zonal distribution of all available plant food products (Fig.5), it is clear that with few exceptions, closed forests harbour the greatest variety. The open eucalypt forests, which covered the undulating-hilly country constituting most of the study area, contain about one-third fewer products. The fringing forests, smallest

A

PRODUCT	No.	PRODUCT	No.
Fruit	46	Nectar	6
Seeds	19	Gum	3
Leaves/shoots	30	Manna & lerp	3
Roots/ tubers	34	Bark	12
Flowers	3	Wood	4

B

ZONE / PRODUCT	1	2	3	4
Fruit	4	11	16	35
Seeds	6	10	7	10
Leaves/shoots	11	9	16	18
Roots/tubers	13	12	12	10
Flowers	2	2	2	2
Nectar	2	5	4	1
Gum	2	3	1	1
Manna & lerp	1	3	1	0
Bark	5	6	6	8
Wood	0	2	2	2

Table 3 , A and B

A shows the numbers of different plant products represented in the study area; B shows breakdown of product types by zone.

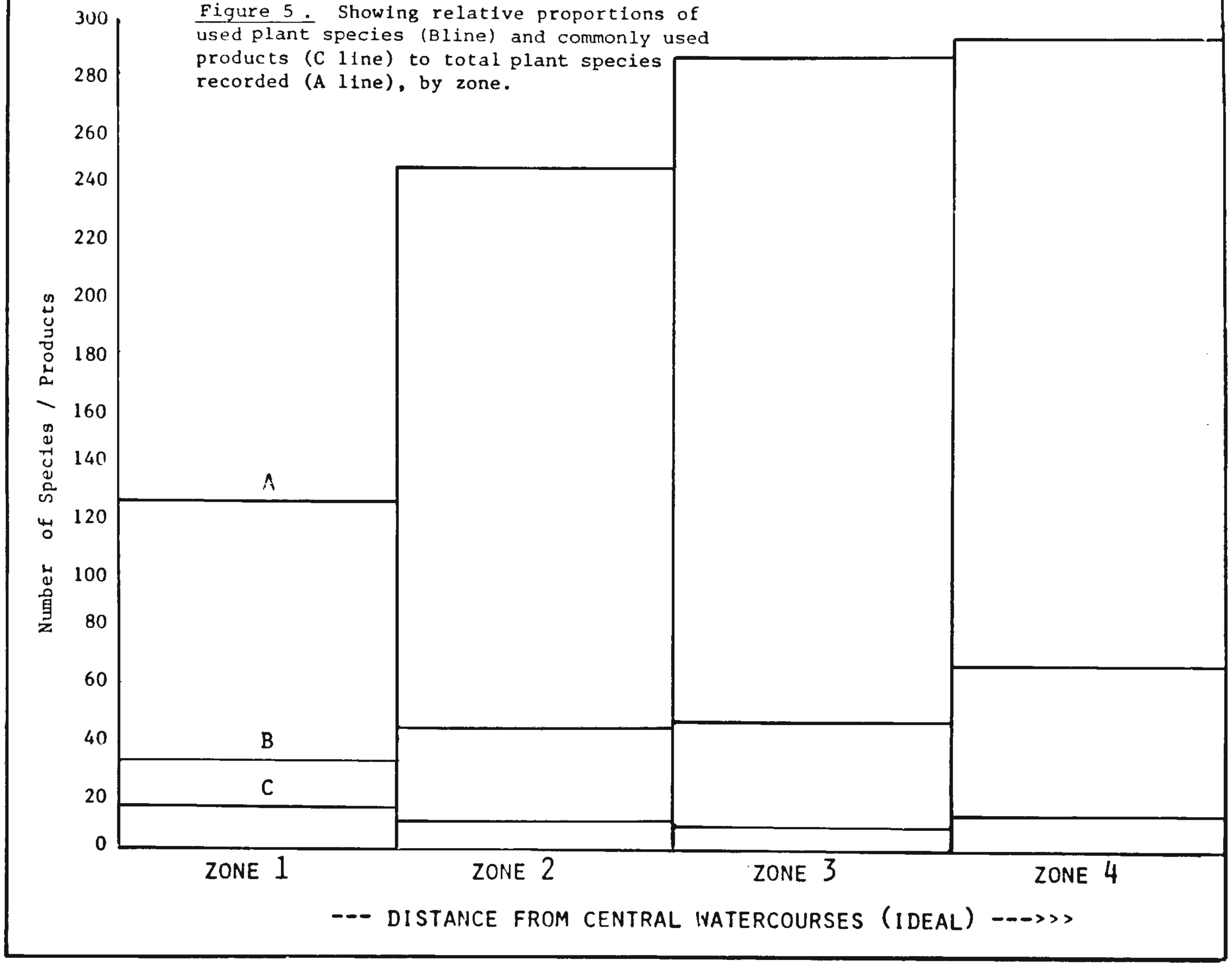


Figure 5 . Showing relative proportions of used plant species (Bline) and commonly used products (C line) to total plant species recorded (A line), by zone.

in extent and with the most useable areas restricted to the central rivers and lower-middle catchments of larger tributories, are the least diverse. They contain little more than half the number of products offered by closed forests. In broad terms, then, the diversity of plant foods is a function of distance from the central watercourses; the central sectors of the study area (Zones 1 and 2) are the least varied. This situation obtains throughout the year. When the zonal and seasonal availability of *commonly used* food products is examined, this positive relationship breaks down.

Early sources claim that Aborigines took full advantage of the total range of resources available, eating anything they encountered when hunting or foraging (Mathew 1910:89, Petrie 1975:76). While opportunistic exploitation may have been a feature of Aboriginal subsistence patterns most noticeable to Europeans, most anthropological studies suggest that only a fraction of the resource base would have been regularly or intensively exploited (e.g. Lee 1968:35, Smith 1975). Judging primarily by the frequency with which certain plants are specifically mentioned in the historical sources, this suggestion is borne out. Mathew (1910:91) states that there was "not much variety" in vegetable foods; my calculations indicate that only about 13% of all available plant foods were commonly or regularly used (Appendix A).

Figure 5 shows that Zones 1 and 4 have approximately the same number of regularly exploited products, despite the far greater overall number of products in closed forests. Four of the fringing forest species occur primarily in the uplands, where gallery communities are virtually indistinguishable from surrounding closed forests. This effectively lowers the product range in the middle and lower catchment gallery zones, with the result that upland areas remain the most favourable in terms of both overall diversity and the variety of common foods. However, fringing forests still contain more common foods than open eucalypt forests.

Figure 6 (lower curve) shows the seasonal availability of common foods in the four zones, incorporating the adjustment to gallery forest diversity. In summer, the closed forests and fringing forests contain the greatest variety while open forests contain a slightly lower number of products. In winter the situation is much the same; the diversity of gallery forests remains relatively stable and although there is a minimal decrease, closed forest variety stays on a level similar to that in Zone 1. Open forests contain about half the number of commonly used products found in the other two zones. Clearly, instead of the positive and generally linear relationship between diversity and distance from the central watercourses, the emergent relationship expresses a bimodality, most marked in winter.

This bimodal distribution of regular foods should be viewed within the overall availability graph (Fig. 6, upper curve). Clearly, in terms of the far greater overall range available, Zone 4 remains the zone of most potential throughout the year. In summer, open forests offer a more competitive overall range than lower-middle catchment fringing forests. In winter, the greater number of both common and supplementary foods in the fringing forests would reverse this situation, reducing open forests to the zones of least potential.

To retain a balanced perspective, the zonal variation in plant food availability through the year should be considered against the backdrop of surface water availability. With the marked winter

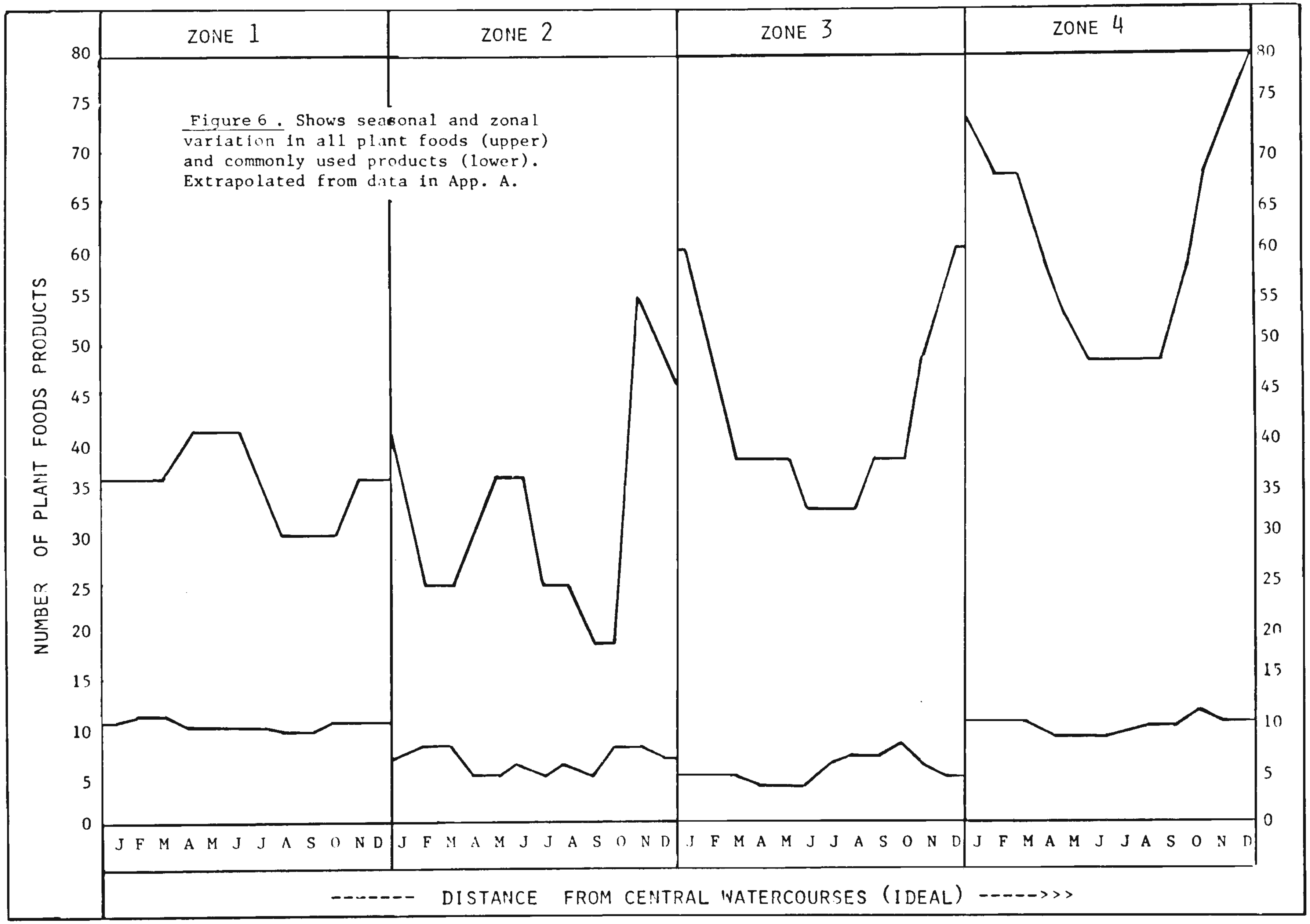


Figure 6 . Shows seasonal and zonal variation in all plant foods (upper) and commonly used products (lower). Extrapolated from data in App. A.

decrease in the amount of free water available in non-riverine habitats, the foothills and upland forest areas were probably not as favourable as the diversity of plant foods would suggest. I propose that where Zones 1 and 4 are distinguished by the fact that the latter has a greater variety of supplemental foods while the former has comparatively reliable water in an area with an uncertain rainfall regime, Zone 1 should be regarded as the zone of greatest potential in the dry season.

Animal Foods

The data obtained for animal foods are encapsulated in Figures 7 to 9 (refer also to Appendix B). It should be noted that at least 14 species of bats and an unknown number of invertebrates have been excluded, due to a lack of accessible information.

Referring to the zonal distribution of all available prey, again viewed as a function of distance from the central rivers, (Fig. 7, upper curve) it can be seen that Zone 2 (lowland open forest) contains by far the greatest variety of species. This is the case throughout the year. In summer, Zones 3 and 1 have approximately the same overall diversity, while in winter Zone 1 gains slightly. Zone 4 has the least variety throughout the year. In short, zonal and seasonal variations in total diversity are expressed as a slightly assymetrical bell curve. This general pattern is mirrored in the curve showing the numbers of commonly used species per zone in summer (Fig. 7, lower curve). Zones 2 and 3 have twice the number of regular prey species found in Zones 1 and 4. Again, it is noteworthy that only a small percentage (12%) of the total number of species can be classified as regular prey. Differentiating commonly exploited species was a

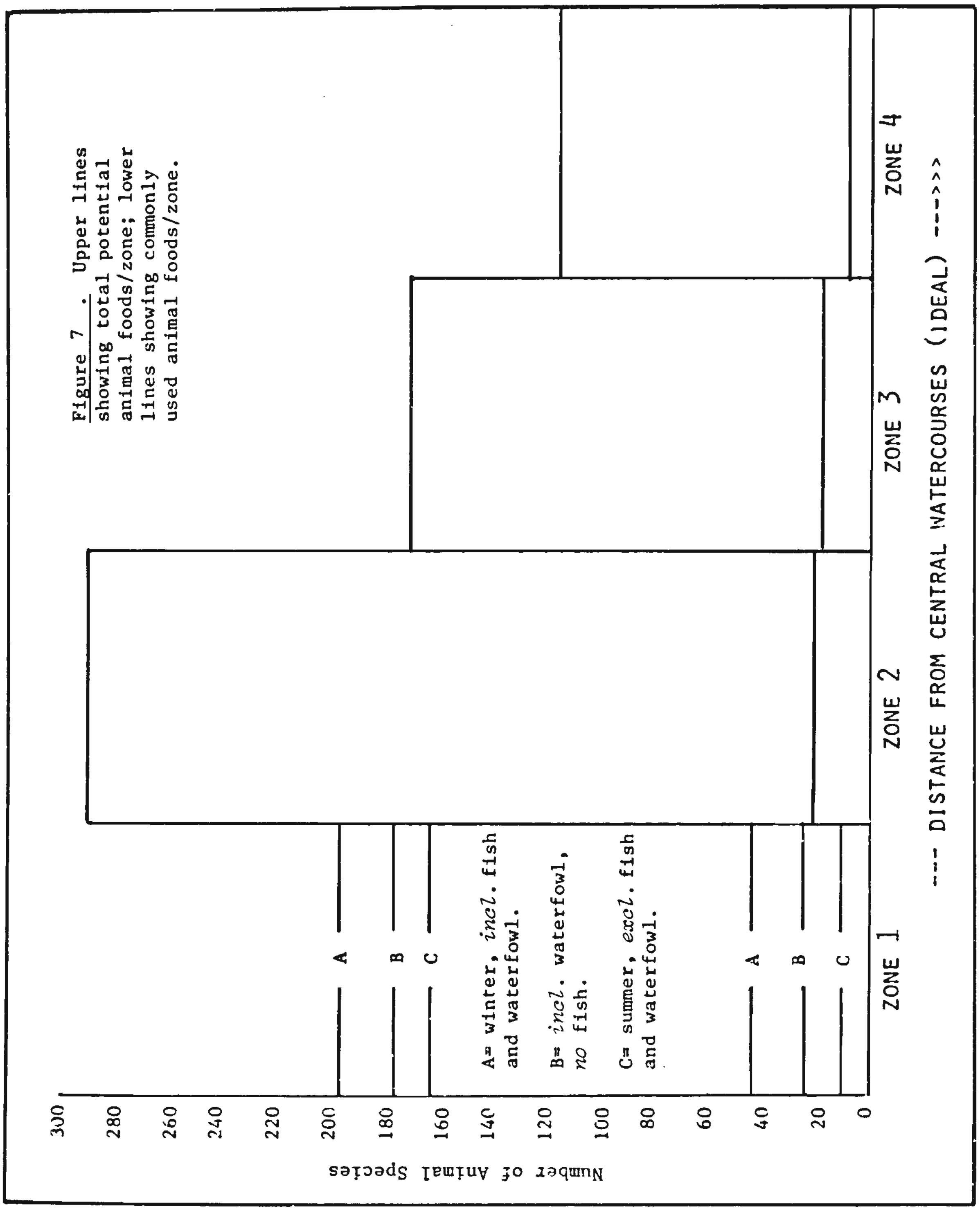


Figure 7 . Upper lines showing total potential animal foods/zone; lower lines showing commonly used animal foods/zone.

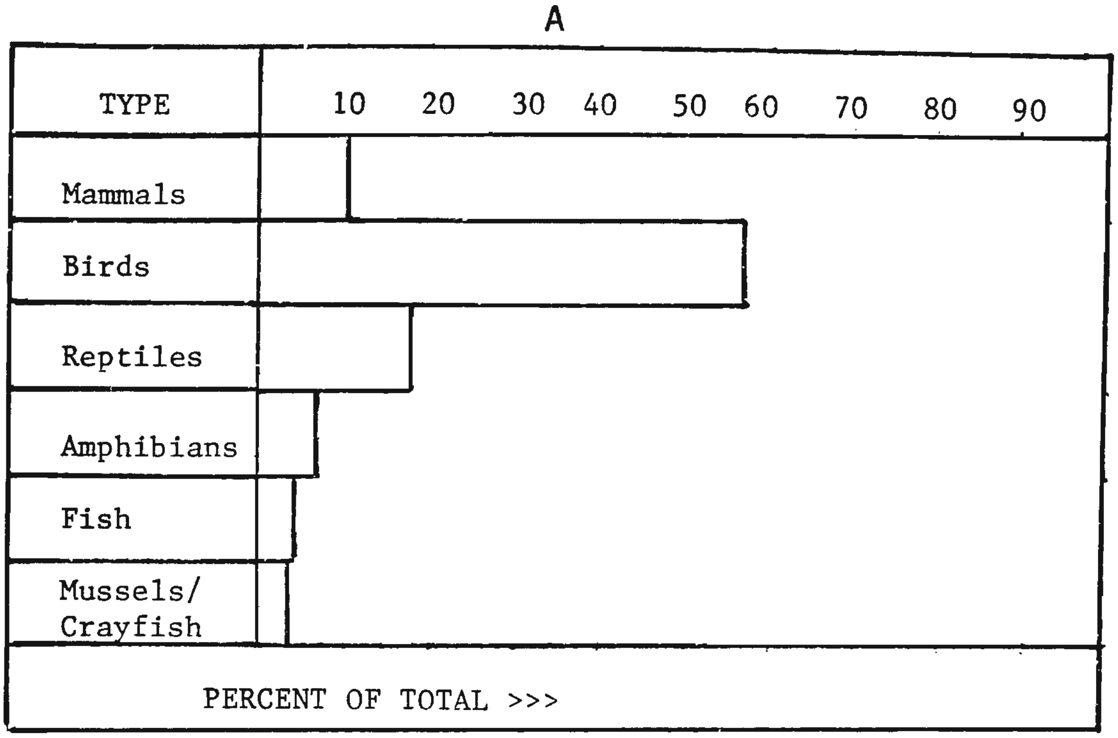
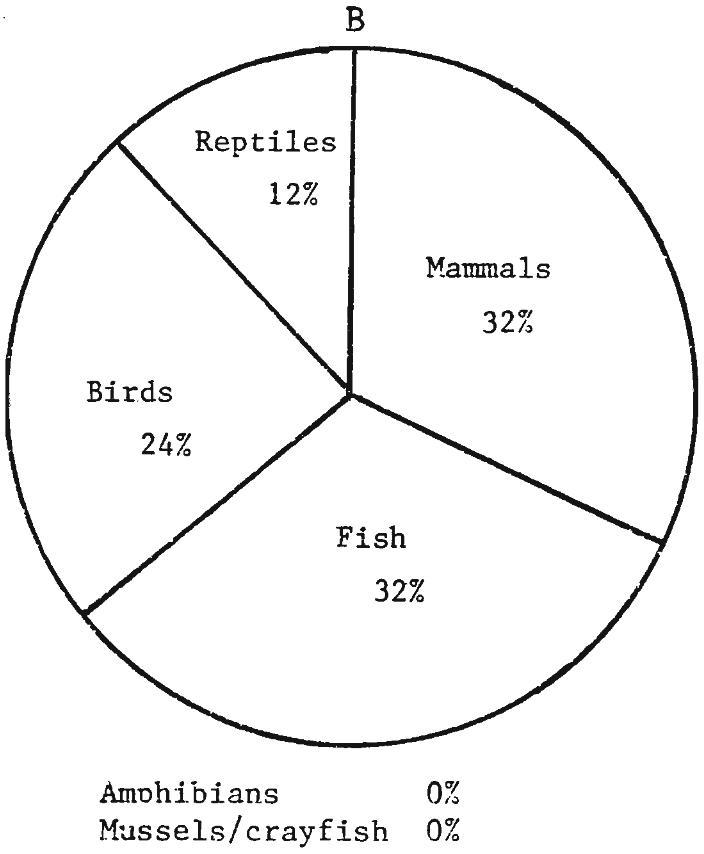


Figure 8, A and B. A shows relative proportions of various faunal classes represented in the study area; B shows relative contributions of the same classes to the total number of commonly used animal food species.



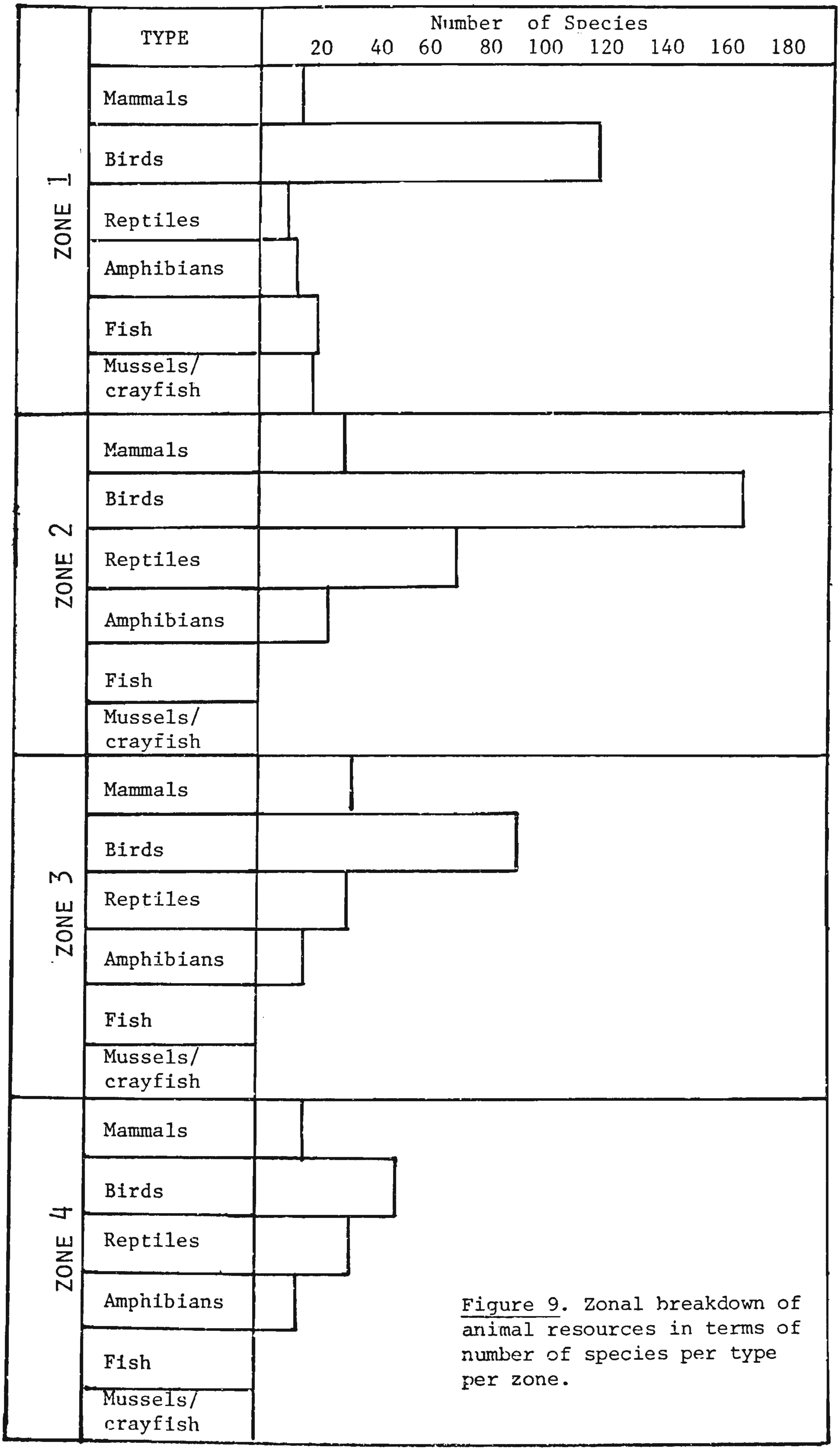


Figure 9. Zonal breakdown of animal resources in terms of number of species per type per zone.

rather arbitrary process. As with plant foods, the bulk were identified by repeated specific references in the historical sources. Where generic or familial terms are given, (e.g. "kangaroo"), selection was based on the weight, abundance, and social habits of the various possible target species.

In winter, the regular prey curve develops a more positive assymetry. The riverine lifezone emerges as the most favourable with regard to commonly exploited species, harbouring twice the number found in open forests and five times as many as upland closed forests. This situations arises from two factors, both raised earlier. First, fishing becomes a more viable proposition in winter due to environmental conditions and an abundance of fish. Second, waterfowl tend to congregate on major water sources in winter. Although both prey types were undoubtedly present throughout the year, they are excluded as regular summer targets in the first instance because of technological limitations on intensive exploitation, and in the second case because summer waterbird populations are dispersed and so markedly reduced by migration within and emigration from the study area.

In sum, the data indicate that with regard to overall variety, lowland open forest is the most favourable zone throughout the year, most particularly in summer. In winter, the riparian zone has by far the greatest number of regular prey species and a range of supplementary targets second only to lowland open forests. As with plant foods, the dry season attraction of the riverine zone is heightened by the availability of comparatively reliable water.

Raw Materials

A total of 24 species of plants are known to have supplied a range of raw materials, poisons and other non-food products (excluding medicines) (Table 3 and Appendix A). At least half these species also provided food products. Open forests and closed forests contain most of these species used, particularly those used in the manufacture of implements. Gallery forests mainly contain material used to make facilities, such as baskets. Identified fish poisons are found in equal numbers in all zones and salt substitutes grow in all areas except fringing forests.

Birds, mammals, and bivalve molluscs are also recorded as having been used in various manufacturing processes. Feathers were components of adornments and ritual objects, mammal skins were used for cloaks and rugs, and bones, shells and quills were used for a variety of cutting, scraping and piercing tasks. Most of the birds and animals known to have been exploited for these purposes are open forest and/or riverine species (refer Appendix B).

Stone suitable for tool manufacture can be found throughout the study area. Outcrops of various types occur in all zones, but an enormous variety of silicified sediments, volcanics and metamorphic rocks occur in large quantities in the alluvial gravel beds of streams. In terms of abundance, variety, and ease of acquisition, the riverine zone is likely to have been the most favoured source of stone material.

In sum, open forests supported the widest variety of organic raw materials, while the river zones provided a range of accessible stone and a range of organic materials. Closed forests were the least provident.

ITEM	Zone 1	Zone 2	Zone 3	Zone 4
Canoe	1	2	2	0
Honey rag	0	0	0	1
Shelter	1	1	0	0
Shield	0	0	0	1
Spear	0	2	2	0
String	1	2	2	3
Vessel	1	0	1	4
Waddy	0	1	1	0
Fish poison	4	4	5	4
Fire drill	0	1	0	0
Climb vine	0	0	1	1
Salt	0	1	1	1
Paint fixer	0	0	0	1

Table 4 . Zonal distribution of plant products used in the manufacture of common items of material culture and other non-food items. Drawn from App. A.

Discussion

The preceding has provided a broad summation of information concerning the subcoastal resource base, and has demonstrated the validity of a spatiotemporal dichotomy in resource availability when upland areas are incorporated in the reconstruction. In summer, the upper-middle reaches of main tributary streams and the ranges were the most productive areas, and offered the most competitive range of plant and animal foods and raw materials. In winter the opposite was true, with the areas surrounding the rivers and the lower catchments of major feeder streams providing comparatively reliable water, the greatest variety of animal foods, a diversity of regular plant foods equal to that of the generally more bountiful closed forests, and a range of organic and stone raw materials.

Contemporary studies show that low latitude hunter-gatherers tend to operate "minimax" foraging economies controlled to a degree by the minimal (or worst) conditions obtaining in their ecosystem (Clarke 1968:94-95, Binford 1980, Hayden 1975, Jochim 1976, McCarthy and McArthur 1960, Yellen 1977:64). For any group to effectively and efficiently maintain itself it must obtain an adequate quantity and variety of resources of acceptable quality without exceeding predetermined energy expenditure thresholds. The interplay of many complex socially determined factors and a lack of relevant ecological data make it difficult to build detailed models of subcoastal subsistence strategies at present. However, an outline model can be submitted if certain basic factors are considered.

First, it is assumed that subcoastal energy expenditure patterns approximated those recorded ethnographically; they were characterized by a dichotomous hierarchy of priorities and thresholds. This would have been manifested in sexual divisions of subsistence activities and concomitant differences in energy output limits (Bowdler 1976, Hiatt 1970, McCarthy and McArthur 1960, Yellen 1977). It is probable that subcoastal groups, like most other low latitude hunter-gatherers, were primarily dependent on low risk, steady-return plant foods and small prey. Women are likely to have collected most, if not all, such food for in-camp redistribution. Men are more likely to have pursued high risk, uncertain-return large mammal prey, and to have done most of the fishing (Petrie 1975:73,92, see also Bowdler 1981, 1976).

Contrasting the importance of plant foods in general (and of high yield staples in particular) and the various bio-social restrictions on female foraging ranges with the lesser day-to-day importance of large prey and the comparative freedom of male movement, it may be inferred that maximum access to predictable vegetable foods would have been a primary consideration in camp placement. Winterbotham provided the only specific historical evidence of this when he noted that women usually foraged within three to five kilometres of camp (1957:77, his measurements are in miles, see also Tindale 1974:10). The necessity of proximity to vegetable food patches is likely to have been counterbalanced to some degree by the desirability of reasonable access to good hunting grounds.

For similar reasons, the propinquity of reliable water sources would also have been a necessary consideration in siting a camp. This inference is permitted assuming a, a lack of sophisticated water collection techniques and of long-term, large volume storages, b, the importance of water for direct daily consumption and food preparation, and c, the fact that women are likely to have collected most of the water for in-camp use and to have done most of the food processing involving water (Petrie 1975:94). At the same time, some limit on proximity would probably have been observed to avoid disturbing game which habitually used the water source and immediately contiguous areas (Yellen 1977:8).

In the context of these basic considerations, the pulsation model still holds. Accepting climatic variability and the general space-time discontinuities in resource distribution, winter camps are most likely to have been concentrated along the rivers and the lower reaches of major tributaries. This would have permitted female access to reliable water and a range of stable, low-risk riverine resources, and would have permitted male and/or female access to fish resources. It would also have allowed relatively unhindered access by both sexes to the surrounding lowland open forests where other plant foods and prey could be obtained.

In early summer dry season congregations would probably have begun to fragment with most of the resulting groups moving away into the non-riverine lowlands and foothills areas. During this period, it is possible that the groups broadened their resource base and exploited a wide range of habitats between the central rivers and the upland forests. Access to water would not have been as difficult as in winter, due to thunderstorm activity, but reliable sources are still most likely to have been located along larger creeks.

At the height of the wet season, small groups would probably have camped in the middle and upper catchments of feeder streams near the ranges. Water would not have been a problem, as most streams are likely to have been flowing. Groups probably located themselves close to a stream within female range of the uplands to facilitate access to water, riparian resources and the upland forests. I suggest that the people would not have camped in the ranges proper as this would have reduced access to open forest plant foods and the prey inhabiting the lower slopes and valley floors. In late summer, as the weather became drier, the cycle would have reversed, with groups gradually merging and moving back to the rivers.

The hypothesis just tendered is based on consideration of the *sine qua non* of hunter-gatherer economics. It is an outline model, and is not intended to incorporate the minutiae of subcoastal subsistence and settlement strategies. There are a multiplicity of more specific factors which could qualify the broad suggestions of the model. Demographic patterns, subsistence technologies, and the requirement for specific sets of *in situ* resources on campsites may have influenced the balance between what may have been (in Western terms) more desirable or rational courses of action and those more expedient given different decision-making criteria. In the remaining sections of this chapter these variables will be examined and the model altered if necessary.

Population Organization

Although the early explorers witnessed grouping on the rivers in winter, any inferences drawn from their observations must be qualified by two facts. First, they rarely strayed far from the major watercourses, and second, they never travelled through the area in summer (Fig. 10). This presents a problem when attempting to deal with population organization in both the subcoastal lowlands and highlands. When considering only the lowlands, it was relatively simple to argue that the nature of the resource base would have forced winter groups to fragment and disperse into non-riverine zones in summer. When the uplands are included the situation becomes more complex. The inclusion of this zone, physiographically and biotically quite different from the lowlands, raises the possibility that it was used by a wholly upland oriented population; people employing an exploitation strategy having little or nothing to do with winter coalescence in the river valleys. Hence there is a need to resolve the entire question of the nature of the subcoastal population and its arrangement with regard to resources.

Certain fundamental aspects of subcoastal demography are clearly described in the historical record. The nuclear family was by all accounts the basic socio-economic unit in all areas; usually several such families would cooperate in highly flexible groups labelled by Mathew as communities (Table 1). The diaries of early explorers and settlers, and information from Winterbotham's transcripts suggest that these communities made up loose bands which regularly exploited a particular range or territory. The size, composition and location of the band within the range varied in response to social and economic

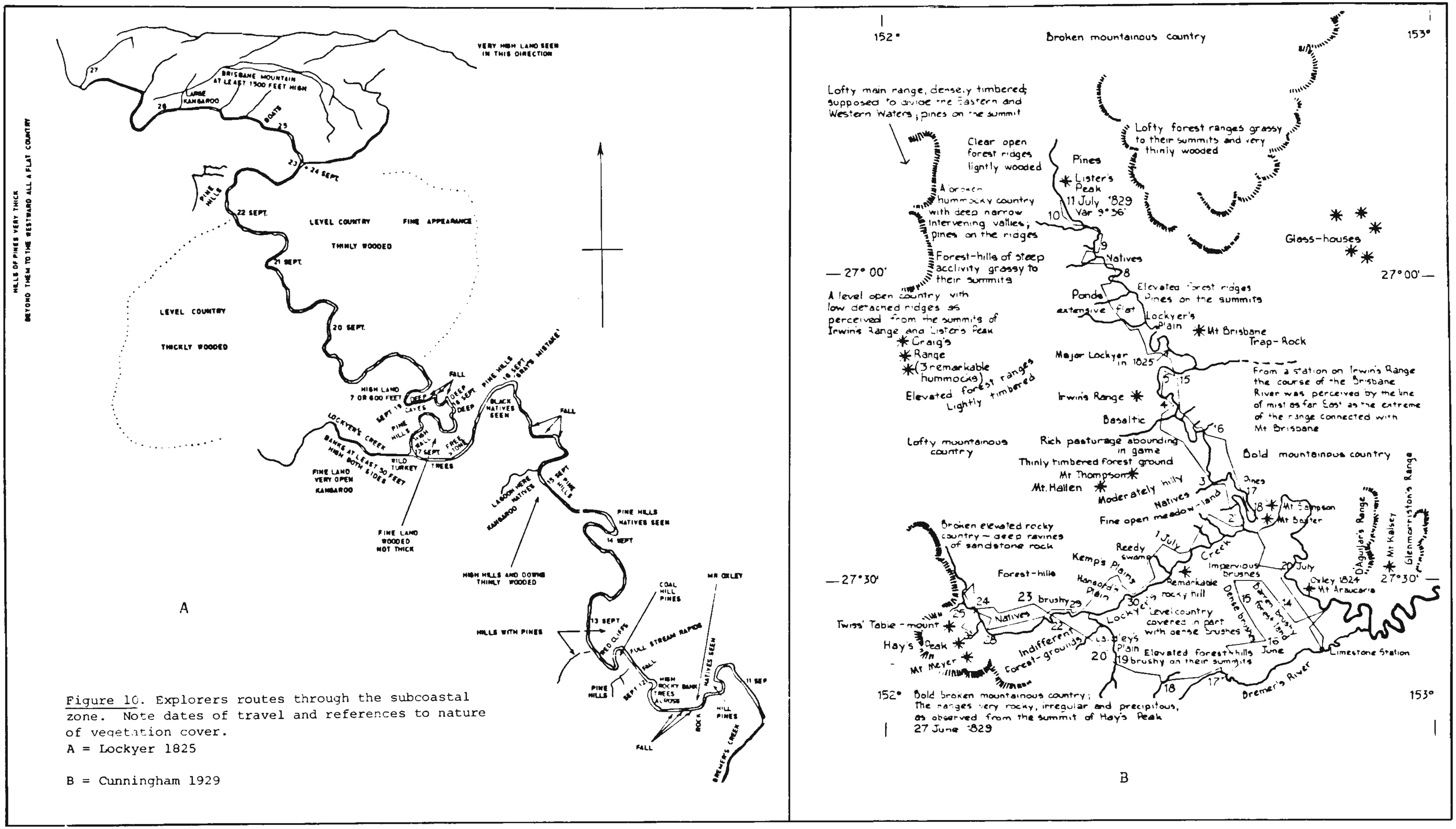


Figure 10. Explorers routes through the subcoastal zone. Note dates of travel and references to nature of vegetation cover.
A = Lockyer 1825

B = Cunningham 1929

demands (see Mathew and Winterbotham, Table 1; also Berndt and Berndt 1977:141-143, Lourandos 1977, Mulvaney 1975:65-67, Maddock 1974:32, Stanner 1965:2).

It can also be inferred that groups of bands formed relatively unstructured tribes (defined here as band clusters, cf. Turner 1976:190). There were at least three such tribes. One, the Jinibara, used the northern and northeastern sections of the study area. Another, the Jagara, used the central and southwestern portions, while the last, the Jukumbe, claimed the southeastern sections. The Giabel, centred on the Darling Downs to the west, may have used a small area in the far western sector, but have been excluded owing to an almost complete lack of information.

There are adequate grounds to argue that together these tribes formed a recognized subcoastal population, seen to be different by both Aborigines and white settlers. Europeans differentiated between coastal and subcoastal groups by referring to the latter as inlanders and/or by detailing differences in habit (e.g. Petrie 1975:55). Aboriginal informants stated that the "saltwater" groups labelled the subcoastal groups as inlanders, while Darling Downs people distinguished themselves from the subcoastal "Biriin" people, and between the "Biriin" and the coastal groups and the mountain "Waapa" groups who lived immediately north of the study area and operated upland economies (Tindale 1974:123-126). (Note: Parts of Tindale's text and in-text map are incorrect. There are two Brisbane Rivers on the map (pg 124), and "southwest", line four, para. two, pg. 125, should read northwest.)

It is clear that there were social and economic connections between subcoastal bands and groups from surrounding areas (Sullivan 1977). There seems to have been a noticeable directionality in these relations. The most northerly of the Jinibara appear to have had closer ties with the mountain groups further north, while the southern elements had stronger ties with the Jagara. This can be inferred from Gairabau's information in Winterbotham's transcripts (1957). The Jagara and (probably) the Jukumbe spoke the same or a very similar language to the coastal peoples, and there seem to have been close ties between them, probably best developed where coastal groups ranged close to subcoastal territories (Petrie 1975: various, see also Sullivan 1977:11-12). The Jinibara seem to have had few direct links with the coast; A.J. McConnel (n.d.) records that those bands using the western side of the D'Aguilar Range would seek protection when they heard coastal groups were moving up to exploit the eastern slopes.

On occasion these ties resulted in the coming together of large congregations, primarily for warfare, ceremony, trade and extraordinary resource exploitation *cum* social gatherings (Sullivan 1977). At the same time, there seem to have been strict rules preserving the integrity of each band territory. Movement through someone else's land was subject to compliance with prescribed social conventions and the use of any resources remained the prerogative of the band upon whose range it occurred. Nowhere in the historical record is there mention of inter-band gathering for prosaic purposes, such as merging to exploit normal seasonal resources and/or to overcome resource scarcity (Sullivan 1977:32-33,51-59, cf. Lourandos 1977).

How the population was organized in relation to resources, particularly riverine resources, cannot be adduced directly from the historical literature. Unfortunately the evidence relating to this problem is patchy and often contradictory. Tindale, who has synthesised most of the available information, argues that the population was divided, with each subpopulation operating a separate exploitative system. One population consisted entirely of the Jinibara, who were restricted to the ranges in the north and east, and whose economy centred on upland resources. The Jagara and Jukumbe formed the other population, and were organized to take advantage of the undulating river valleys and the foothills in the centre and south of the study area (Tindale 1974:124-125).

Tindale's thesis is that the Jinibara were descended from a relict Barrinean population. It is based on two sets of information: 1, myths related to Winterbotham about the Djandjarri or "Denderri Pygmies" (1957:116-118), and 2, Simpson's documentation of mountain peoples in Southeast Queensland (Langevad 1979:12-13). The Djandjarri are described by Winterbotham as red, hairy little people who lived in caves and made miniature tools and weapons. Mathew (1910:170) described "Jonjari" as "benevolent spirits whose haunts were mineral springs". I do not accept that the Djandjarri myths result from corporate memories of Barrinean ancestry. Without entering into the tri-hybrid origins debate (Tindale and Birdsell 1941, Kirk and Thorne 1976), the fact that similar stories about Djandjarri are told throughout Queensland reduces the credibility of Tindale's speculations (R.Robins, Queensland Museum; P. Smith, Archaeology Branch, D.A.I.A. Brisbane, pers. comms 1978-1980).

Simpson's records cannot be dismissed so lightly. He suggested that for convenience of documentation the Aborigines under his jurisdiction could be separated into three categories: "Inhabitants of the Sea Coast, of the Mountain Ranges, or of the Inland Creeks and Rivers" (Langevad 1979:12-13). The mountain people were described as those living in the ranges ringing the subcoastal zone and in the mountainous area to the north. He went on to say that they were very numerous (Table 1), and were divided into small groups "occupying principally the heads of the Creeks and Rivers". The river dwellers, on the other hand, were divided into three small groups and were seen to be "serving an apprenticeship to civilization" as they usually lived on or near European settlements in the lowlands. They were considered distinct from the mountain groups who were "in every sense of the word wild Blacks, rarely or never visiting the Stations in the vicinity of the Ranges but for the purposes of pillage and bloodshed".

When considering these passages it should be noted that Simpson's brief included supervision of the Aboriginal groups in the Wide Bay Region, which extends north from the present boundary of the Moreton Region to Frazer Island. For physiographic reasons there could only have been two of Simpson's classes present in that region, namely, mountain people and coast dwellers. As already noted, neither the Wide Bay mountain people nor coastal people were identified as part of the subcoastal population and even Simpson differentiated them as "Wide Bay Blacks" (Langevad 1979:16). Excluding these groups, discussion need only concern the inhabitants of the perimeter ranges of the study area and the river dwellers.

The problem is whether these two classes of inhabitants were really separate subpopulations which operated different exploitative strategies. Assuming the veracity of the foregoing discussion, and of the environmental reconstruction, three competing propositions can be raised in an attempt to resolve this question.

> 1. The population was organised to facilitate a two-into-one economic system. In summer the Jinibara operated mainly in the ranges and the lowland groups used the river valleys. In the winter the Jinibara groups moved to the riverine zone to gain access to the resources there. A need for cooperative effort and/or social obligations to provide food and water during the dry season mitigated territorial restrictions enforced in summer. Similar situations have been recorded elsewhere (Lourandos 1977:215-218, Tindale 1974:65).
>
> 2. As Tindale argues, the population was arranged in such a way that two different systems had to operate. The Jinibara remained in the ranges throughout the year and the lowlands groups monopolized the river valleys.
>
> 3. The people were organized to allow most of the Jinibara groups and the lowlanders to use similar economic strategies. Territories were delimited so that the groups in each band had access to the full range of resources available, including parts of the river valleys and the ranges. In both summer and winter, all groups would have had access to the most favourable areas without infringing the territorial claims of others.

I argue that there are sufficient grounds for the rejection of the first proposition. There is no evidence of regular large-scale inter-band gatherings for ordinary subsistence purposes. Moreover, agonistic relations between bands seem to have been the norm. This permits the inference that some kind of territorial restrictions were enforced throughout the year. Following Sahlins' arguments

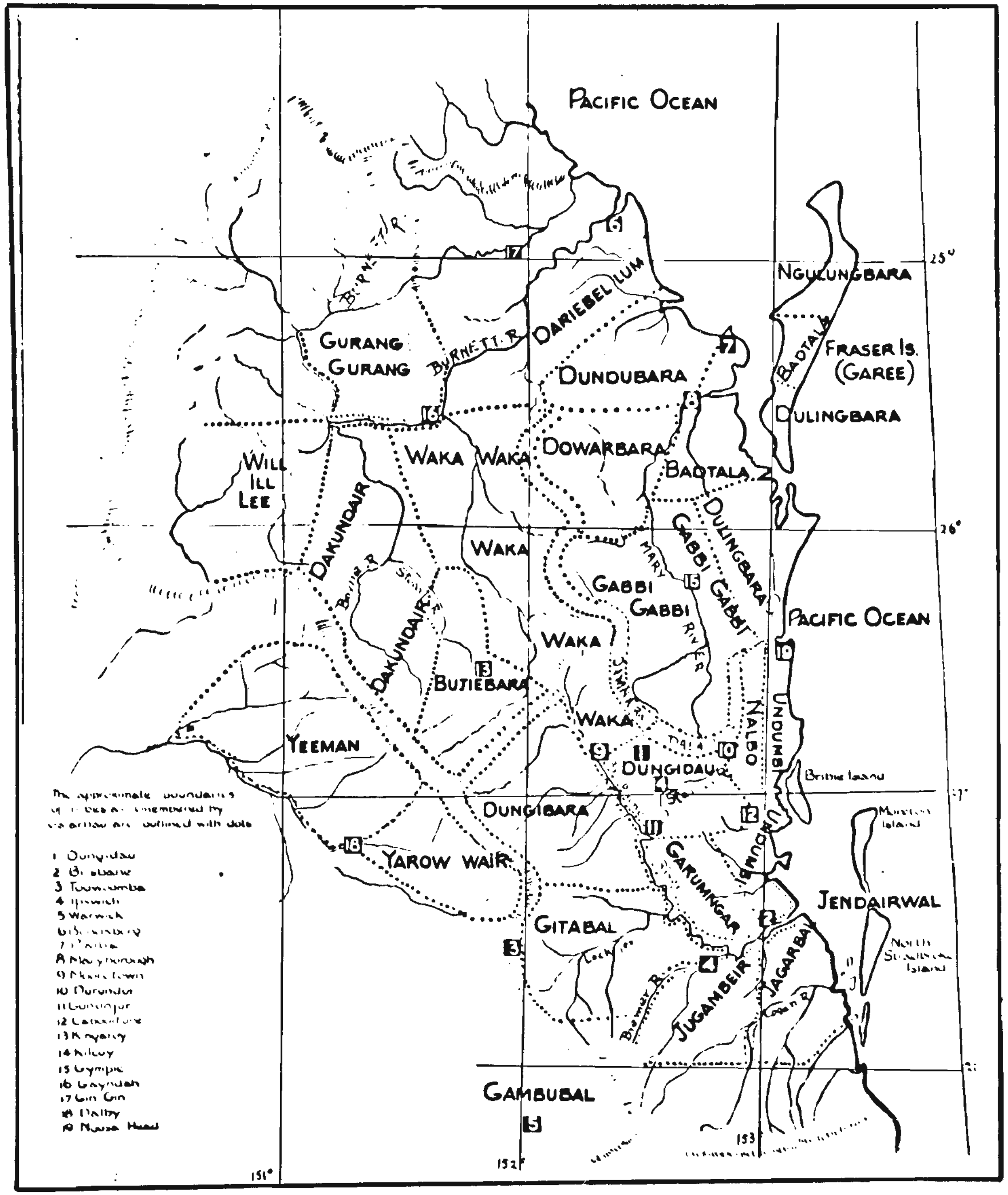
(1972:124-130), it is possible that in the dry season, when the resource base was comparatively impoverished, territoriality intensified, thereby precluding the sort of gatherings required by proposition one.

It is more difficult to refute the second proposition. There are two sets of evidence militating for its rejection: 1, implications drawn from Simpson's letters regarding the validity of his trichotomous classification, and 2, the rather tenuous information furnished by tribal boundary maps. Three factors suggest that the mountain people claimed and used territory in the lowlands. First, in using the term "head" when referring to creeks and rivers Simpson seems to be describing upper-middle catchment areas and/or major feeder streams in the foothills, *not* the actual source areas in the ranges. For example he describes Sandy Creek (one of two possibilities; a large upper-middle catchment tributary of the Brisbane River, or a tributary of the Stanley River) as "one of the heads of the Brisbane" (Langevad 1979:7; in Simpson's time the Stanley was thought to be a continuation of the Brisbane River). In other words it seems that the mountain people lived on larger tributary streams, not in the mountains. Second, the raids against settlers made by these "wild" peoples usually penetrated some distance into the lowlands, for example onto properties in the north-central river valley country around Wivenhoe (Fig. 1)(Petrie 1975:146-149). This suggests the raiders were probably groups who originally possessed territory extending from the ranges out onto the river flats. Upon European encroachment they may have retreated up the less accessible valleys in the foothills where troopers would not follow (Langevad 1979:24), and from there directed their incursions against the settlers.

Finally, the "creek and river" dwellers were not the only people who decided (for whatever reason) there were advantages in relatively peaceful relations with the Europeans. It is clear from the records of the McConnel family (A.J.McConnel, n.d.) that several of the supposedly aggressive groups living in the foothills were also attracted to the stations and homesteads, and lived in comparative harmony with the whites, even protecting them from raiders from adjacent areas. In summary, information gained from a careful reexamination of historical records seriously undermines the dichotomy upon which Tindale's arguments pivot. I argue that the division between subcoastal "mountain" peoples and "river and stream" dwellers was largely a manifestation of post-contact dislocation and stress.

Maps delineating band and/or tribal territories lend some support to this idea (Fig. 11). As Mitchell pointedly remarked (1949:110) the actual position of any boundary line (probably the whole concept of lines) is likely to be wrong. Nonetheless the maps were based on verbal evidence received by Winterbotham and Tindale and the use of certain specific geographical features (e.g. the main rivers and drainage divides) to mark boundaries conforms with expectations raised by the literature (C. Anderson, Dept of Anthropology and Sociology, University of Queensland, pers comm 1980; see also Doolan 1979, Lewis 1976, Lourandos 1977, Peterson 1976). Viewed in these terms, the maps may furnish at least plausible guidelines to how areas used were arranged in relation to available resources.

The maps show that all but the two northernmost Jinibara groups had access to a major subcoastal watersource. Further, all territories (with the same two exceptions) included areas of all four habitat zones



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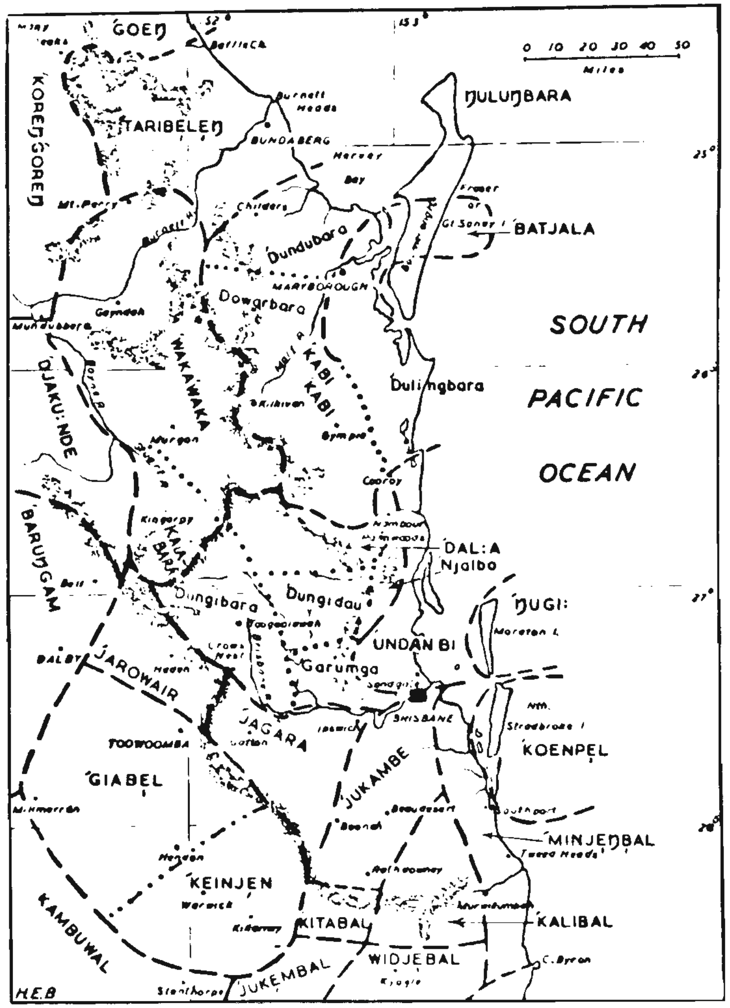


B

Figure 11. Maps of tribal territories. Note alignment of boundaries with respect to biogeographical units discussed in text.
A = Winterbotham 1957
B = Tindale 1974:124.

present in the study area. Band ranges seem to have been aligned at right angles to the general trend of the environmental zones. It is possible that the two anomalous groups had more in common with Wide Bay mountain groups, possibly to the extent that their economies reflected a similar upland orientation.

The foregoing suggests that proposition two is less consistent with our knowledge of hunter-gatherer economics than proposition three. For various reasons, hunter-gatherer economies were "not organized to give brilliant performance" (Sahlins 1972:99). In broad terms these economies adapted populations to regional environments rather than the reverse. An essential element of this general adaptive strategy, particularly in uncertain environments, was to optimize alternatives by maximizing the range of exploitable resource zones. As the subcoastal peoples were hunter-gatherers living in a comparatively uncertain environment, it can be argued *a priori* that as a population they would have adapted in a similar manner. In this context, proposition two is the weaker hypothesis. While it solves the problem of territoriality, which the first argument does not, it does not adequately solve the problem of *population* adaptation to environmental circumstances. Clearly, the third proposition emerges as the most satisfactory interpretation of a poorly documented aspect of subcoastal adaptation. What remains to be considered is whether there are other factors which might invalidate this reasoning.

Procurement Technologies

On first inspection the historical evidence bearing on subsistence technology does not seem particularly edifying (Tables 5 and 6). The toolkit as a whole was relatively undiversified, with a few generalized implements and facilities (i.e. the one-piece spear) being used for a variety of tasks. Similarly, hunting, riverine fishing, and foraging techniques seem to have been much the same throughout the Moreton Region. Apart from fishing technologies, there is no suggestion in the literature that the use of any item or technique was restricted to particular seasons or places. Nor is there any indication that technological factors would have precluded the exploitation of any subcoastal habitat or resource. In short, there was probably no technological restriction on the operation of a pulsatory subsistence strategy. It is possible, however, that certain technological capacities may have removed or reduced the need for such a strategy; proposition two could have been made viable through resource management.

There are several references to anthropogenic modification of the environment and/or resource management by fire or other means (for example, Cunningham 1824, 1829 in Steele 1972:171,313, Lockyer 1825, in Steele 1972:201). However, there is no suggestion of activities of the types recorded in Victoria (Lourandos 1980, Mulvaney 1975: Chap.9), or of the use of fire on the scale observed in southwest Western Australia (Hallam 1975). Both the general ethnographic record and the notes and map annotations of early European explorers show that pyro-modification was probably practiced, but provide few clues as to the seasonality or frequency of burning. It seems likely that the country was periodically fired to clear shrub layers and surface debris in open forest

ITEM	COMMENT	REFERENCES
Shelter A	Usual shelters consisted of a windbreak made of brush.	Petrie 1975:15
B	Semicircular bark and/or grass structure supported on a frame of bent and tied saplings. Houses up to five.	Mathew 1910:84 Petrie 1975:13,99 Winterbotham 1957:100
C	Note: a larger, more permanent type of the same design, housing up to ten people, was used on the coast.	Petrie 1975:100
Spear Hunting Fishing Fighting	A straight shaft, six to ten feet long, unbarbed, no prongs, no stone or bone point. Hand-thrown as there were no spear-throwers.	Cunningham, 1929, in Steele 1972:340 Mathew 1910:86,118,122 Winterbotham 1957:80
Spear B	Note: a specialized pronged spear was used for fishing by coastal people.	Petrie 1975:102
Yam stick	A thick shaft, four to six feet long, pointed at both ends.	Petrie 1975:103 Winterbotham 1957:88
Club Hunting Fighting	There were a variety of these short, thick implements. They were pointed at one end, with a hand-grip at the other.	Mathew 1910:85-86 Petrie 1975:102-104 Winterbotham 1957:80-81
Boomerang Hunting Fighting Games	There were two basic types. The one used for hunting and fighting was straight and non-returning. The one used for games was of the curved, returning type.	Mathew 1910:90 Petrie 1975:90,100-101 Winterbotham 1957:51,80-83
Stone axe	Flaked from a river pebble blank, edge-ground, and hafted with vine, cord and resin.	Mathew 1910:118-119 Petrie 1975:104-105 Winterbotham 1957:88
Stone knife Cutting Scraping Fighting	Usually primary flakes on fine-grain siliceous rock. Flakes were seldom modified by retouch, but Petrie notes they were occasionally hafted.	Mathew 1910:86,119-120 Petrie 1975:105 Winterbotham 1957:88
Shell Cutting Scraping	Sharp pieces of mussel shell of indeterminate size were used for a variety of tasks.	Mathew 1910:86,120,122-123 Petrie 1975:101,105 Winterbotham 1957:75,84,87
Net A	For hunting, a three to four inch mesh, strung along the ground to snare terrestrial game, and in trees for birds (often in conjunction with throwing sticks). Made from fibre.	Mathew 1910:87,121 Petrie 1975:84,86,90
B	For fishing, a small hand-held scoop net, or tow-row, was used.	Mathew 1910:90,121 Petrie 1975:73-75 Winterbotham 1957:28-29
Dillybag	Made of grass, bark or hair fibre, of varying dimensions. Winterbotham also mentions the use of cane.	Mathew 1910:121 Petrie 1975:93,106-107 Winterbotham 1957:85
Canoe	Constructed of bark sheets, bunched and tied at both ends and held open by stretchers. Mathew notes "the construction of bark canoes was understood, but they were rarely called into requisition".	Mathew 1910:121 Petrie 1975:97-98

Table 5 . A list of major material items recorded historically in the Moreton Region.

RESOURCE	EQUIPMENT USED	COMMENT
Macropods and other marsupials eg. bandicoots	Spears, clubs, nets	The game was driven by fire and/or beaters to waiting hunters who then speared and/or clubbed the animals to death. Petrie and Mathew also describe the use of nets, as noted in Table 5 . Game was also hunted with spears by individuals or small groups, by stalking around waterholes.
Freshwater fish and eels	Spears, tow-rows, brush weirs, poison	Petrie describes the use of nets and spears in co-ordination with fish weirs in shallow water. Mathew mentions the use of spears and tow-rows in shallow water, and Winterbotham records fish poisoning in smaller pools or in still water.
Possums and other phlangerids	Axes and climbing vines, clubs	The animals were either cut out of trees and flung to the ground or caught on the ground and clubbed to death.
Freshwater tortoises	Nets	Men would swim up to basking tortoises and grab them from underneath. Petrie also describes capture by netting.
Freshwater mussels	None	The shells were felt for in the mud with the feet. Neither Mathew nor Winterbotham mention mussels as food.
Honey	Axes, honey rags, dillybags	Hives were cut into and the honey either put into a dillybag or soaked up with a honey rag.
Echidna	Clubs	The animals were dug out and clubbed to death. Petrie mentions that dogs were used in the search.
Emus	Spears, clubs, nets	The animals were usually speared from a hide near a water source. Petrie mentions a technique using nets similar to those used for hunting macropods.
Ducks	Boomerangs and nets	Nets were placed in the birds' flight path near a water source. Flights of ducks were frightened into the nets by thrown boomerangs intended to simulate hawks.
Reptiles	Axes, digging sticks, clubs	Snakes and lizards were caught on the ground or dug out or cut out and clubbed to death.
Root vegetables	Digging sticks	Roots were grubbed out by digging.
Fruit, nuts, seeds	Dillybags	These foods were consumed raw at or near the extraction point and/or collected in dillybags for later processing and consumption in camp.
Grubs	Axes, sharp sticks	Grubs were either cut out with an axe or dug out with a sharp stick. Petrie mentions there was some management of grub populations on the coast.

Table 6 . A compilation of historical references to major foods and their usual methods of acquisition in the Moreton Region, from Mathew 1910, Petrie 1975, Winterbotham 1957.

and open forest-closed forest ecotones. The explorers travelled through extensive areas of "thin" forest and grassland, mostly on the central riverine plains (Fig. 10). Such features probably resulted from burning off to facilitate movement of people and prey, to make the area generally more liveable, and to reduce the risk of destructive uncontrolled fires (Hallam 1975, Prof. H.T. Lewis, Anthropology Department, University of Alberta, pers comm 1980). Such widespread clearance burning was probably infrequent. Anthropological and botanical evidence (Hallam 1975:54-55 , Pryor 1976:65-66) suggests a three to five year cycle for this sort of activity.

It is also probable that there was more frequent smaller-scale firing. It can be argued that game drives using fire were part of a regular seasonal burning cycle probably carried out towards the end of winter. It is at this time that the resource base would have been most impoverished, particularly for large groups of people in the riverine zones. Fishing would have begun to decline in importance as breeding populations diminished and migratory prey species began to disperse. Further, just prior to, or during the initial stages of the light late winter rains, lowland groundcover would have been driest and the rainfall would have promoted rapid regrowth of pasture and other habitats.

Such a management regime would have had two desirable results. By taking advantage of environmental conditions and the postulated concentration of population to conduct fire-assisted drives in and around the riverine plains, it is probable that a wide variety of prey would have been made available at a generally unfavourable time. This and perhaps some additional burning off may also have prolonged the presence of more mobile migratory species by improving their habitac conditions, thus maintaining some degree of stability in the late winter resource base.

The lack of documentation notwithstanding, it is possible that purposive environmental modification and management was both more common and more effective than it seems. In the past, groups may have been able to manipulate their resource base to such a degree that year-round occupation of the central riparian areas was possible. However, I contend that resource control would have become much less effective as summer progressed. Mobile prey species would have become increasingly less dependent on centralized sources of feed and water, the accessibility of remaining fish populations would have been gradually reduced to a minimum, and rich sources of plant foods would have been coming into season elsewhere. In short, the effort involved in staying in the riverine zone would not have been justified by the returns. Therefore, I argue that while resource management may have *delayed* late winter fragmentation to some degree, the basic pulsation strategy would not have been greatly affected.

Camp Types and On Site Conditions

There is nothing in the historical literature intimating the existence of either special camp types or any special sets of desirable on site resources which would have appreciably altered the pattern of subsistence and settlement outlined above. The little evidence available implies that there were two basic classes of camps: base camps and "satellite extraction", "work" or "dinner-time" camps (Binford and Binford 1969:71, Jochim 1976:61, Meehan 1977:366; see Mathew 1910: 83, Petrie 1975: 13, Winterbotham 1957:56,73). Base camps can be defined as those occupied by families or groups either overnight (when mobile) or for intermediate periods up to two or three weeks. It was in these camps that most food preparation and redistribution would have taken place, and where most other maintenance activities would have been pursued. In addition to facilitating easy access to the necessary resources, the actual placement of these camps apparently hinged mainly on the liveableness of a location rather than defensive requirements or the need to observe people and game (cf. Cassels 1972, Jochim 1976: 50). Attractive conditions probably included sandy or relatively stone-free surfaces, reasonably flat but well-drained areas, the presence in the immediate area of fuel and raw materials for shelters and the absence of undesirable plant and/or animal species (Mitchell 1949:108, Petrie 1974:100, Winterbotham 1957:81).

The second type of camp is probably better labelled extraction point, as such places are likely to have been extremely short term foci of specific extractive activities (Yellen 1977:73-78, cf. Binford 1980: 9,18). There is no evidence that these points were regularly used for habitation. It would be virtually impossible to generate a meaningful set of placement criteria for such sites. To effectively model the location of particular resources at specific points in time would be an extremely difficult, if not hopeless, task.

It could be expected that areas where the desired combination of resources and on-site conditions occurred would have been reused for both habitation and extraction. Both Petrie (1975:13,94) and Mathew (1910:84) make this clear in pointing out that well-known places were always named for evening rendezvous when groups were on the move; presumably these were suitable camping locations. Although the periodicity of reuse is difficult to ascertain, it is doubtful that base camps would have been used more than once a season. Depletion of vital resources within female foraging range, reduction in the traffic of game, and fouling and insect infestations are among the factors likely to have precluded such practices (Petrie 1975:100, Yellen 1977:67).

The most important inference to be drawn is that there were no special types of camps of location associated with logistically-organized collection strategies (long-term residential bases, field camps, stations and caches) (Binford 1980:19). The implication is that base camps were moved between suitable areas within reach of desired resources which were then exploited on a daily (or less frequent) basis. There is no evidence that specialized parties (all-male hunting groups, for example) left central bases for comparatively long periods to allow resources to be brought in bulk from far afield back to the base camp, or to establish food caches to be used at a later date. This is not denying that overnight camps may have been used by procurement parties, or that short-term food storage was not practised. I am arguing that such habits were extraordinary, and that camp types and locations characteristic of foraging rather than collecting strategies were the norm.

Discussion

The foregoing has put forward the idea that the subcoastal population was a recognizable, albeit loosely organized entity, with all constituent groups (with the possible exception of minor peripheral elements) operating within the boundaries of the study area. It is argued that in the absence of technological restraints, effective long-term resource control, specialized medium or long-term work camps, and unusual camp placement criteria, the majority of subcoastal groups employed the same or similar pulsation strategies, facilitated primarily by the arrangement of exploited areas at right angles to a range of environmental zones. This argument is posited as the most justifiable of several hypotheses in that it is the most consistent with both the historical record and ethnographic experience.

When the evidence examined in this chapter is integrated, a reasonable medium-grained scenario emerges. In winter, large extrafamilial base camps should have been grouped near the major central watercourses to allow access to favourable riverine and contiguous open forest zones. Generally such camps should have been placed on sandy, relatively flat places close enough to permanent water to permit easy collection but not so close as to scare game or attract insects. Assuming that the groups involved were large, and that the focus of resource acquisition was restricted in its distribution, it is possible that these camps were extensive linear arrangements moved relatively infrequently over short distances along or around focal watersources.

Most summer camps should have been placed where the required set of on-site conditions coincided in the middle to upper catchments of tributary streams. This would allow female access to non-perennial water sources and associated fringing/aquatic zones, and to the rich upland plant resources. It would also have given comparatively unhindered access to mobile prey in the open forests of the valleys and foothills. Assuming that summer groups were smaller and more mobile than in winter, summer camps were probably relatively ephemeral affairs moved quite frequently between patches of food resources.

Having generated this model, it is now possible to raise specific hypotheses concerning the distribution of archaeological sites in the study area, and to determine the degree to which the locational patterns discerned in the prehistoric record conform with expectations.

III

GETTING THE DATA

The Survey

During the second half of 1979 approximately five months were spent executing the site survey. The usual cycle of operations was comprised of three elements:

1. logistical organization
2. surveying and assessing the need for further work
3. follow-up work.

The proximity of the study area to the University facilitated this work regime.

Two different survey methods were used. Initially it was intended to conduct a 5% simple random sample of the entire subcoastal area. The region was artificially demarcated and divided into ten 200km^2 sampling frames. Each frame was subdivided into 800 x .25km^2 sampling units. Five frames were chosen and 80 units selected within each, using a random numbers table in each instance. Extra units were chosen in each frame to avoid problems of inaccessibility.

A simple random sample was chosen because it makes no assumptions about the reference population and therefore minimizes bias in the sample (Redman 1974:10). This was appropriate to an exploratory survey such as this. The decision to survey 400 x .25km^2 square units was predicated on three factors. Simplicity of operationalization and manageability of resulting data were two primary considerations. Acceptable procedural rigour was the third. Of several choices, a 5% sample comprised of a large number of small, square units was methodologically the most suitable under the circumstances (Redman 1974:16-20, Schiffer and House 1975:45, Schiffer et al. 1978:10-13, Smith 1980:79-83).

To locate squares on the ground, large-scale aerial photographs were used to pinpoint a corner. The square thus located was then measured out. In open, flat or undulating sectors this procedure presented few problems. Forested, hilly country posed some difficulties; it was far less accessible, and the vegetation cover hindered the initial location of specific geographical features on the aerial photographs. Nonetheless, most squares were located in or close to their mapped positions. This can be established using a technique known as a resection, which plots an unknown position by reference to at least three known features of the landscape.

Once a square was flagged, it was surveyed in a zig-zag pattern, following precalculated bearings over set distances. I reckoned on good observation for at least a metre to either side of my path, and so determined that 10,000m^2 would actually be surveyed in each unit.

A higher intensity would have been more desirable, but could not be achieved with the resources at hand. After completing 40 squares in Frame 1 (Reedy Creek), it was decided that adverse field conditions and a lack of time would defeat my purpose. Aided by hindsight, reconnaissance of the other frames demonstrated that similarly restrictive field conditions obtained throughout the study area. Consequently, the survey strategy was altered to incorporate "'methodologically unlovely' techniques" (Aikens 1976, quoted in Schiffer et al. 1978:2).

The boundaries of the frames were redrawn to conform with the catchment boundaries of the major stream(s) in each frame, to give greater control over some analytical variables (see Chapter 4). A non-randomized "gumshoe" search technique was then initiated. (House and Schiffer 1975:37). Upon entering a frame, a vantage point was chosen and the density of groundcover in the surrounding area was assessed. If visibility appeared too low, the area was checked over several traverses. If visibility was adequate, those places where the ground could be seen were intensively examined. In hillier parts this method was not always practicable. In such places several traverses of the area were made. Local (European) informants were consulted in all areas. A number of unsuccessful attempts were made to contact Aboriginal informants.

The main disadvantage of this non-probabilistic approach is its lack of statistical rigour. Hence, the representativeness of the sample and the statistical strength of any inferences drawn from analysis remain problematical (cf. Read 1975:51). The advantages include a minimization of time spent in low visibility areas and a dramatic increase in information gathering in terms of effort expended.

Forty-one sites were located, including a bora ring, a rockshelter, open sites and a number of scarred trees.

An unanticipated event led to a reduction of the number of frames to four. An examination of the Buaraba Creek catchment had begun when it was discovered that one of the local residents (Mr W. Webster; see Australian Archaeology 11:37-39) had systematically surveyed the entire valley, and had made extensive surface collections. The sites and collections were documented, and I made a short videotape of Mr Webster's stone-tool making skills. Rather than use his material in the analysis, it was decided to use it as a base for comparison of results.

The Frames

The four frames examined are similar in many ways. There are some differences in drainage patterns, topography, geology and soils, and in the arrangements of major habitat zones. The environmental details of each frame relevant to this paper are summarized in Figure 12. Much of the information is only approximate, owing to a lack of precise baseline data. The text below expands on the figure and gives specific historical information about each frame.

Reedy Creek catchment (Figs. 12, 13), the northernmost frame, is the largest and one of the best drained. Elements of all major biotic units are represented. The country of relatively low relief has been extensively cleared and is used for grazing and dry crops. In the higher and more rugged parts to the east only a few small areas close to water have been cleared; the rest remains heavily

FRAME 1: Area 200km^2 Drainage density 1.38km/km^2

Area (km^2)/% Total Area:			Forest Zones		
Fringing	1.38	(0.69)	Upland	59.58	(29.80)
Lowland	94.35	(47.17)	Closed	44.69	(22.34)
			Altitude Zones (m a.s.l.)		
0-100	30.00	(15.00)	3-400	48.00	(24.00)
1-200	67.00	(33.50)	400+	10.00	(5.00)
2-300	45.00	(22.50)			
			Soil Zones (Northcote 1971)		
Um2.12	2.0	(1.00)	Gn7.74	4.0	(2.00)
Db3.12	7.0	(3.50)	Uc4.11	20.0	(10.00)
Dr2.41,Dr3.41	29.0	(14.50)	Dr2.22	33.0	(16.50)
Dy3.42	40.0	(20.00)	Um4.11	65.0	(32.50)
			Distance Zones Permanent Water (km)		
0-.05	3.95	(1.98)	.501-1	39.5	(19.75)
.051-.1	3.95	(1.98)	1+	121.0	(60.50)
.101-.5	31.60	(15.80)			

FRAME 2: Area 114km^2 Drainage density 1.89km/km^2

Area (km^2)/% Total Area:			Forest Zones		
Fringing	1.08	(0.95)	Upland	3.97	(3.38)
Lowland	91.12	(79.93)	Closed	17.83	(15.64)
			Altitude Zones (m a.s.l.)		
0-100	28.00	(24.57)	3-400	7.00	(6.14)
1-200	56.00	(49.13)	400+	4.00	(3.50)
2-300	19.00	(16.66)			
			Soil Zones (Northcote 1971)		
Uc4.11	9.00	(7.90)	Dy3.42	26.00	(22.80)
Um4.11	11.00	(9.65)	Db3.12	45.00	(39.50)
Dr2.22	23.00	(20.15)			
			Distance Zones Permanent Water (km)		
0-.05	2.39	(2.10)	.501-1	23.94	(21.00)
.051-.1	2.39	(2.10)	1+	66.12	(58.00)
.101-.5	19.15	(16.80)			

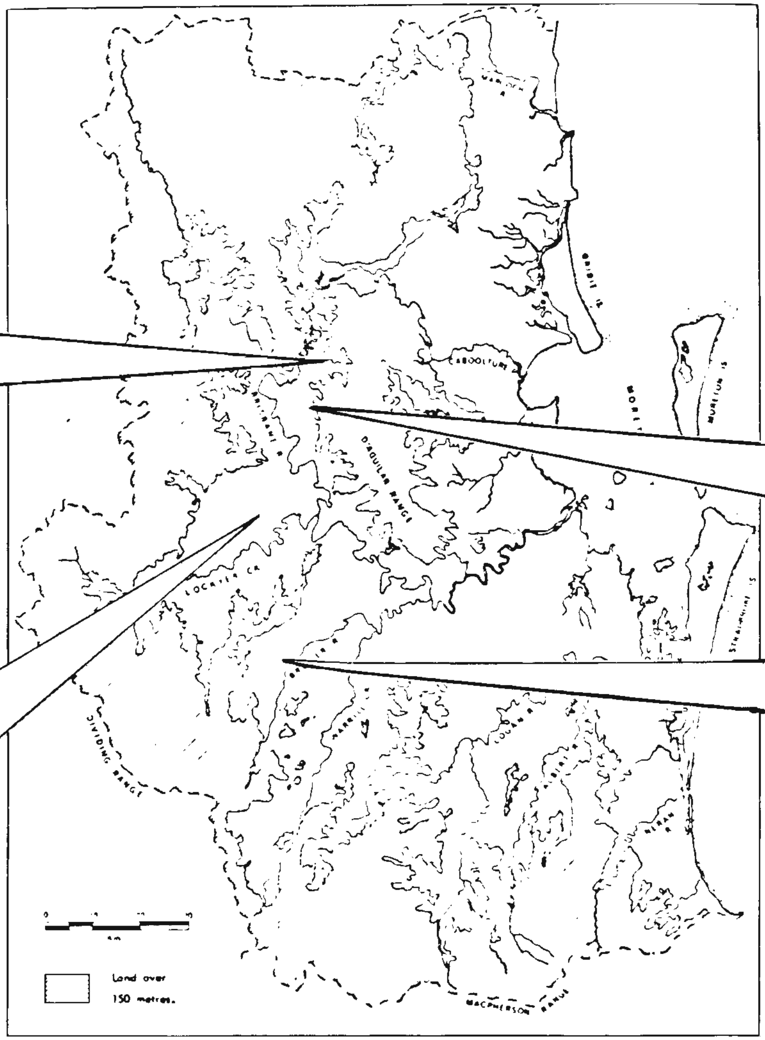


Figure 12. Descriptive data and general location of sample frames within the study area.

FRAME 3: Area 175km^2 Drainage density .748km/km^2

Area (km^2)/% Total Area:			Forest Zones		
Fringing	4.74	(2.70)	Upland	35.00	(20.30)
Lowland	135.26	(77.00)	Closed	0.00	(0.00)
			Altitude Zones (m a.s.l.)		
0-100	90.00	(51.40)	3-400	4.00	(2.28)
1-200	68.00	(38.86)	400+	2.00	(1.14)
2-300	11.00	(6.28)			
			Soil Zones (Northcote 1971)		
Dy3.31,.61	12.00	(6.85)	Dy3.42	55.00	(31.43)
Dy5.21,.42	35.00	(20.00)	Ug5,15	73.00	(41.72)
			Distance Zones Permanent Water (km)		
0-.05	2.97	(1.70)	.501-1	29.75	(17.00)
.051-.1	2.97	(1.70)	1+	115.50	(66.00)
.101-.5	23.80	(13.60)			

FRAME 4: Area 140km^2 Drainage density .843km/km^2

Area (km^2)/% Total Area:			Forest Zones		
Fringing	0.59	(0.42)	Upland	2.00	(1.43)
Lowland	137.41	(98.15)	Closed	0.00	(0.00)
			Altitude Zones (m a.s.l.)		
0-100	38.00	(27.14)	3-400	8.00	(5.71)
1-200	64.00	(45.71)	400+	9.00	(6.43)
2-300	21.00	(15.00)			
			Soil Zones (Northcote 1971)		
Dy2.22	12.00	(8.57)	Uf6.12	19.00	(13.59)
Gn3.91,.94	26.00	(18.57)	Dy3.31	44.00	(31.42)
Ug5.15,.16	39.00	(27.85)			
			Distance Zones Permanent Water (km)		
0-.05	1.82	(1.30)	.501-1	18.20	(13.00)
.051-.1	1.82	(1.30)	1+	103.60	(74.00)
.101-.5	14.56	(10.40)			

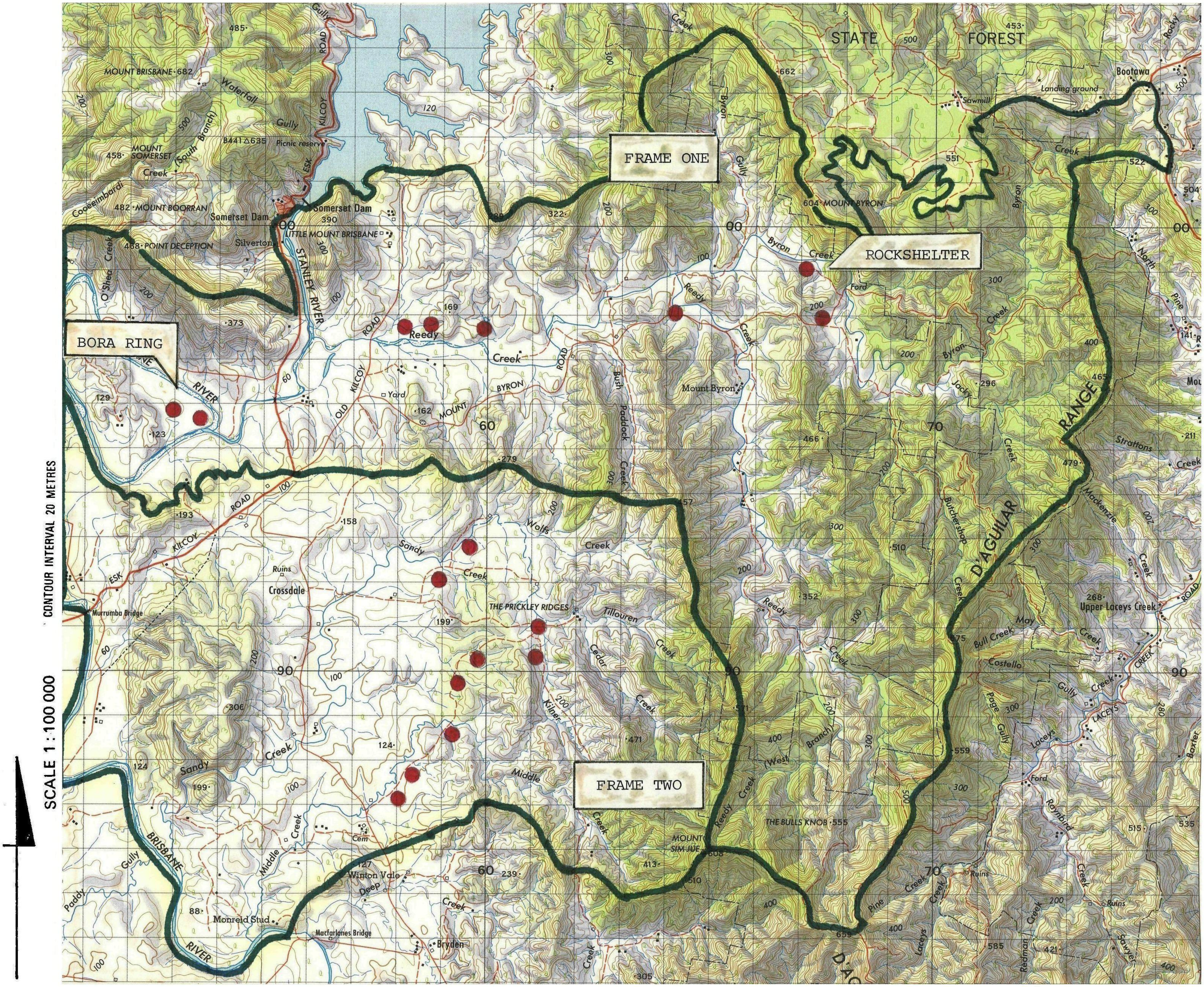


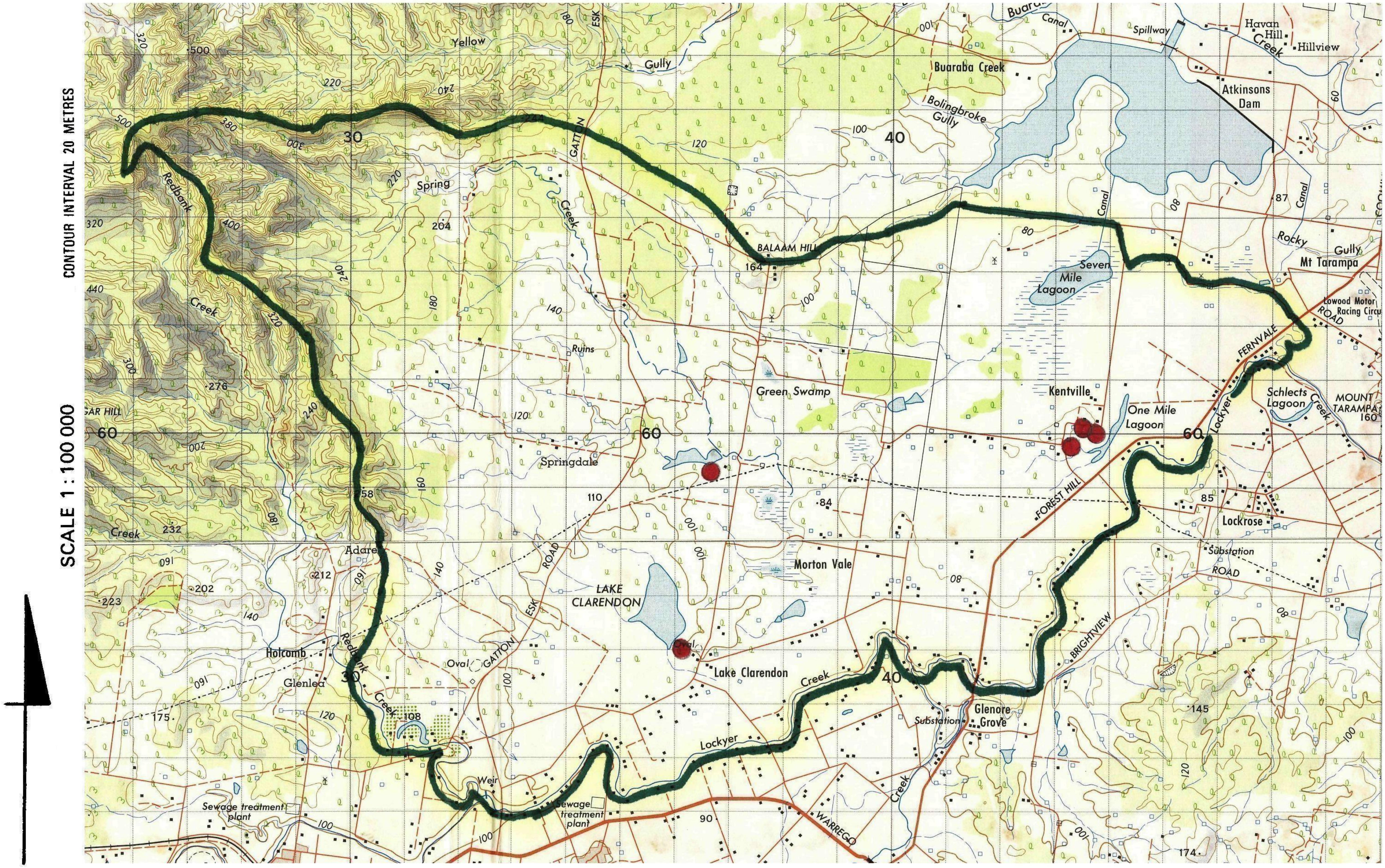
Figure 13. Map of Frame One and Two, showing catchment boundaries (green line) and site locations (red dots).

forested. Apart from one extremely small portion near Mt Byron, this part of the frame is used for cattle grazing. Groundcover in the cleared areas consists of a variety of exotic pasture grasses and is dense throughout the year. This greatly reduces visibility and mobility. The vegetation on the higher ground is mainly upland open forest and/or closed forest, with a medium-dense shrub layer and medium groundcover. Accumulated leaf litter reduces visibility and lantana thickets (*Lantana camara*) render some areas totally inaccessible. There is moderate to severe sheet, gully and tunnel erosion in the cleared areas. During his trip up the Brisbane and Stanley Rivers in September, 1825, Lockyer saw people and campsites in several places in and near this frame (see Table 1, above).

The Spring and Middle Creeks catchment (Figs. 12, 13) is immediately south of Frame 1. It is only half the size of the latter but is better drained. Again, all major biotic units are present. Most of the rolling terrain in the western half has been cleared and impro to support cattle. The eastern half exhibits less clearing and little or no pasture improvement, but the area is still grazed. The vegetation in both the cleared and uncleared areas is similar to Frame 1 in terms of visibility and access. There is some moderate sheet and gully erosion in the cleared parts of the frame. Lockyer noticed fire places and scarred trees in the vicinity of Frame 2. He also encountered what may have been a womens' foraging party. Although he is unclear on the point, it seems no men were present when his party came across a small camp. The people left hastily, leaving their goods and chattels, then several women and children reappeared (in Steele 1972:194-195).

The third frame (Figs. 12, 14) is dominated by a system of lagoons, and is quite different from the others. The land is generally very flat, rising gradually westwards towards the foothills of the Biarra Range. There is no closed forest in the immediate area; precontact vegetation probably consisted of open eucalypt forest, grasslands, and fringing forests. The flat eastern sector is entirely under cultivation by market gardeners. The western portion is grazing land and State forest. Visibility is poor throughout the frame; the horticultural areas are constantly under irrigated crops, and the pasture and forest areas present obstacles similar to those in Frames 1 and 2. There is moderate to severe sheet and gully erosion on the terraces around the lagoons and on the Lockyer Creek floodplain. In June, 1829, Cunningham saw and heard people on several occasions in this area. He also observed a large settlement near the Morton Vale lagoon (Table 1).

Franklin Vale Creek, the last frame surveyed, is in the southwest of the study zone (Figs. 12,15). It is the least well-drained frame, and gets least rain. Most of the rolling terrain and the creek flats in the centre of the catchment have been cleared, while the ranges in the east and west remain forested. The floodplain is used for both grazing and dry and irrigated agriculture. The ranges are also used for grazing. There is no closed forest in the catchment, although it is present in the general area, mainly to the south. Precontact vegetation consisted primarily of open forests, some grassland, and gallery forest. Moderate to severe sheet and gully erosion occurs on the lower slopes, terraces and creek flats. In 1829, Cunningham saw "very recent traces" of Aborigines at the northern end of the frame, and saw and heard people quite frequently. On June 18, his



<u>Figure 14.</u> Map of Frame Three, showing catchment boundary (green line) and site locations (red dots).

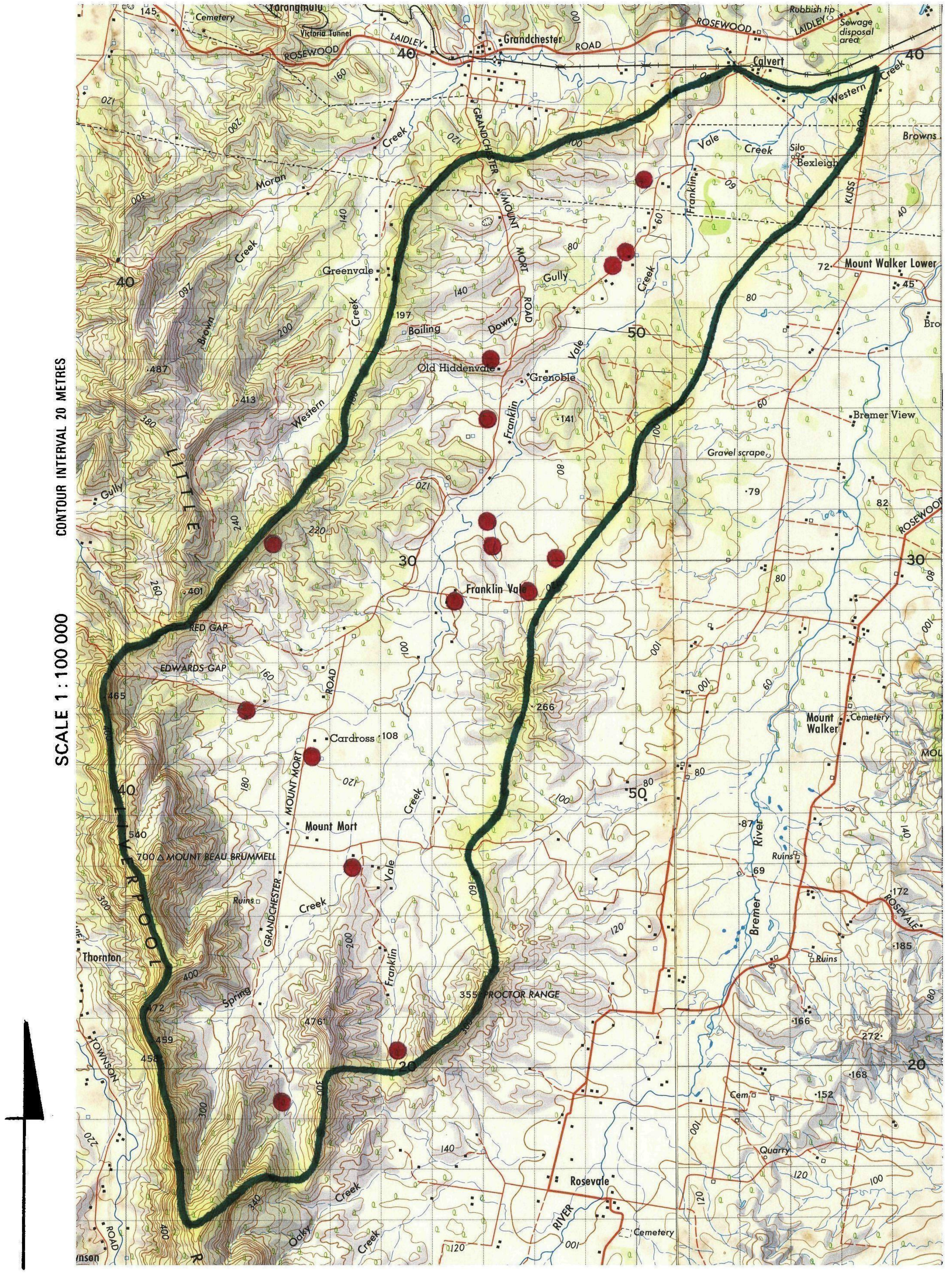


Figure 15. Map of Frame Four, showing catchment boundary (green line) and site locations (red dots)

party was visited by a small group and various gifts were exchanged. A few days later the expedition was nearly burnt out by a fire lit and supervised by Aborigines (in Steele 1972:312-315).

Field Methods and Results

For survey purposes any material reflection of past human activity was recorded as a site. This definition includes all artefacts and ecofacts. Site boundaries were fixed on a presence-absence basis; the site ended where the evidence ran out. Any items or clusters of items more than 50m apart were recorded as separate sites. Site recording followed a straightforward procedure. A standardized checklist of locational and archaeological attributes was completed for each site, sketches were made and photographs taken of the site and surrounds (see Fig. 16).

Groups of small, disturbed scatters of stone artefacts are the dominant archaeological feature of the areas examined. The majority of sites are located above normal floodheights, on sandy terraces or low gradient slopes. Most are, or would have been, in lowland open forest. The greater proportion are within one kilometre of permanent water and 500m of intermittent water. All surface scatters were found in areas of moderate sheet and/or gully erosion in localities known or reasonably presumed to have been used only for grazing since European settlement. Frame 1 has the second lowest number of sites (8), but the greatest variety, including a bora ring and Balancing Rocks Shelter. Frame 2 has marginally more sites (9), including several isolated finds and scarred trees. Frame 3 contains fewest sites (5), including the only large site. Frame 4 has two to three

Figure 16.

BRISBANE RIVER VALLEY SURVEY SITE RECORD FORM

Frame No. Site No. G.R. Map

SITE TYPE: (tick)

1. rockshelter/deposit
2. disturbed open midden
3. undisturbed open midden
4. disturbed surface scatter
5. undisturbed surface scatter
6. isolated item
7. buried worked stone
8. buried occupation
9. modified tree
10. ceremonial site
11. burial
12. quarry
13. art site
14. stone arrangement
15. other (specify)

Comment.....

Fotos...

SETTING: (Tick)

Landform 1. floodplain 2. bank 3. terrace 4. hillslope 5. hilltop

Soil type ____ (CHECK!!)

Vegetation 1. fringing 2. lowland open 3.highland open 4. closed

Altitude (m) 0-100, 101-200, 201-300, 301-400, 400+

Aspect ____

Flooding 1. never 2. rare 3. ordinary floods

Distance drainage mouth (m) ____ stream name ____

Distance permanent water(m) ____ type ____

Distance intermittent " " ____ type ____

Comment...

Fotos...

Cultural Material (tick)		Collected?	Foto in situ?
stone artefacts			
shell (&type)			
nonhuman bone			
human bone			
charcoal/ash			
mod. tree			
glass			
pottery			
metal			
other (specify)			

Comment...

DIMENSIONS:

length (m) ____ width (m) ____

SITE CONDITION: (tick)

erosion	none		moderate	
	negligible		severe	

other damage ____

OTHER DETAILS:

RECORDER: DATE:

PLAN AND SECTION ATTACHED?? YES NO

times the number of sites found in other frames (16). All were surface scatters. Three sites were also found *en route* between Frames 3 and 4. A site inventory, including all relevant data, is presented in Appendix C.

Surface collection methods were also straightforward. Except in the large site in Frame 3, all portable remains were recovered. Several authors suggest that surface material should be probabilistically sampled (e.g. Rootenberg 1964). Such methods were not generally employed because of the low number of items in most sites, coupled with the desire to retain as broad as possible a range of material for future study (which can be done after various development projects have been completed). The large site was systematically sampled by transects spaced at three metre intervals, with all material encountered in a transect being collected.

A total of 1045 stone artefacts were recovered. Of these, 78 (7.46%) exhibit usewear. The remaining variety of items, dominated by cores and flakes, is classified here as non-utilized, or debitage. A preliminary sorting of the material was checked by Dr J. Kamminga (Division of Prehistory, Latrobe University). The following presents preliminary descriptions of, and discussion concerning, the recoveries.

Knapped Stone

Virtually all the stone artefacts (99.7%) and the bulk of the recognizable tools (96.15%) are knapped items. Nearly all the tools fall into three categories based on edge morphology and damage patterns (cf. Kamminga 1980):

1. scrapers
2. used edges
3. choppers

A single backed blade was also recognized. General descriptions of these items are contained in Table 7 and Figure 17.

Other

Only three non-knapped artefacts were found:

1. an anvilstone
2. a grindstone fragment
3. an edge-ground hatchet.

These items are also described in Table 7 and Figure 17.

Discussion

The flaked tools are clearly dominated by a range of amorphous items similar to those typifying Late Holocene assemblages in many parts of Australia (personal observation, see also Morwood 1981:42-45, Mulvaney 1975:243-244). There is no evidence of systematic blade production, and with the exception of the backed blade and the edge-ground axe, there are no type artefacts characteristic of classic Small Tool or Core Tool and Scraper assemblages. An instructive comparison can be made between the data presented here and the results of initial analyses of material from Platypus Rockshelter. The first point concerns the backed blade. In Platypus Rockshelter these items are absent from the most recent levels but present in levels dated to between 2500 and 4500 B.P. (Dr H.J. Hall, Dept of Anthropology and Sociology, University of Queensland, pers.comm. 1981). The second point focusses on certain *qualitative* differences between the open site and rockshelter assemblages.

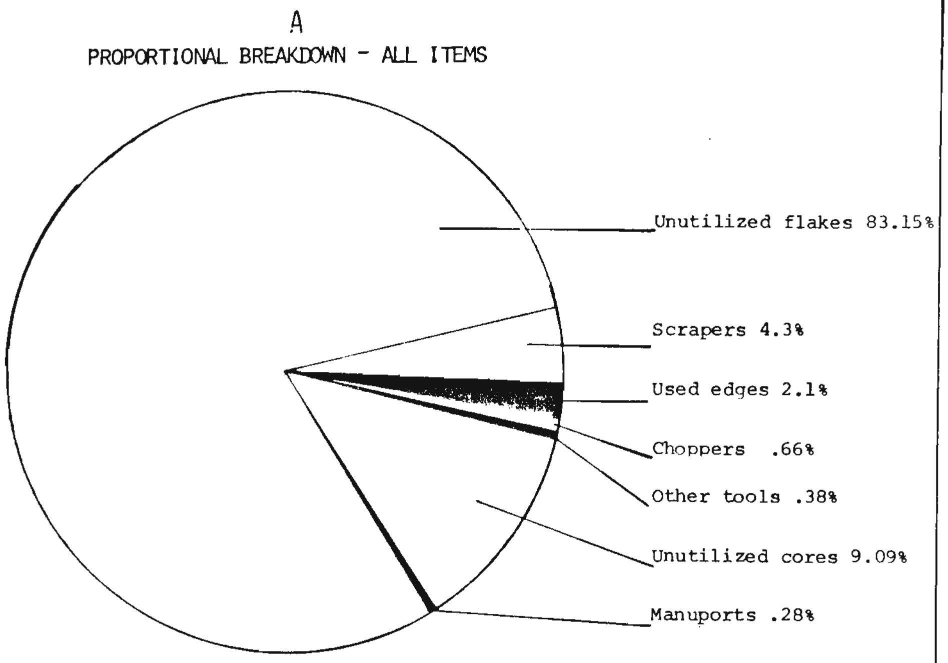


Figure 17. Breakdowns of stone artefact recoveries, A showing all material collected, B showing breakdown and mean metric characteristics of stone tools (excluding single-item classes).

KEY:

$\bar{l}$ = mean length

$\bar{b}$ = mean breadth

$\bar{h}$ = mean height

$\bar{w}$ = mean weight

$\bar{we}$= mean length of working edge

$\bar{ea}$= mean average angle of working edge

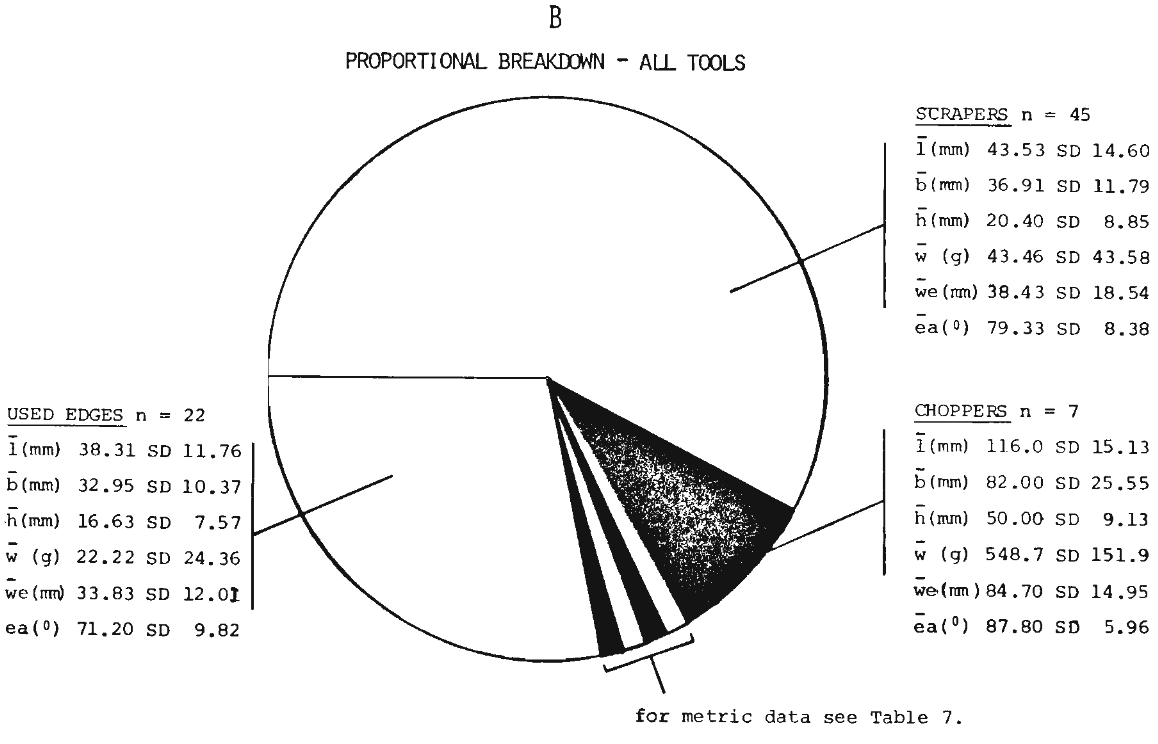


Table 7. Description of stone tools from surface sites in the Brisbane Valley.

ITEM	L mm	B mm	H mm	W g	ANGLE (°)	LWE mm	MATERIAL	COMMENTS
Scraper	41	40	11	28	58.5	26	fine grained unknown	retouch and use fractures on distal end
Scraper	53	37	23	46	83	58	fine grained siliceous	retouch on left edge and distal end
Scraper	52	45	25	42	89	42	fine grained siliceous	retouch and step fractures on left edge
Scraper	46	30	15	20	88	33	medium grained siliceous	retouch and use fractures on left edge
Scraper	36	24	10	8	81	22	medium grained unknown	retouch and fractures on right edge
Scraper	93	76	36	224	72.5	85	medium grained siliceous	use fractures and bending fractures on left edge
Scraper	54	30	21	41	L 83 R 88.5	53 49	medium grained siliceous	use fractures on left and right edges
Scraper	26	29	25	20	78	24	medium grained siliceous	use fractures on left edge
Scraper	36	42	18	44	79.5	38	unknown	use fractures on distal end
Scraper	41	34	27	32	83.5	33	Fine grained siliceous	retouch on left edge
Scraper	29	34	14	13	76.5	52	medium grained siliceous	use fractures on distal end
Scraper	46	32	24	36	89.5	24	fine grained siliceous	use fractures on distal end
Scraper	49	39	41	71	84.5	32	fine grained siliceous	use fractures on right edge
Scraper	58	37	29	79	79.5	47	Medium grained siliceous	use fracture on right edge
Scraper	76	45	28	113	74.5	106	medium grained siliceous	retouch and use fractures on left edge and distal end
Scraper	52	45	34	94	87.5	56	unknown	use fractures on right edge and proximal end
Scraper	44	50	12	27	71.5	53	unknown	notchs with retouch on distal end
Scraper	31	45	12	25	80.5	29	medium grained siliceous	retouch on left edge
Scraper	50	27	30	30	76	45	medium grained siliceous	use fractures on left edge
Scraper	27	28	12	12	R 81 L 77.5	24 25	fine grained siliceous	retouch and use fractures on right and left edges
Scraper	35	42	14	23	83.5	41	quartz	use fractures on distal end
Scraper	30	25	14	13	83.5	30	fine grained siliceous	highly irregular fractures on distal end
Scraper	41	19	20	19	78	41	medium grained siliceous	irregular fractures on distal end
Scraper	58	55	29	111	82.5	46	medium grained siliceous	irregular use fractures on right edge
Scraper	28	26	13	12	81.5	26	medium grained siliceous	use fractures on left edge bending fractures right margin
Scraper	77	47	29	128	79	43	medium grained siliceous	use fractures on right edge
Scraper	28	39	12	10	70.5	28	medium grained siliceous	retouch and use fractures on left edge
Scraper	35	40	19	29	72.5	34	medium grained siliceous	use fracturing and moderate rounding on left edge
Scraper	28	32	13	12	86.5	23	unknown	irregular fractures on distal end, resin on left edge
Scraper	59	56	41	122	85.5	38	medium grained siliceous	retouched all edges, use fractures on right edge

ITEM	L mm	B mm	H mm	W g	ANGLE (°)	LWE mm	MATERIAL	COMMENTS
Scraper	43	36	22	27	83.5	59	medium grained siliceous	retouch on left edge
Scraper	41	28	13	18	69.5	24	fine grained silicified wood	retouch on distal end
Scraper	50	42	23	50	80.5	37	medium grained siliceous	use fractures on right edge
Scraper	26	25	7	6	74	13	medium grained siliceous	use fractures on distal end
Scraper	36	48	11	20	69.5	30	medium grained siliceous	retouch on right edge
Scraper	21	16	9	4	71.5	14	fine grained siliceous	retouched on distal end
Scraper	51	44	29	61	73	37	medium grained siliceous	retouch on left edge
Scraper	53	50	33	105	95	86	medium grained siliceous	retouch on left edge
Scraper	37	27	12	14	70	55	medium grained siliceous	use fractures right edge
Scraper	35	16	15	8	79	22	fine grained siliceous	retouch on right edge
Scraper	44	39	26	53	L 89 R 98.5	33 23	medium grained siliceous	retouch and use fractures on left edge and distal end
Scraper	49	49	18	47	53.5	25	medium grained siliceous	retouch on right edge
Scraper	33	31	18	22	70	30	fine grained siliceous	use fractures on left edge
Scraper	25	18	10	4	87	16	fine grained siliceous	retouch on right edge
Scraper	36	42	21	33	78.5	35	medium grained siliceous	retouch on distal end
Used edge	34	37	15	16	62.5	25	fine grained unknown	use fracture on distal end
Used edge	40	40	13	21	60	60	medium grained siliceous	retouch and use fractures around circumference
Used edge	30	36	9	8	72.5	29	medium grained siliceous	dentated retouch on right edge
Used edge	39	38	9	14	64	30	medium grained siliceous	dentated retouch on right edge
Used edge	25	27	11	5	55	41	fine grained siliceous	retouch and use fractures around circumference
Used edge	29	27	25	13	81.5	33	medium grained siliceous	dentated retouch on right edge, some phytolithic polish
Used edge	49	48	14	40	82.5	52	medium grained siliceous	dentated retouch on right edge
Used edge	33	21	20	12	76.5	21	fine grained siliceous	use fractures on left edge
Used edge	39	39	39	20	70	34	fine grained siliceous	use fractures on left edge and distal end
Used edge	47	17	17	14	64.5	16	fine grained siliceous	use fractures on distal end
Used edge	55	30	15	18	67.5	34	medium grained siliceous	used fractures on right edge
Used edge	29	49	15	20	84	28	fine grained siliceous	use fractures on distal end
Used edge	65	50	24	86	L 78.5 R 79	63 40	medium grained siliceous	use fracture and polish on left and right edges
Used edge	28	20	8	5	65	18	fine grained siliceous	retouch and use fractures on left edge
Used edge	22	32	11	8	82.5	35	medium grained siliceous	use fracture on left edge
Used edge	42	40	17	28	71	25	medium grained siliceous	retouch on left edge
Used edge	65	49	32	100	L 82 R 88	39 41	fine grained siliceous	retouch on distal end
Used edge	34	25	12	11	65	29	fine grained siliceous	use fractures on left edge
Used edge	27	30	14	8	60	25	fine grained siliceous	retouch on left edge
Used edge	38	18	17	12	62	32	fine grained siliceous	retouch on left edge
Used edge	35	25	12	9	56	21	fine grained siliceous	retouch on right edge
Used edge	38	27	17	21	82.5	41	fine grained siliceous	retouch on distal end

Table 7, cont.

ITEM	L mm	B mm	H mm	W g	ANGLE (°)	LWE mm	MATERIAL	COMMENTS
Chopper	100	62	67	551	88.5	76	Unknown	stop flaking on right margin Use fracturing on left edge
Chopper	117	82	38	443	92.5	94	medium grained Unknown	use fractures and crushing on right margin
Chopper	120	60	55	522	92.5	99	Silcrete	use fracturing on right edge
Chopper	106	64	46	410	82.5	80	medium grained unknown	use fracturing on left edge
Chopper	140	130	46	842	L 86.5 R 87.5	100 96	unknown	use fracturing on left and right edges
Chopper	100	102	50	639	94.5	79	medium grained siliceous	use fracturing on left edge
Chopper	129	79	54	434	1. 74 2. 91 3. 88.5	85 85 53	medium grained siliceous	use fracturing on three edges
Backed blade	27	15	3	0.5	20	25	fine grained siliceous	broken
Edge-ground hatchet	152	74	51	843	78	47	unknown	highly weathered and pitted surface, end only ground
Anvil	240	220	120	55,000	-	-	volcanic	dished and pitted surface
Top Grindstone	112	82	38	444	-	-	coarse volcanic	dished and heavily abraded on dorsal and ventral surfaces

Table 7, cont.

Kolmogorov-Smirnov tests demonstrate that the length and weight ranges of material from the surface sites are statistically different from those of the rockshelter artefacts. These differences apply to all levels in the rockshelter (Tables 8, 9). If the tables are examined closely, it can be seen that the nature of the differences varies between levels. Weight and length histograms for the surface sites show minimal skewing to extreme values; material is distributed relatively evenly across the value ranges (Figs. 18, 19). The graphs for Platypus Rockshelter show increasing positive skewness in both weight and length as a function of increasing depth/age. The increasing restriction of length values is particularly noteworthy. The most recent material, from Level X, shows almost no skewing at all. Further, like the open sites, there are no items smaller than five millimetres. The Level 1 graph shows marginal positive skewing and no items in the smallest class. Level 2 exhibits more marked skewing and a noticeable bias towards the smallest size class. This trend continues with increasing depth. Clearly the Level X material is similar, in terms of the distribution of length values, to the open site assemblages despite the statistical difference. I argue this difference, restricted as it is to the highest values, is at least partially a function of the deposition of large items outside the dripline. In short, the open site assemblages are most similar to the most recent material from Platypus Rockshelter in terms of both the range of items present (or, more specifically, absent), and the morphological characteristics of those items.

Class	Surface	Level X	Diff
<5	.2121	.7785	-.5664
10	.3828	.9142	-.5314
15	.5067	.9713	-.4646
20	.5617	.9784	-.4167
25	.6167	.9855	-.3688
30	.6607	.9855	-.3248
35	.6854	.9926	-.3072
40	.7184	.9926	-.2742
45	.7459	.9926	-.2467
50	.7679	.9926	-.2247
55	.7816	1.0	-.2184
60	.7871	0	.7871
>60	1.0	0	1.0
n^1 = 363		crit .1353	
n^2 = 140		Ho rejected	

Class	Surface	Level 1	Diff
< 5	.2121	.9007	-.6886
10	.3828	.9432	-.5604
15	.5067	.9715	-.4648
20	.5617	.9715	-.4098
25	.6167	.9715	-.3548
30	.6607	.9715	-.3108
35	.6854	.9715	-.2861
40	.7184	.9715	-.2531
45	.7459	.9785	-.2326
50	.7679	.9855	-.2176
55	.7816	.9925	-.2109
60	.7871	.9925	-.2054
>60	1.0	1.0	0
n^1= 363		crit .1349	
n^2= 141		Ho rejected	

Class	Surface	Level 2	Diff
< 5	.2121	.8661	-.6540
10	.3828	.9365	-.5537
15	.5067	.9787	-.4720
20	.5617	.9857	-.4240
25	.6167	.9857	-.3690
30	.6607	.9927	-.3320
35	.6854	.9927	-.3073
40	.7184	.9927	-.2743
45	.7459	.9927	-.2468
50	.7679	.9927	-.2248
55	.7816	.9927	-.2111
60	.7871	.9927	-.2056
> 60	1.0	1.0	0
n^1= 363		crit .1346	
n^2= 142		Ho rejected	

Class	Surface	Level 3	Diff
< 5	.2121	.8525	-.6404
10	.3828	.9614	-.5786
15	.5067	.9678	-.4611
20	.5617	.9870	-.4253
25	.6167	.9870	-.3703
30	.6607	.9934	-.3327
35	.6854	.9934	-.3080
40	.7184	.9934	-.2750
45	.7459	.9934	-.2475
50	.7679	.9934	-.2255
55	.7816	.9934	-.2118
60	.7871	.9934	-.2063
> 60	1.0	1.0	0
n^1= 363		crit .1301	
n^2= 156		Ho rejected	

Class	Surface	Level 4	Diff
< 5	.2121	.8707	-.6586
10	.3828	.9381	-.5553
15	.5067	.9661	-.4594
20	.5617	.9773	-.4156
25	.6167	.9941	-.3774
30	.6607	.9941	-.3334
35	.6854	.9941	-.3087
40	.7184	.9941	-.2757
45	.7459	.9941	-.2482
50	.7679	.9941	-.2262
55	.7816	.9941	-.2125
60	.7871	.9941	-.2070
>60	1.0	1.0	0
n^1= 363		crit .1244	
n^2= 178		Ho rejected	

Table 8. Kolmogorov-Smirnov results for comparisons of weight distributions of artefacts from Platypus Shelter and surface sites in the Brisbane Valley. Note: values should exceed critical value to be significant at .05. Class refers to measurement interval, in grams.

Class	Surface	Level X	Diff
< 5	0	0	0
10	0	.0719	-.0719
15	.0137	.3093	-.2956
20	.0577	.4963	-.4386
25	.1870	.6689	-.4819
30	.3605	.7983	-.4378
35	.4788	.9277	-.4489
40	.5862	.9780	-.3918
45	.6688	.9851	-.3163
50	.7404	.9923	-.2519
55	.7927	.9923	-.1996
60	.8312	.9923	-.1611
65	.8725	.9923	-.1198
70	.8862	1.0	-.1138
>70	1.0	0	1.0

n^1 363 crit .1356
n^2 139 Ho rejected

Class	Surface	Level 1	Diff
< 5	0	0	0
10	0	.1119	-.1119
15	.0137	.3880	-.3743
20	.0577	.6417	-.5840
25	.1870	.8506	-.6636
30	.3605	.9103	-.5498
35	.4788	.9625	-.4837
40	.5862	.9774	-.3912
45	.6688	.9774	-.3086
50	.7404	.9848	-.2444
55	.7927	.9848	-.1921
60	.8312	.9923	-.1611
65	.8725	1.0	-.1275
70	.8862	0	.8862
>70	1.0	0	1.0

n^1 363 crit .1374
n^2 134 Ho rejected

Class	Surface	Level 2	Diff
< 5	0	.5035	-.5035
10	0	.5247	-.5247
15	.0137	.6239	-.6102
20	.0577	.7373	-.6796
25	.1870	.8224	-.6354
30	.3605	.9075	-.5470
35	.4788	.9500	-.4712
40	.5862	.9712	-.3850
45	.6688	.9712	-.3024
50	.7404	.9853	-.2449
55	.7927	.9923	-.1996
60	.8312	.9923	-.1611
65	.8725	.9923	-.1198
70	.8862	.9923	-.1061
>70	1.0	1.0	0

n^1 363 crit .1349
n^2 141 Ho rejected

Class	Surface	Level 3	Diff
< 5	0	.5192	-.5192
10	0	.6153	-.6153
15	.0137	.6986	-.6849
20	.0577	.8460	-.7883
25	.1870	.8844	-.6974
30	.3605	.9164	-.5559
35	.4788	.9548	-.4760
40	.5862	.9932	-.4070
45	.6688	1.0	-.3312
50	.7404	0	.7404
55	.7927	0	.7927
60	.8312	0	.8312
65	.8725	0	.8725
70	.8862	0	.8862
>70	1.0	0	1.0

n^1 363 crit .1301
n^2 156 Ho rejected

Class	Surface	Level 4	Diff
< 5	0	.3352	-.3352
10	0	.4261	-.4261
15	.0137	.6533	-.6396
20	.0577	.8067	-.7490
25	.1870	.8805	-.6935
30	.3605	.9316	-.5711
35	.4788	.9656	-.4868
40	.5862	.9712	-.3850
45	.6688	.9769	-.3081
50	.7404	1.0	-.2596
55	.7927	0	.7927
60	.8312	0	.8312
65	.8725	0	.8725
70	.8862	0	.8862
>70	1.0	0	1.0

n^1 363 crit .1249
n^2 176 Ho rejected

Table 9. Kolmogorov-Smirnov results for comparisons of length distributions of artefacts from Platypus Shelter and surface sites in the Brisbane Valley. Note: values should exceed critical value to be significant at .05. Class refers to measurement intervals, in millimetres.

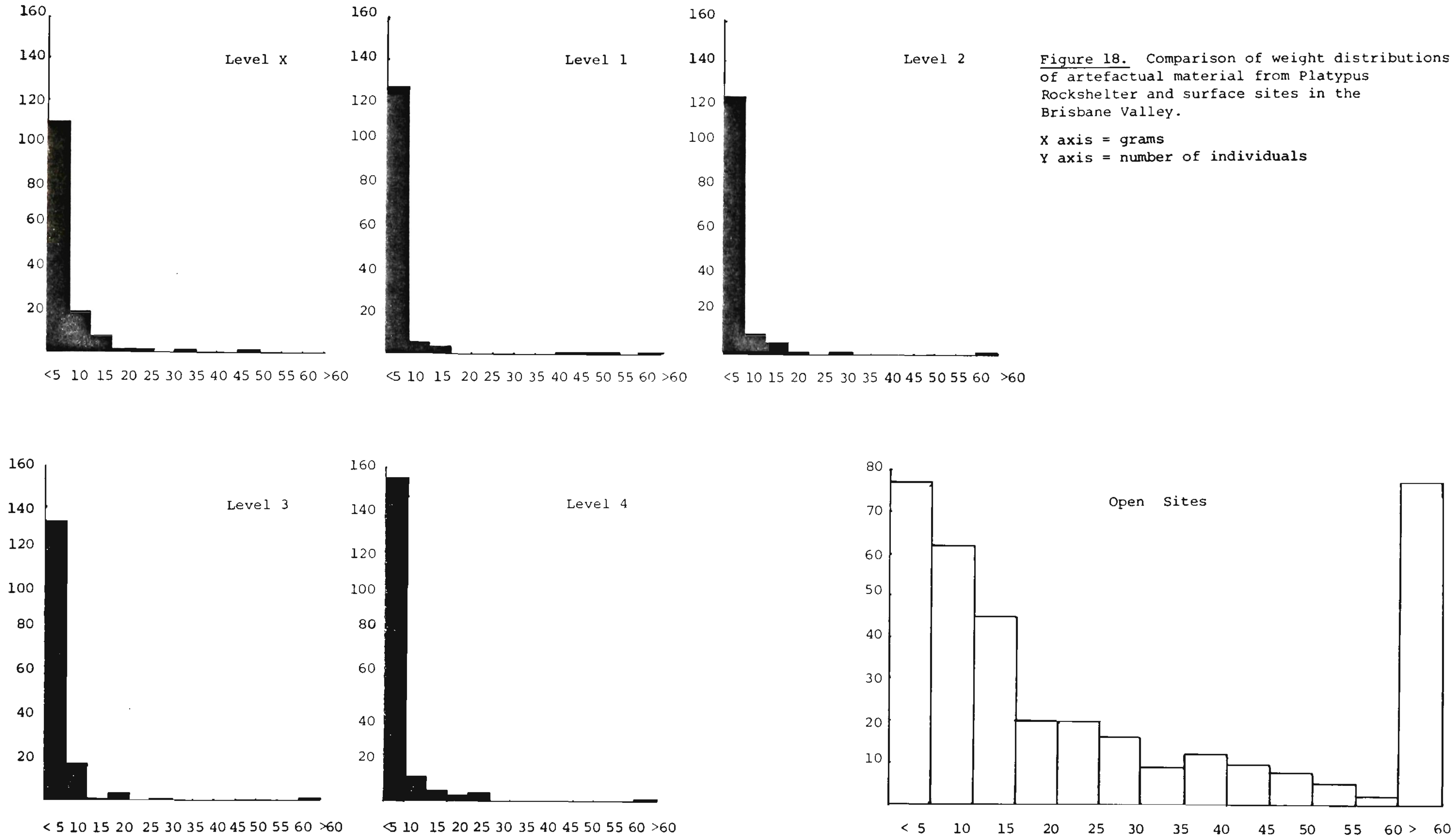


Figure 18. Comparison of weight distributions of artefactual material from Platypus Rockshelter and surface sites in the Brisbane Valley.

X axis = grams
Y axis = number of individuals

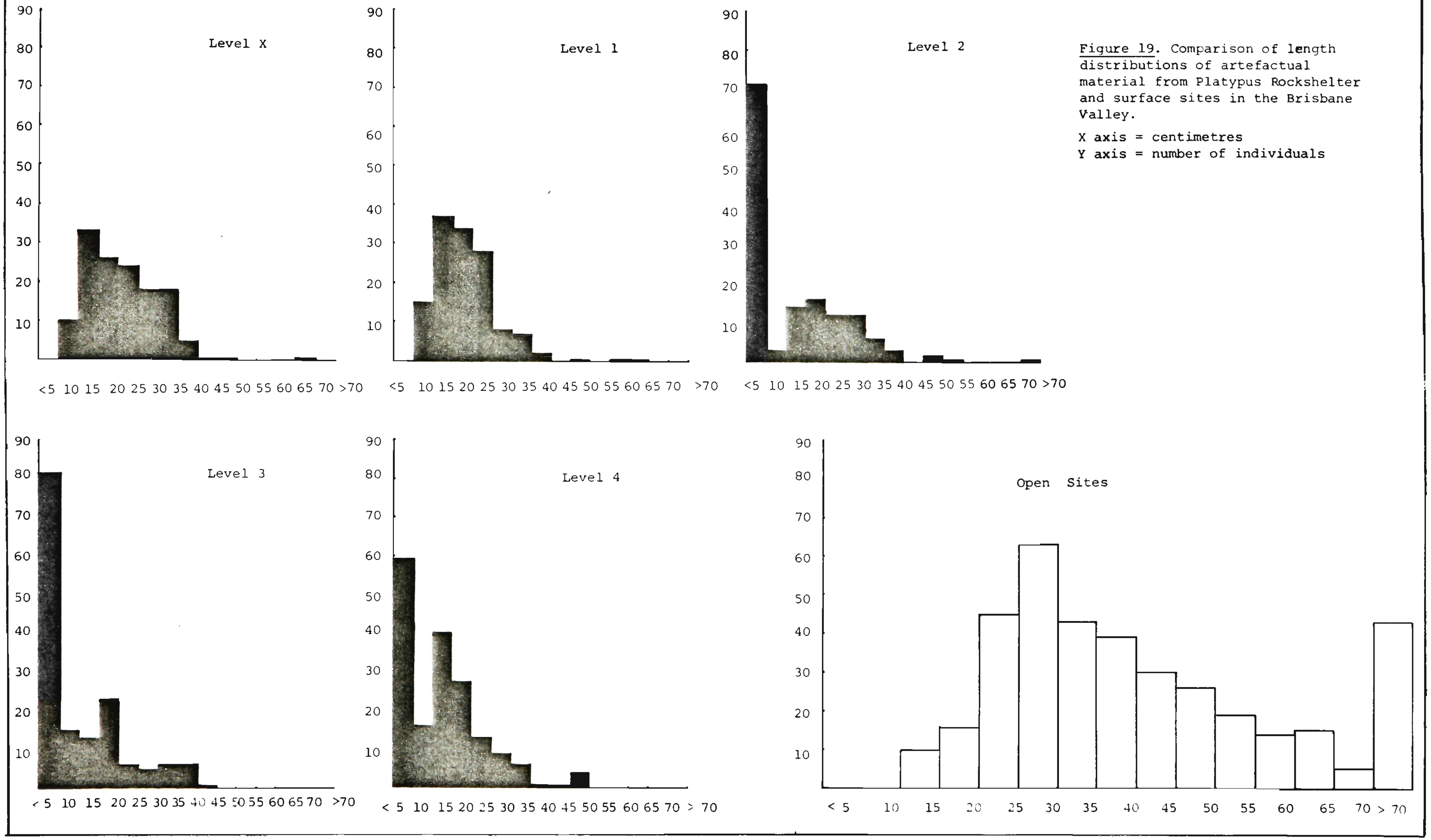


Figure 19. Comparison of length distributions of artefactual material from Platypus Rockshelter and surface sites in the Brisbane Valley.

X axis = centimetres
Y axis = number of individuals

Balancing Rocks Shelter

Site and Setting

As the only potentially stratified site found, this shelter was excavated in an attempt to augment current subcoastal chronology. The site is located in the upper-middle section of the Reedy Creek catchment, on the interface of a colluvial slope and a relict stream terrace (Figs 13, 20). It is centred on a large pile of agglomerate boulders, one of which forms a roof covering a flat floor area of about 100m^2. The boulder pile is one of three similar features in the locality; all three are within 200m of each other. No other such features could be found in the surrounding area.

Including an 'outside' surficial element, the site is 900m^2 in size. In addition to the main chamber there is a very low overhang on the northeastern periphery and an enclosed but uncovered section to the southwest. The floor of the main chamber slopes to the northwest, the flat area mentioned previously being in the centre. The surface of the deposit is a dark, compacted soil with a visibly high organic content. Under the low overhang there is a powdery sand-silt deposit. The surface of the deposits in both sections are covered with small fragments derived from the boulders. There is a vertical concavity or chimney above the overhang. It is about 1.5m by 1m in the horizontal plane, and about 2m high.

The site is in lowland open forest (predominantly *E. crebra* - Ironbark - communities). Groundcover consists mainly of native and introduced pasture grasses. The shrub layer is sparse. The site is

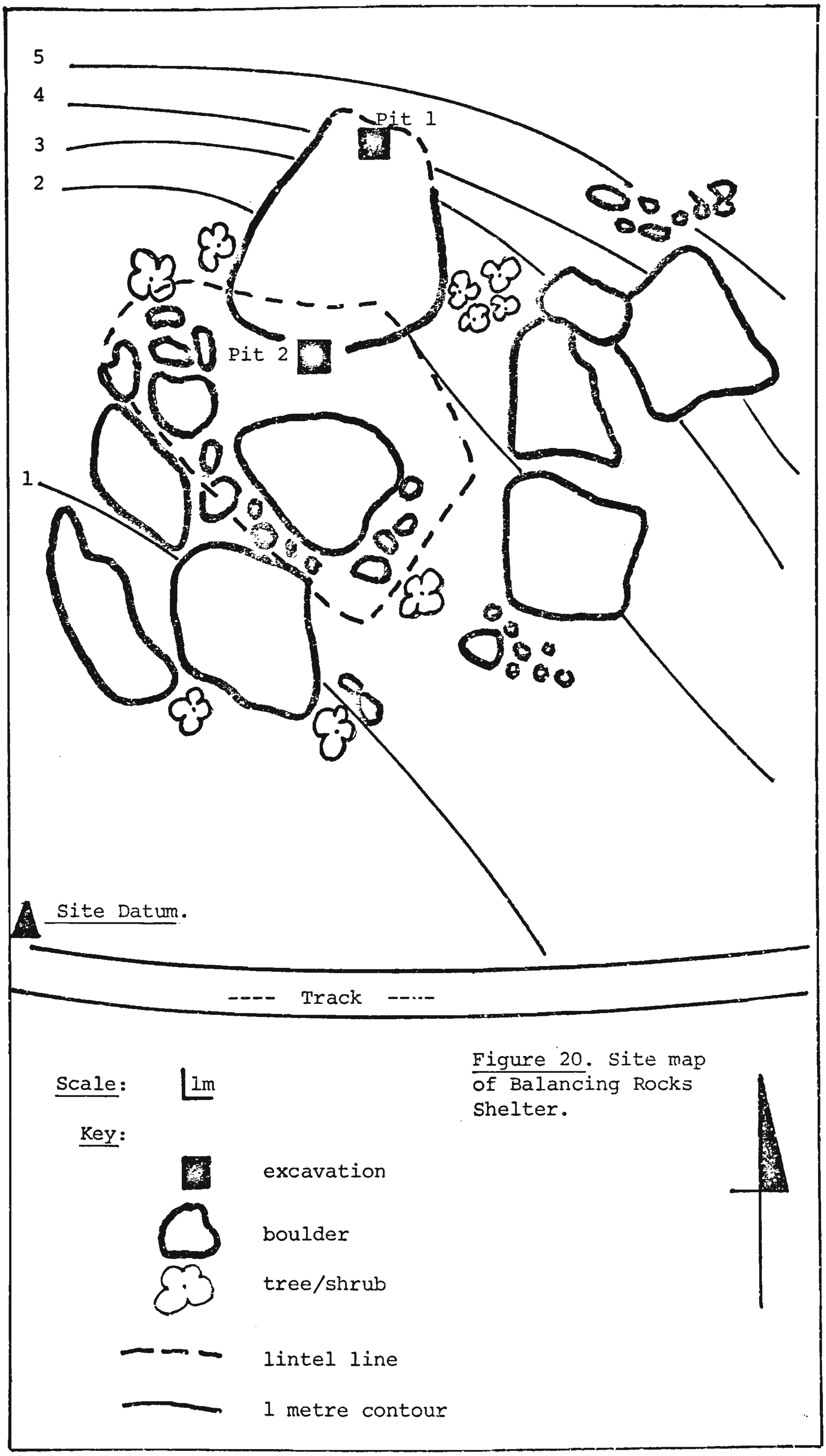


Figure 20. Site map of Balancing Rocks Shelter.

within 100m of an intermittent stream and about 300m from Reedy Creek. On the opposite side of Reedy Creek the Mount Byron escarpment rises very steeply from about 200m to 500m a.s.l. The slopes are covered with highland open forest and minor stands of closed forest.

No previous scientific excavations have been carried out at the site. Several previous surface collections have been made by local people, and by R. Sheridan (former archaeology student with the Dept of Anthropology and Sociology, University of Queensland). Sheridan's collection and some photographs of other items from the area are in my possession. No records of site use by Aborigines are known to exist. A local resident claims the area was used for female burial, and several verbal reports indicate the possible presence of burials in the cliffs. None have actually been seen as the escarpment is inaccessible without climbing equipment. The site has been used as a bushwalker's shelter, as evidenced by a large fire place against the northern wall of the main chamber, which is strewn with modern debris. The site has also been used as a cattle yard. There is barbed wire around several minor entrances to the shelter and the floor is covered with cattle droppings.

Excavation and Stratigraphy

A one by one metre grid was laid over the covered area and a small part of the open area. To test the cultural content and subsurface structure of the site two trial pits were excavated. The first, a one metre by one metre pit (Pit 1) was placed in the edge of the deposit under the low overhang. The second (Pit 2) was placed in the middle of the flat portion of the main chamber floor. Both pits were later reduced in size; Pit A was continued as a 50cm by 50cm pit and Pit B as a 50cm by 1m trench. Both were excavated using Johnson's "bucket method" (1979) and all material was screened through 1.5mm mesh.

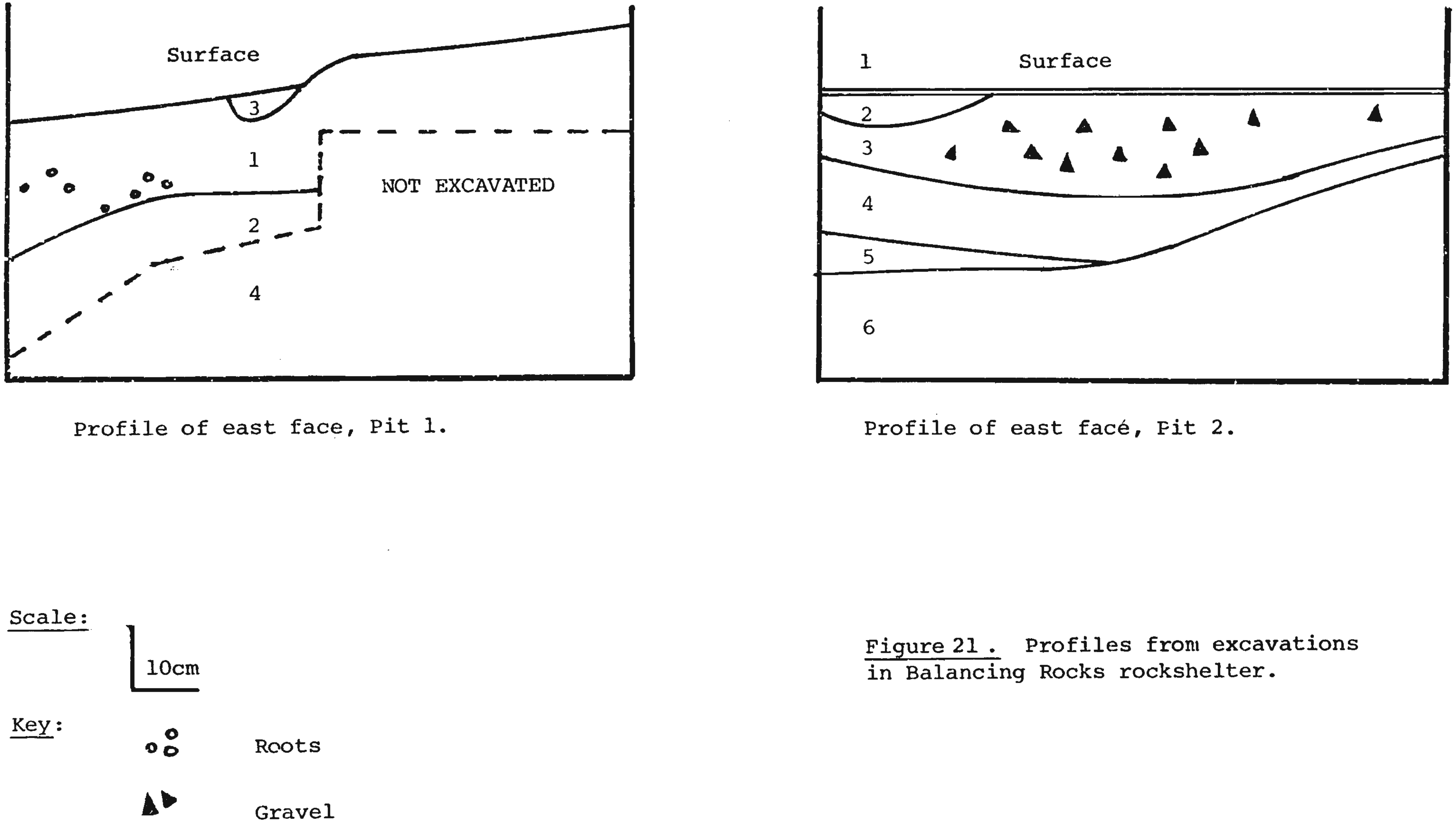
Pit 1

Four levels were recognized during the excavation (Fig. 21). The upper unit, Level One, has a maximum depth of about 15cm, and is composed of a loose yellow sand-silt with a small number of roof spall fragments. Roots and rootlets penetrate throughout the level. Level Two directly underlies Level One and is very similar in structure and composition. The major difference is that the deposit is slightly more compacted, particularly in the northern (most exposed) extremity of the pit. Level Two is about 10cm deep. Level Three is a dripline feature or gutter associated with Level One. It differs from the first unit in that it is more friable, slightly darker and has a larger pebble/roof spall component. Level Four is an extremely hard mottled clay unit forming the base of the pit. It slopes gently south-north, following the general line of surrounding slopes.

Only two minute debitage flakes and a negligible quantity of highly comminuted bone and charcoal (less than 2g in each instance) were recovered. It is highly likely that the presence of this material in Pit 1 is entirely fortuitous, and that it washed down from upslope, possibly from inside the main chamber.

Pit 2

Six stratigraphic features were distinguished in the pit profile (Fig. 21). Level One is a hard surface pavement about 1cm deep. It is dark, gravelly and has a high visible organic content. It probably



Profile of east face, Pit 1.

Profile of east facé, Pit 2.

Figure 21 . Profiles from excavations in Balancing Rocks rockshelter.

represents the area of maximum compaction from human and animal activity inside the shelter. Level Two is situated directly below the first unit in the eastern end of the pit. It is a shallow depression slightly more friable than Level One, and has a relatively high organic content. Charcoal lumps are scattered throughout the feature. Level Three is below these uppermost units. It is a compacted red gravelly deposit with a maximum depth of about 18cm. Levels Four to Six are composed of a hard clay material virtually identical to the basal unit in Pit 1. Level Four contains a friable degraded clay which compacts with depth and merges with Level Five in the western half of the pit, and with Level Six - the basal unit - in the eastern half.

Slightly more cultural material was found in this pit than in Pit 1. Five tiny flakes (total weight <1g) were recovered from the uppermost 10cm. Given the number of artefacts found on the surface, both in and around the shelter area, the scarcity of subsurface material is a little perplexing. One possibility is that the shelter was not used for habitation at all in the past, with any groups using the area preferring to use the open terraces nearby. Another possibility is that the area was in fact a burial area until the contact period, when various (perhaps disparate) groups were forced to seek refuge in less accessible areas. I do not think further excavation at Balancing Rocks shelter itself would prove fruitful. Work in the immediate future should concentrate on the Mt Byron escarpment, to check on the stories concerning burials.

IV

ANALYSIS

In the field, groups of sites appeared to be concentrated along valley floors with most individual sites situated in places similar to those anticipated by the model. To furnish an objective set of site location criteria it is necessary to quantitatively confirm or disconfirm these impressions. I have attempted to accomplish this by examining in turn those factors which will progressively reduce the focal area(s) in each frame. These factors are:

1. the general nature of intra-frame site distribution
2. the positioning of sites in relation to the resource zones in and around each frame, and
3. the association of sites and specific environmental features in their vicinity, i.e. "'background' variables' (Hodder and Orton 1976:224) or "on-site resources" (Plog and Hill 1971:14).

This staged reduction from a broad to a more finely-focussed view of locational patterns is both an effective decriptive device and a logical aid to future planning. Prior to discussion of the tests and the results for each stage, there are several problems to be addressed.

Nearly all the sites are disturbed surface features comprised wholly of stone material. Hence it is difficult to accurately gauge their antiquity, the degree of their contemporaneity and their respective functions. It is therefore feasible that the sample incorporates a range of temporally and functionally unrelated sites. Attempting to control this problem has long been recognized as one of the most frustrating impediments to hunter-gatherer archaeology (cf. Lee and DeVore 1968:285-287). To delineate discrete spatio-temporal units in sites like those dealt with here, and to then study inter-unit differences in structure, composition and location would be impossible in most cases. Several factors confound work of this sort, including the characteristically low visibility of single-occupation open sites, the introduction of new and confusing elements when sites or parts of sites are reused, and post-depositional degradation (cf. Jones 1980, Peterson 1971, Smith 1980, Yellen 1977:77-84). In this instance the problems of sample variability are exacerbated by the small number, geographical dispersal and comparative archaeological poverty of the sites. In an attempt to rationalize these difficulties I have aimed for a relatively coarse-grained resolution.

Age and Contemporaneity

I argue that all of the sites are recent and thereby relatively contemporaneous. This claim, based on the evidence of the recovered stone artefacts, is justified when viewed in the light of our knowledge of the spatio-temporal distribution of Australian stone tools. Put briefly, the almost complete lack of *fossiles directuers* common elsewhere, indeed, with the exception of an edge-ground axe and one backed blade, the lack of any recognizable type artefacts, suggests a Late Holocene, post backed blade age (Hiscock and Hughes 1980, Lampert 1971a, Morwood 1981, Mulvaney 1975). Further, the association in some sites of glass and porcelain with stone tools that do not differ from those in other sites implies a modern upper age limit.

While it may be difficult to argue convincingly for precise contemporaneity, the foregoing intimates that the sites belong in one "archaeologically synchronic unit". Such a unit is defined by Chang (1972:11) as one

> "in which changes occur within the bounds of constancy and without upsetting the overall alignment of cultural elements. It is a stationary state in which generalizations ... from most of its parts or its most significant parts can be applied to its enitrety."

Site Function

The small size of the sample prevented site function being entered as an analytical variable. While there is a plethora of difficulties in assigning function to hunter-gatherer surface sites (cf. Yellen 1977: 77-84), the sites could have been divided into simple categories based on structure and composition (e.g. scarred trees, isolated items, multiple activity sites, etc.). However, preliminary experiments including these categories demonstrated that functional differentiation resulted in unworkable small subsamples. Therefore the broad definition of 'site' used in the field survey has been retained here, and all sites have been treated similarly. This approach notwithstanding, I am confident that the tests undertaken will highlight any peculiarities attributable to presumed site function.

The Tests

The first factor investigated is the general nature of intra-frame distribution. Specifically, I have shown that sites are grouped within each frame. This is the first step in identifying areas of concern or potential in a stream catchment. I have used Nearest Neighbour tests following a procedure developed by Pinder and others (1979). Their revised formula incorporates a variable reduction coefficient, derived from extensive computer simulations, to reduce boundary effect problems. These problems are not satisfactorily dealt with by the widely used original formula, which uses a set reduction coefficient (Clark and Evans 1954).

The test compares actual distributions with random patterns generated by the formula and shows whether sites occur uniformly, randomly, or in clusters in the area in question. The statistical significance of the pattern is assessed by reference to a graph presented by Pinder *et al.* (1979:439). The decision to redefine the frames to coincide with stream catchment boundaries hinged partly on the requirements of this test. Using a naturally rather than arbitrarily defined area is a defensible, if not wholly satisfactory solution to the ill-understood effect of area shape and size on test results (Pinder *et al.* 1979:433-437). It should be noted that the three sites found between Frames 3 and 4 were excluded from these and all other tests involving frame area. Where possible, they have been included in other tests as elements of Frame 3.

The second point of interest is the location of sites in relation to the resource zones in and around each frame. If sites are clustered, it is axiomatic that they are clustered around something. The notion I wish to test is that sites are grouped around a point central to a specifiable range of critical resources or resource zones. To this end I have analysed, at a broad level, the catchments or "exploitation territories" (ET's) (Foley 1977, Higgs 1975, Jarman 1972) surrounding the site clusters to delimit the range of configurations in the sample. If any consistently non-random features emerge, they could be readily used to further refine the focus on each (or any other) stream catchment, by isolating those areas in which site clusters do and do not occur.

To test for non-randomness in ET configurations I compared those surrounding observed sites (OET's) with those around points randomly plotted on a two dimensional grid (quadrats of one square kilometre) laid over a 1:100,000 base map of each frame (RET's). A separate pattern was generated for each frame, with the number of points equalling the number of sites. Points in the middle of each cluster were selected as the centres of hypothetical annular five and ten kilometre radius exploitation territories. The set of figures describing each cluster was then assigned to every site in that cluster so as to retain a test population of reasonable size (experiments on a randomly selected cluster in each frame demonstrated that intra-cluster differences are minimal).

The variables actually measured and compared are the areas of each of the four basic subcoastal forest types (see pg: 20) that are incorporated in each ET or the relative proportion of each ET made up by each forest type. Vegetation maps were prepared as accurately as possible. Given that much of the study area has been radically altered since European settlement, the maps are approximations of the pre-contact situation. Boundaries between forest zones were delineated on 1:100,000 topographic maps using aerial and satellite photographs; maps prepared by Webb (1956 and unpublished maps held by C.S.I.R.O., Long Pocket, Brisbane); distributional data in existing vegetation studies (Anon. 1974) and field checks. The areas of all zones except fringing forest were measured with a compensating polar planimeter. The areas of fringing forests were measured by finding the total length of streams (in kilometres) in each of the other zones, multiplying those figures by five metres (.005 km) (see pg: 20), and subtracting the results from the areas of the other zones.

Intra- and inter-frame variability in ET configurations are first examined through Coefficients of Variation. This statistic permits comparisons of variability between samples or subsamples with different means. It is a modification of the standard deviation which, unaltered, is not an effective index of comparison when sample means differ too greatly. To compare the configurations of observed and random ET's, a non-directional one sample Kolmogorov-Smirnov test is used. This test is similar in aim to the widely used Chi^2 test, but operates on a higher level of measurement and compares cumulative proportions rather than absolute frequencies (Thomas 1976:82-85, 336-337).

The third factor considered is the association of sites and specific on-site resources. These resources include soil, landform, altitude, aspect, vegetation, distance to water and flood susceptibility. There are ecological (and therefore statistical) relationships between most of these variables. For example, edaphic, geomorphic and physiographic factors are, alone or in combination, fairly accurate predictors of vegetation type. However, the aim is to assess the utility of each factor (or specific subclasses of the factors) as a predictor of site location; hence they are examined separately. The basic assumption is that critical factors will exhibit less variability than incidental factors. In operational terms, the general working hypothesis is that there will be statistically significant biases towards certain sub-classes of the variables listed. To show that such biases exist would complete the progression from a broad to a finely-focussed view of site distribution.

The tests for on site vegetation, soil, altitude and distance to permanent water use a percentage point technique. This is a simple method best explained by example. A theoretically expected distribution pattern is first derived as a function of the areal extent of particular subclasses of the variable in question in each frame. If a study area has four soil zones, each comprising 25% of the area, 25% of sites could be expected in each zone if soil type has no effect on site location. The variation between the actual percentage of sites in each zone and these expected proportions is assessed with a standard significance test, in this instance Chi^2 tests (see Hodder and Orton 1976:224-226, Plog and Hill 1971:19).

The implication of the test is straightforward; if, for example, 90% of sites are found on soil B, but soil B covers 95% of the study area, arguments concerning bias are meaningless because the past inhabitants would have had very little choice. If soil B covers only 40% of the area, and still contained 90% of the sites, such arguments could be more reasonably entertained.

To test for bias towards specific landforms and distance to non-permanent water, actual distributions are compared with random point patterns. The point patterns are identical to those used in exploitation territory analysis. Bias in aspect and flood susceptibility is tested in a different manner, as is described below (pgs: 127,141).

To complement the three factors just discussed, spatial variations in locational patterns within and between frames are also examined. The aim is to refine the picture emerging in each stage of the analysis. All tests of variation through space use the same independent variable, namely, distance from the mouth of the stream catchment in question. This has also been described as the distance from the highest ranking stream. The distance is that measured in a straight line from the site to the river or stream into which drain the major streams in the frame in question (see Plog and Hill 1971:17-19) (the decision to use this variable was the main reason for the redefinition of frame boundaries).

This variable is the most practical standard for two reasons. First, it can be measured easily and precisely. Second, it underlies all major environmental variation in each frame. All of the stream nets considered drain from the perimeter ranges or foothills to a major central watercourse or intermediate tributary. As described in Chapter One, broad environmental changes in the subcoastal zone can be viewed as a function of distance from these central watercourses (or, inversely, proximity to the ranges). Distance from the highest ranking stream is therefore an equivalent measure of environmental change which can be applied to any drainage net in the study area, circumventing the undue complications of a single datum on one river.

Where the dependent variable can be measured at interval level, least squares linear regression tests have been used. This method will highlight any significant covariations between the variable in question and distance from the drainage mouth and will, with a standard formula, provide a means of accurately gauging the magnitude and direction of the change (Hodder and Orton 1976: Chap.5, Thomas 1976: Chaps.13,14). In cases where the dependent variable can only be measured to nominal or ordinal level, the values of the independent variables are reduced to the same level and contingency tables (two by two and row by column) are used. Contingency tables permit bivariate and multivariate tests of association and employ the Chi^2 test (Thomas 1976:272-279).

The Results

Nearest Neighbour Tests

The null hypothesis for this test series states that sites will be randomly distributed through each frame and that there will be no relationship between inter-site distance and distance from the highest ranking stream. The competing hypothesis states that repeated use of favoured localities should be reflected in clustering of sites and that summer fragmentation and dispersal of domestic groups should result in a positive relationship between inter-site distance and distance from the highest ranking stream.

Two tests are done for each frame. The first assesses the degree of clustering in terms of total frame area, and the second in terms of the area of lowland open forest in each frame. The latter is a precautionary measure to ensure consistency of results despite a change in the size and shape of the reference area.

In all frames, both tests indicate statistically significant clustering: sites occur in groups within each frame. The overall (i.e. all-cases) mean inter-site distance is 1124m ± 380m, with individual frame means ranging from about 650m in Frame 2 to 1.56km in Frame 3. The overall expected mean distance is 4.72km, with individual frame expected means ranging from 2.57km in Frame 4 to 7.37km in Frame 3 (Fig. 22). With regard to the effects of area shape and size, it should be noted that an experiment in Frame 1 demonstrated that the reference area had to be radically changed in shape, and reduced to about 40% of the total frame area before observed patterns began to approximate a random distribution.

An all-cases regression of nearest neighbour distance over distance from the highest ranking stream gives a statistically significant positive correlation of moderate-low strength. The positive covariation is mirrored in all frames, although only in Frame 3 and 4 are the results significant at the designated level. In Frames 1, 2 and 4 rates of site dispersal range from about 80-100m/km, while in Frame 3 that rate is over 900m/km. This figure is abnormally high because only one site is situated at a relatively great distance from the highest ranking stream and the other sites clustered in the lower catchment (Figs. 22,14).

That sites are clustered cannot be disputed; in this the results are in accord with the model. In overall terms, the positive co-variation between inter-site distance and distance from the drainage mouth also agrees with predictions. However, the relatively low strength of the all-cases correlation and the fact that the results are only significant in two frames indicates that this agreement is, at best, tenuous.

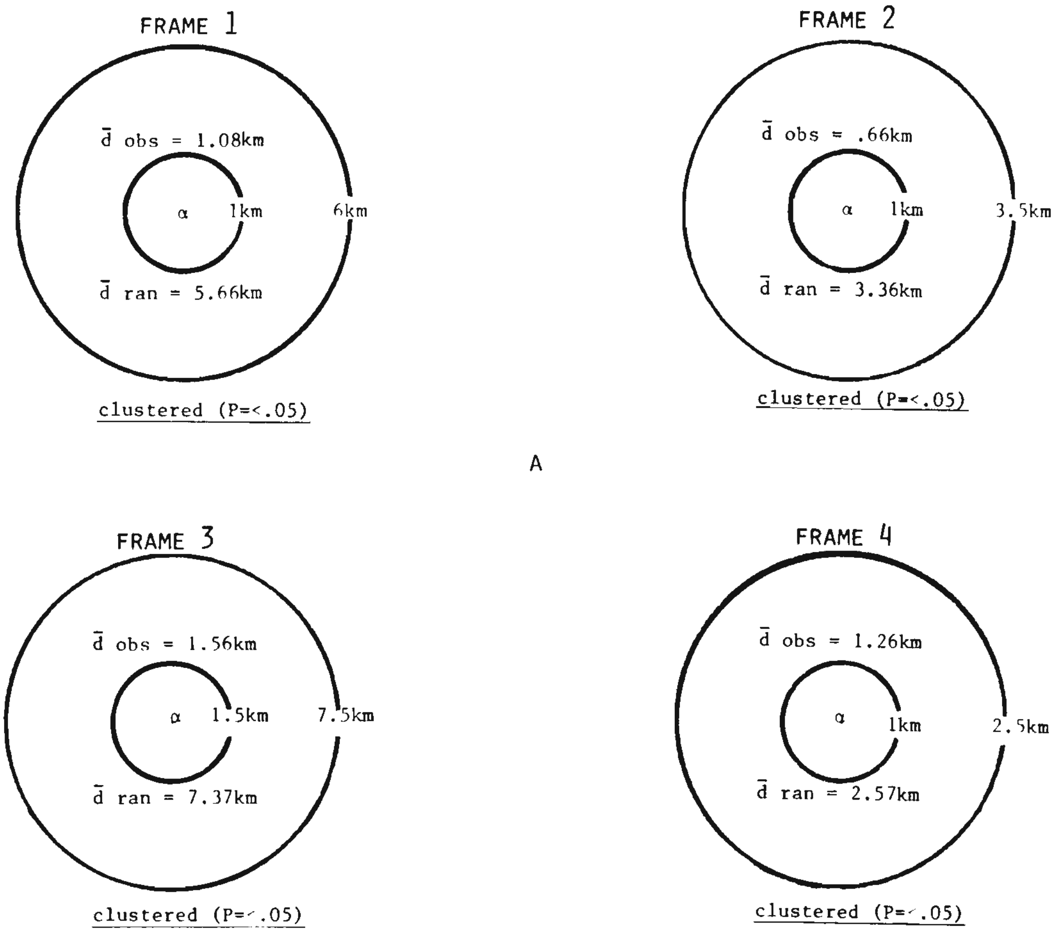
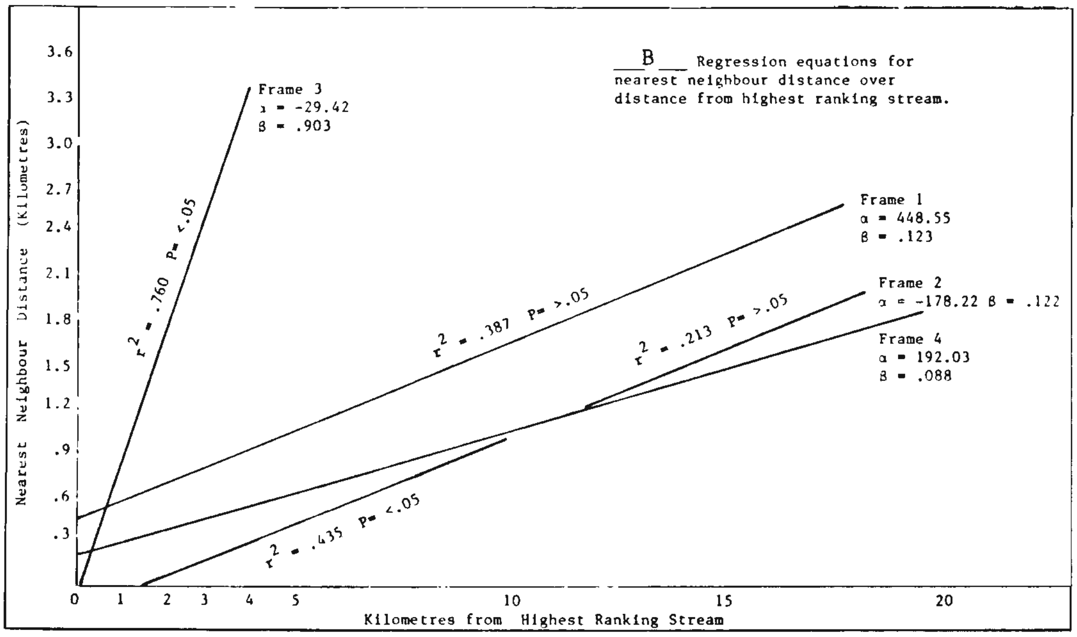


Figure 22. Nearest Neighbour test results.
A. Graphic representation of clustering vs. random dispersal. Outer circle approximates mean random distance, inner circle approximates mean observed distance.
B. Regression curves for nearest neighbour distance over distance from the highest ranking stream.



Exploitation Territory Analysis

The environmental data furnished in earlier sections indicate that the configurations of exploitation territories should change as a function of distance from the central rivers. Lowland open forests, which dominate most of the study area, should decrease in extent while fringing forests, upland open forests and closed forests should increase. The model hypothesises that groups wintering on the major rivers would have directed their attention to riverine and lowland open forest resources, but with summer dispersal the resource base would have been broadened to include higher proportions of upland open forest and vine-forest resources. It was also postulated that despite the attraction of the upland zones, groups would have camped in the valleys, and lower altitude fringing forests and lowland open forests would have remained important resource zones.

Taking these factors into account the null hypothesis for this test series may be stated as follows: the configurations of site-cluster exploitation territories will *not* change as a function of distance from the drainage mouth, and there will be no identifiable non-random features in cluster ET's. The competing hypothesis states that OET configurations will change as anticipated in a statistically significant manner, and that there will be a statistically significant bias towards OET's (of both sizes) dominated by lowland open forest rather than upland open forest or closed forest.

Coefficients of Variation derived from breakdowns of ET characteristics are shown in Table 10 . Clearly, there is considerable inter-frame variability in the amounts of the various forest types included in observed ET's. When intra-frame variability is considered, fringing

	FRAME	ACTUAL	RANDOM	FRAME	ACTUAL	RANDOM
FFR 5	1	14.71	*15.34*	3	2.51	*1.95*
	2	3.35	*7.15*	4	8.47	*10.17*
FFR 10	1	15.47	*15.72*	3	4.53	*7.14*
	2	3.96	*7.01*	4	3.34	*3.16*
OFL 5	1	38.00	*90.05*	3	0.00	*0.07*
	2	14.77	*42.31*	4	5.59	*7.13*
OFL 10	1	31.96	*72.60*	3	0.00	*3.27*
	2	11.16	*33.38*	4	9.90	*6.42*
OFH 5	1	138.01	*118.61*	3	0.00	*0.00*
	2	60.00	*146.37*	4	140.00	*99.23*
OFH 10	1	138.01	*76.79*	3	0.00	*173.20*
	2	40.87	*99.26*	4	72.46	*83.48*
VNF 5	1	96.73	*73.14*	3	0.00	*0.00*
	2	55.32	*137.80*	4	0.00	*0.00*
VNF 10	1	45.18	*47.70*	3	0.00	*173.20*
	2	21.88	*92.37*	4	183.33	*145.60*

Table 10 . Coefficients of Variation for observed and random exploitation territories. A value between four and ten reflects a normal or average variation in the factor measured.

KEY: FFR 5 = fringing forest within 5kms
FFR 10 = " " " 10kms
OFL 5 = lowland open forest " 5kms
OFL 10 = " " " " 10kms
OFH 5 = highland " " " 5kms
OFH 10 = " " " " 10kms
VNF 5 = vineforest " 5kms
VNF 10 = " " 10kms

forests and lowland open forests emerge as the most consistent features of both five and ten kilometre OET's. The areas of upland open forests and vineforests are highly erratic. A comparison of these figures with those for the RET's shows a reasonable coincidence in the low degree of variation in fringing forests and similarly large variation in the size of upland forest and closed forest inclusions (Table 10). A dichotomy is apparent in the figures for lowland open forest. Whereas variability in and between OET's and RET's in Frames 3 and 4 is low, in Frames 1 and 2 variability in OET's is quite high and in RET's is pronounced. On further analysis, this divergence between Frames 1-2 and 3-4 emerges as a pivotal factor.

Frames 1 and 2

The results for Frame 1 conform almost perfectly with expectations. Regressions show that as distance east from the Brisbane River increases, the configurations of both large and small OET's change as anticipated (Figs.23-26, pgs:115-118). Lowland forest dominates lower catchment OET's of both sizes (85-95% in all cases). This proportion decreases to the point where this forest type constitutes about 40% of upper-middle catchment OET's (large and small). Fringing forest increases marginally in both five and ten kilometre OET's; from approximately 0.8-1% of small ET's and from about 0.6-0.9% of large ET's. Inclusions of upland open forest and vineforest increase from negligible proportions in lower catchment areas to the point where they respectively constitute about 27% and 32% of upper-middle catchment ET's of both sizes. All curves are significant at the 0.05 level.

There are no statistically significant differences between observed and random ET's of either size in terms of fringing forest or vineforest inclusions. All ET's contain minute areas of fringing forest and small areas of closed forest (in the majority of cases vineforest makes up less than 25% of ET areas). There are significant biases towards OET's with large proportions of lowland open forest (none less than 40% of ET area) and small proportions of upland open forest (none more than about 27% of ET area). In RET's, lowland open forest inclusions range down to a minimum of 1.25% of small ET's and 9.5% of large ET's, and upland open forest ranges up to a maximum of 70% of small ET's and almost 50% of large ET's (Table 11). The results clearly support Hi. Site clusters are found where lowland open forest constitutes the major single element of five and ten kilometre radius exploitation territories.

Frame 2 results are less consistent with expectations but remain similar to those gained for Frame 1. Fringing forest inclusions in OET's of both sizes increase slightly through space, although the relationship is significant only in large ET's. In small OET's the direction of variation in lowland and upland open forest components is the reverse of what was expected. Lowland open forest areas increase marginally and upland open forest inclusions diminish with greater distance from the Brisbane River. Only the latter relationship is significant. In ten kilometre OET's the anticipated directionality obtains. The proportions of lowland open forest decrease and upland open forest areas increase with greater distance east of the river. Again, however, only the second curve is significant. As expected, the proportions of closed forest in OET's of both sizes tend to increase with greater distance from the drainage mouth, but neither curve is significant (Figs. 23-26, pgs:115-118).

FRINGING FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
>.5 - .75	0	0	0
>.75 - 1.0	.625	.25	.375
>1.0 - 1.25	1	1	0
>1.25 - 1.5	0	0	0
n = 8	α = .457	H_o	retained

LOWLAND OPEN FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
0 - 25	0	.5	-.5**
>25 - 50	.375	.75	-.375
>50 - 75	.375	.875	-.5
>75 - 100	1	1	0
n = 8	α = .457	H_o	rejected (**)

CLOSED FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
0 - 25	.625	.625	0
>25 - 50	1	1	0
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 8	α = .457	H_o	retained

FRINGING FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
>.5 - .75	.625	.25	.375
>.75 - 1.0	1	1	0
>1.0 - 1.25	0	0	0
>1.25 - 1.5	0	0	0
n = 8	α = .457	H_o	retained

HIGHLAND OPEN FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
0 - 25	.625	.5	.125
>25 - 50	1	.5	.5**
>50 - 75	0	1	-1
>75 - 100	0	0	0
n = 8	α = .457	H_o	rejected (**)

CLOSED FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
0 - 25	.625	.625	0
>25 - 50	1	1	0
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 8	α = .457	H_o	retained

LOWLAND OPEN FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
0 - 25	0	.5	-.5**
>25 - 50	.375	.5	-.125
>50 - 75	.375	.75	-.375
>75 - 100	1	1	0
n = 8	α = .457	H_o	rejected (**)

HIGHLAND OPEN FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
0 - 25	.625	.25	.375
>25 - 50	1	.875	.125
>50 - 75	0	1	-1**
>75 - 100	0	0	0
n = 8	α = .457	H_o	rejected (**)

Table 11. Kolmogorov-Smirnov results for comparisons of observed and random ET configurations in:

FRAME 1.

Overall, the configurations of OET's do change with greater distance from the highest ranking stream, albeit not always at statistically significant rates. RET's, on the other hand, change in the expected way with all curves significant at the .05 level. The peculiarities in OET's can be accounted for by the presence of a major easterly meander in the Brisbane River at the mouth of the frame. This effectively compresses the frame, substantially reducing the distance over which environmental variation occurs. The anomalies in the small OET's are a clear result of this. Mid-catchment site clusters, while being comparatively close to the drainage mouth, are also sufficiently close to the ranges to incorporate small areas of upland open forest within their five kilometre ET's. The effect of frame compression also works in reverse. Upper catchment OET's are close enough to the river to include unexpectedly large areas of lowland forest, and hence the OET configurations do not change as anticipated.

Despite these problems, Kolmogorov-Smirnov tests demonstrate some significant configurational biases (Table 12). There are no statistically significant differences between OET's and RET's with regard to fringing forest in small territories or closed forest in ET's of either size. In large ET's there is a marginal but significant difference in the relative proportions of fringing forest inclusions. These differences notwithstanding, the results are similar to those for Frame 1; fringing forest comprises between .5 - 1.0% of all ET's, and closed forests do not exceed 28% of any ET's of either size. The important differences again lie in the divergent relative proportions of lowland and upland open forests in OET's and RET's.

FRINGING FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
>.5 - .75	0	0	0
>.75 - 1.0	1	.777	.222
>1.0 - 1.25	0	1	-1
>1.25 - 1.5	0	0	0
n = 9	α = .432	H_o	retained

LOWLAND OPEN FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
0 - 25	0	0	0
>25 - 50	0	.111	-.111
>50 - 75	.333	.222	.111
>75 - 100	1	1	0
n = 9	α = .432	H_o	retained

CLOSED FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
0 - 25	.666	.777	.111
>25 - 50	1	1	0
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 9	α = .432	H_o	retained

FRINGING FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
>.5 - .75	.444	0	.444**
>.75 - 1.0	1	1	0
>1.0 - 1.25	0	0	0
>1.25 - 1.5	0	0	0
n = 9	α = .432	H_o	rejected (**)

HIGHLAND OPEN FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
0 - 25	1	.888	.111
>25 - 50	0	1	-1**
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 9	α = .432	H_o	rejected (**)

CLOSED FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
0 - 25	1	1	0
>25 - 50	0	0	0
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 9	α = .432	H_o	retained

LOWLAND OPEN FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
0 - 25	0	0	0
>25 - 50	0	.111	-.111
>50 - 75	.777	.222	.555**
>75 - 100	1	1	0
n = 9	α = .432	H_o	rejected (**)

HIGHLAND OPEN FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
0 - 25	1	.777	.222
>25 - 50	0	1	-1**
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 9	α = .432	H_o	rejected (**)

Table 12. Kolmogorov-Smirnov results for comparisons of observed and random ET configurations in:

FRAME 2.

No OET's contain more than 14% upland open forest. Concomitantly, no small OET's contain less than about 65% lowland open forest. Interestingly, there is no significant difference between the proportions of lowland open forest included in ten kilomtre OET's and RET's. All large ET's except one random one contain more than 50% lowland forest; the bulk incorporate more than 75%. Random points were scattered throughout the frame, with the outstanding one centred in the ranges on the eastern boundary of the frame. This indicates that a large ET could be centred virtually anywhere in the frame except the most easterly ranges and still include more than 50% lowland open forest. I suggest this can be attributed to the compression of the frame. The anomaly does not alter the fact that there is a non-random bias away from areas where upland open forest would constitute more than 25% of five and ten kilometre exploitation territories.

In sum, the results for Frames 1 and 2 have specified a range of ET configurations with one consistently non-random feature, namely, limitations on the size of upland open forest inclusions. Moreover, the direction of variation is wholly consistent with expectations in Frame 1. In Frame 2 a general conformity is marred by some easily explained exceptions. Despite this problem, I contend that Ho should be rejected in both frames.

Frames 3 and 4

These frames present some problems due to their position in the study universe. Whilst the Reedy Creek and Spring - Middle Creeks catchments drain directly from the D'Aguilar Range to the Brisbane River, the Lagoons and Franklin Vale Creek catchments are situated in the western sector of the subcoastal zone and do not drain directly from the main range in that area (the Eastern Escarpment). They are situated in the midst of the foothills and the outlying elements of the Escarpment complex. This has one major implication with regard to the distribution of resource zones in and around the two frames. Upland open forests and closed forests are much more patchily distributed in the western sector and in the main are restricted to the upper slopes of the Escarpment itself. The consequences of this become apparent in the test results.

In Frame 3, analysis is hindered by the absence of upland open forest from all five kilometre ET's (Figs.23-26,pgs:115-118). Results for small OET's show marginal, non-significant decreases in fringing forest, lowland open forest and closed forest components with increased distance from the highest ranking stream. In ten kilometre OET's, fringing forests and both lowland and upland open forest components vary in size in accordance with expectations, although the gallery forest curve is not significant. As in the small OET's, vineforest areas vary in an unanticipated manner, in that they decrease in size at a statistically significant rate with greater distance from the drainage mouth. This deviation stems from the frame location problem discussed above. The OET's in the *eastern* extremity of the frame, and the one around the three sites between Frames 3 and 4, incorporate small areas of a relict vineforest situated in the low ranges in the centre of the subcoastal plain. The other OET's, centred slightly further west in Frame 3, include no closed forest and, as a result, the expected direction of variation is reversed.

The results of Kolmogorov-Smirnov tests show that there are no significant differences between the configurative ranges of OET's and

RET's (Table 13). All small ET's contain 3-4% fringing forest (the figure is higher than in other frames because of the lagoons in the area), more than 95% lowland open forest, 0-7.5% closed forest, and no upland open forest. All ten kilometre ET's incorporate between 1-2% gallery forest, more than 90% lowland open forest, 0-7% upland open forest and 0-17% closed forest.

The regression results for Frame 4 are similar to those for Frame 1. The main differences lie in the small OET's, where there is a negative curve for fringing forest, and no closed forest. All correlations, except those for fringing forest in both large and small OET's, are statistically significant (Figs.23-26,pgs:115-118). Again, tests fail to demonstrate any significant differences between the configurative ranges of OET's and RET's of either size (Table 14). All five kilometre ET's comprise 0.5-0.7% fringing forest, more than 80% lowland open forest, 0-19% upland open forest and no closed forest. All large ET's include 0.6-0.65% gallery forest, more than 70% lowland open forest (most more than 90%), 0-10% upland open forest and 0-20% closed forest (most less than 5%).

The results for both frames clearly conform with expectations insofar as no observed exploitation territory is dominated by either upland open forest or vineforest. However, the lack of any statistically significant differences between observed and random configurative ranges shows that an ET of either size could be centred anywhere in either frame and satisfy the basic requirements of Hi. This factor, coupled with the aberrations in Frame 3, precludes the rejection of Ho in either frame.

FRINGING FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
1.5 - 2	0	0	0
>2 - 2.5	0	0	0
>2,5 - 3	0	0	0
>3 - 3.5+	1	1	0
n = 5	α = .565	H_o	retained

LOWLAND OPEN FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
0 - 25	0	0	0
>25 - 50	0	0	0
>50 - 75	0	0	0
>75 - 100	1	1	0
n = 5	α = .565	H_o	retained

CLOSED FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
0 - 25	1	1	0
>25 - 50	0	0	0
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 5	α = .565	H_o	retained

FRINGING FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
1 - 1.5	0	0	0
>1.5 - 2	.8	.4	.4
>2 - 2.5	1	1	0
>2.5	0	0	0
n = 5	α = .565	H_o	retained

HIGHLAND OPEN FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
0 - 25	1	1	0
>25 - 50	0	0	0
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 5	α = .565	H_o	retained

CLOSED FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
0 - 25	1	1	0
>25 - 50	0	0	0
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 5	α = .565	H_o	retained

LOWLAND OPEN FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
0 - 25	0	0	0
>25 - 50	0	0	0
>50 - 75	0	0	0
>75 - 100	1	1	0
n = 5	α = .565	H_o	retained

HIGHLAND OPEN FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
0 - 25	1	1	0
>25 - 50	0	0	0
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 5	α = .565	H_o	retained

Table 13. Kolmogorov-Smirnov results for comparisons of observed and random ET configurations in:

FRAME 3.

FRINGING FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
.25 - .5	0	0	0
>.5 - .75	1	1	0
>.75 - 1	0	0	0
>1	0	0	0
n = 16	α = .328	H_o retained	

LOWLAND OPEN FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
0 - 25	0	0	0
>25 - 50	0	0	0
>50 - 75	.125	0	.125
>75 - 100	1	1	0
n = 16	α = .328	H_o retained	

CLOSED FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
0 - 25	1	1	0
>25 - 50	0	0	0
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 16	α = .328	H_o retained	

FRINGING FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
.25 - .5	0	0	0
>.5 - .75	1	1	0
>.75 - 1	0	0	0
>1	0	0	0
n = 16	α = .328	H_o retained	

HIGHLAND OPEN FOREST - 5KM

% ET Area	% Observed	% Expected	Difference
0 - 25	1	1	0
>25 - 50	0	0	0
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 16	α = .328	H_o retained	

CLOSED FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
0 - 25	1	1	0
>25 - 50	0	0	0
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 16	α = .328	H_o retained	

LOWLAND OPEN FOREST - 5KM

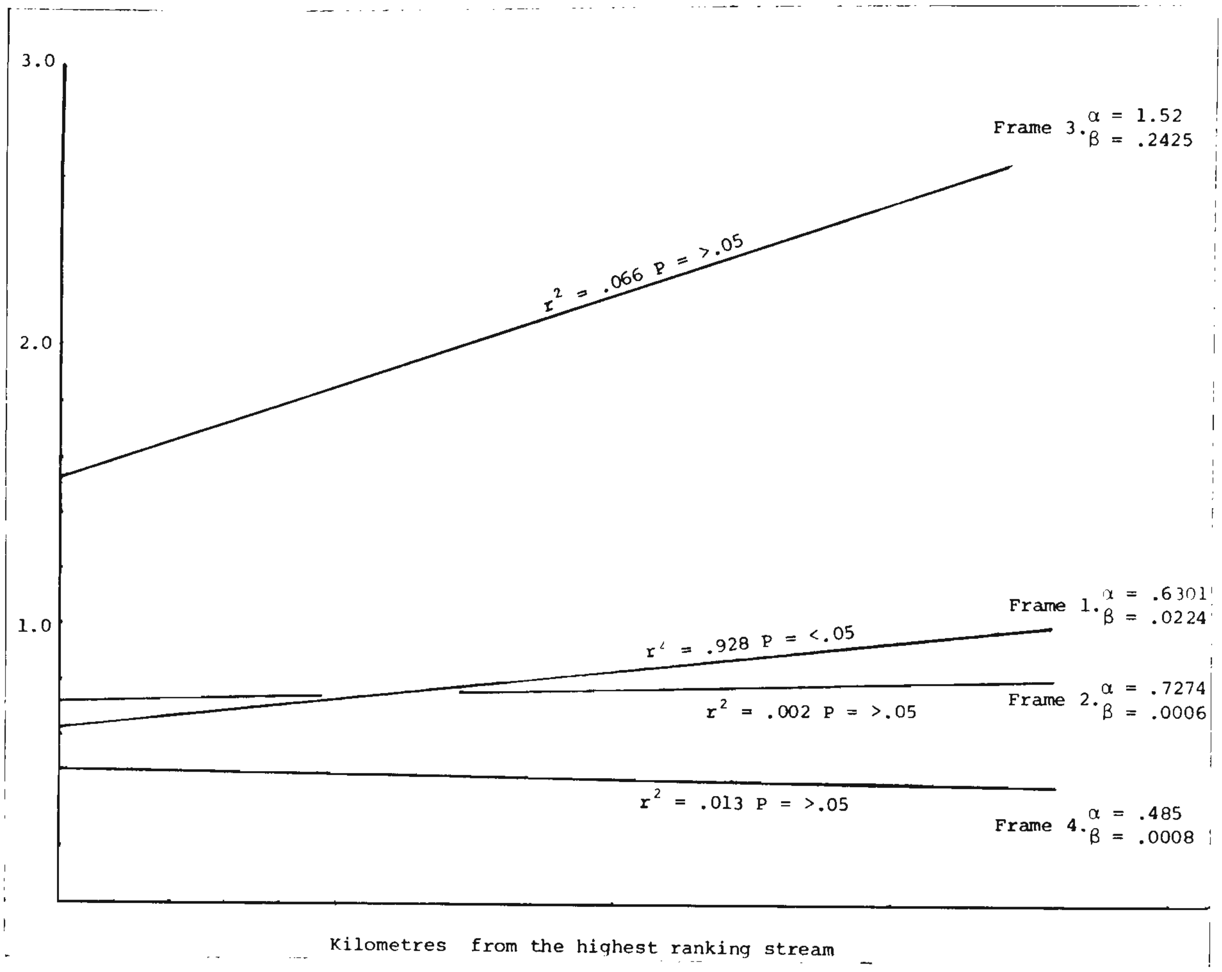
% ET Area	% Observed	% Expected	Difference
0 - 25	0	0	0
>25 - 50	0	0	0
>50 - 75	0	0	0
>75 - 100	1	1	0
n = 16	α = .328	H_o retained	

HIGHLAND OPEN FOREST - 10KM

% ET Area	% Observed	% Expected	Difference
0 - 25	1	1	0
>25 - 50	0	0	0
>50 - 75	0	0	0
>75 - 100	0	0	0
n = 16	α = .328	H_o retained	

Table 14. Kolmogorov-Smirnov results for comparisons of observed and random ET configurations in:

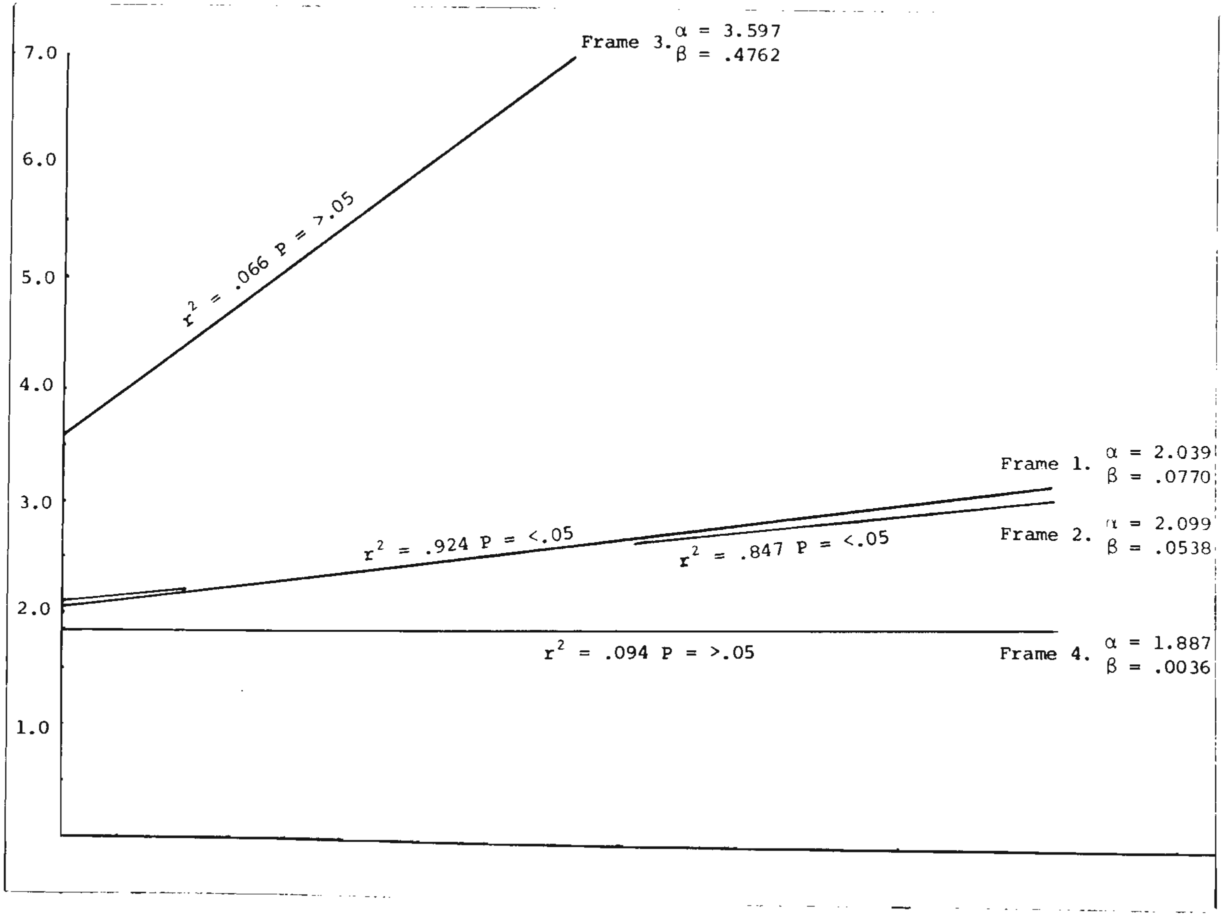
FRAME 4.



Y = KM^2 FRINGING FOREST/ 5KM OET

Figure 23. Regression curves for fringing forest components of 5km and 10km radius observed exploitation territories.

Y = KM^2 FRINGING FOREST/ 10KM OET



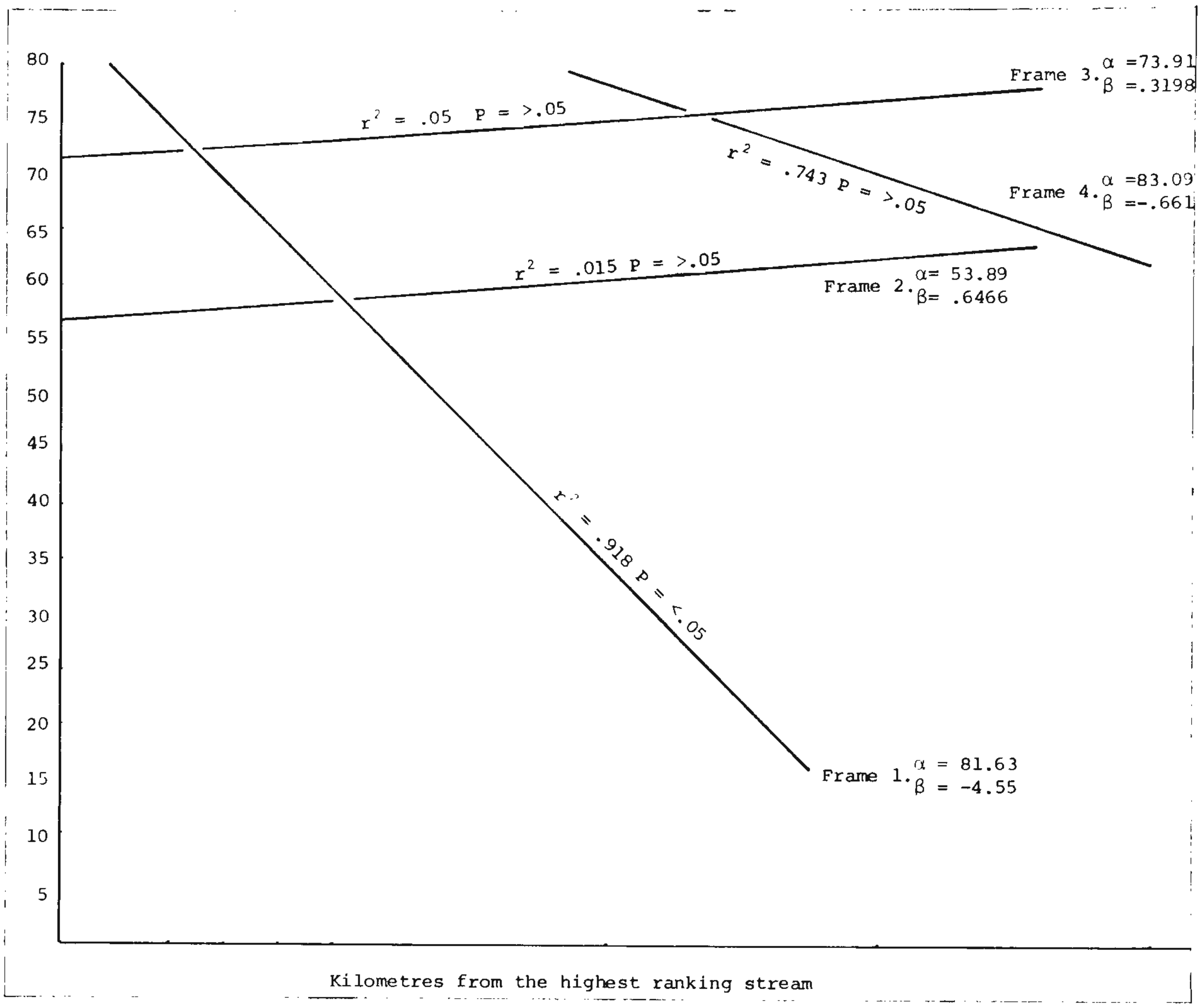
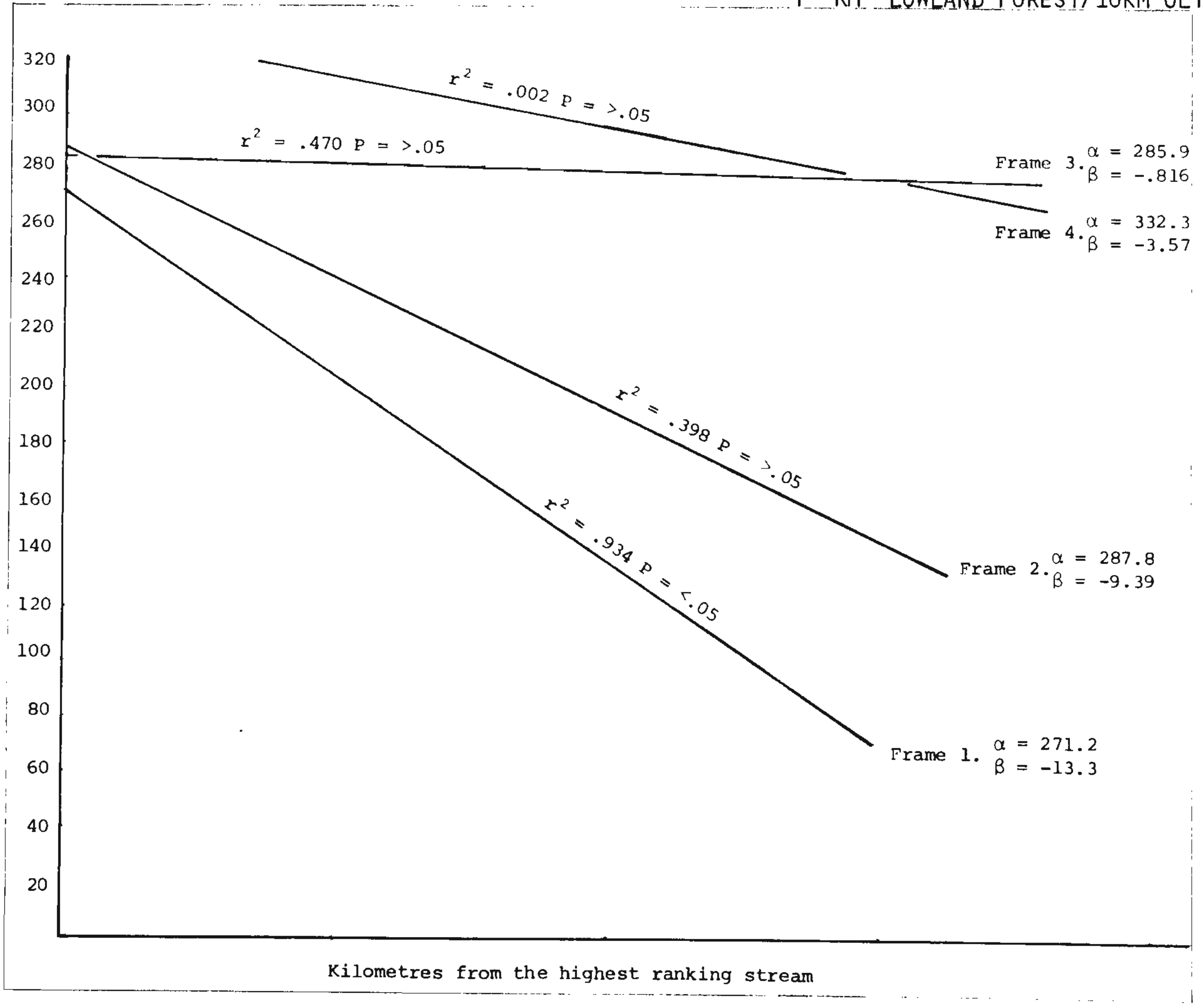
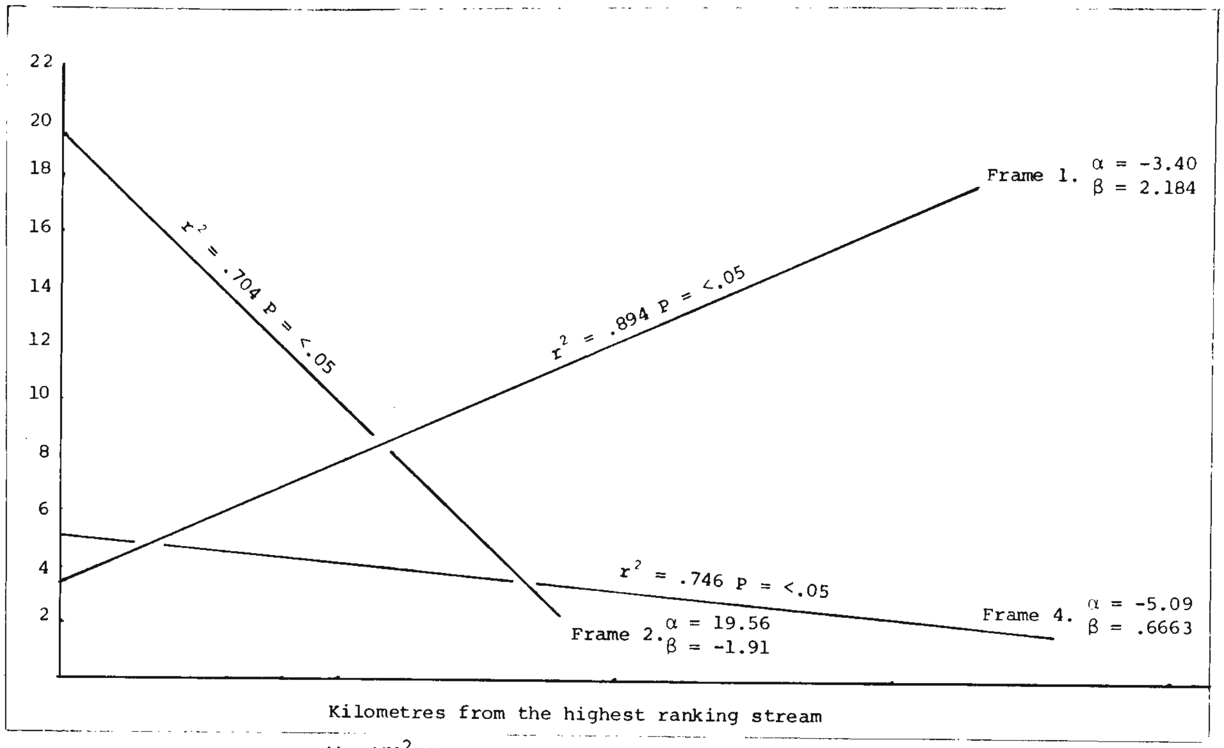


Figure 24. Regression curves for lowland open forest components of 5km and 10km radius observed exploitation territories.

Y = KM² LOWLAND FOREST/5KM OET

Y = KM² LOWLAND FOREST/10KM OET

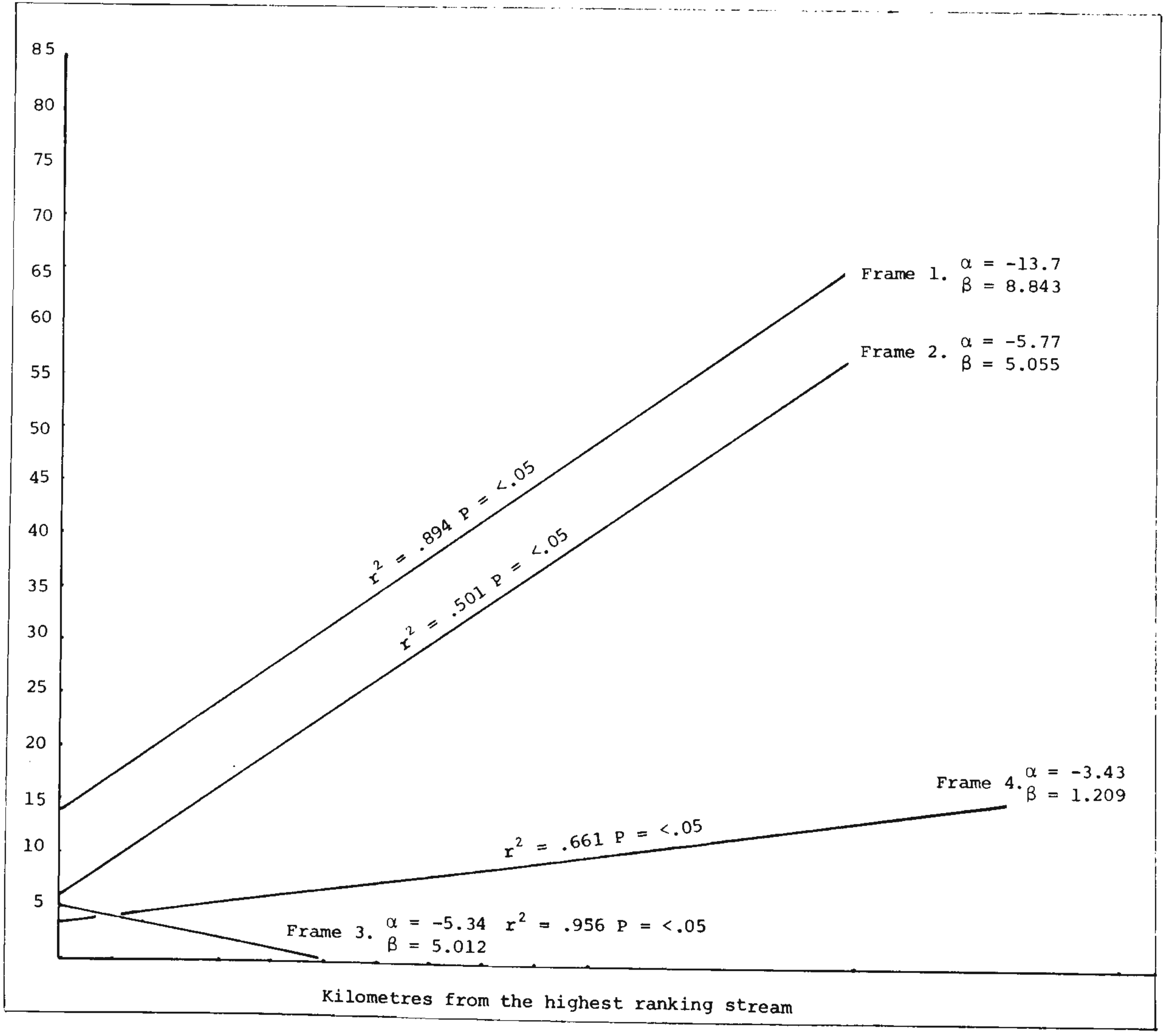




Y = KM² UPLAND FOREST/ 5KM OET

Figure 25. Regression curves for upland open forest components in 5km and 10km radius observed exploitation territories.

Y = KM² UPLAND FOREST/ 10KM OET



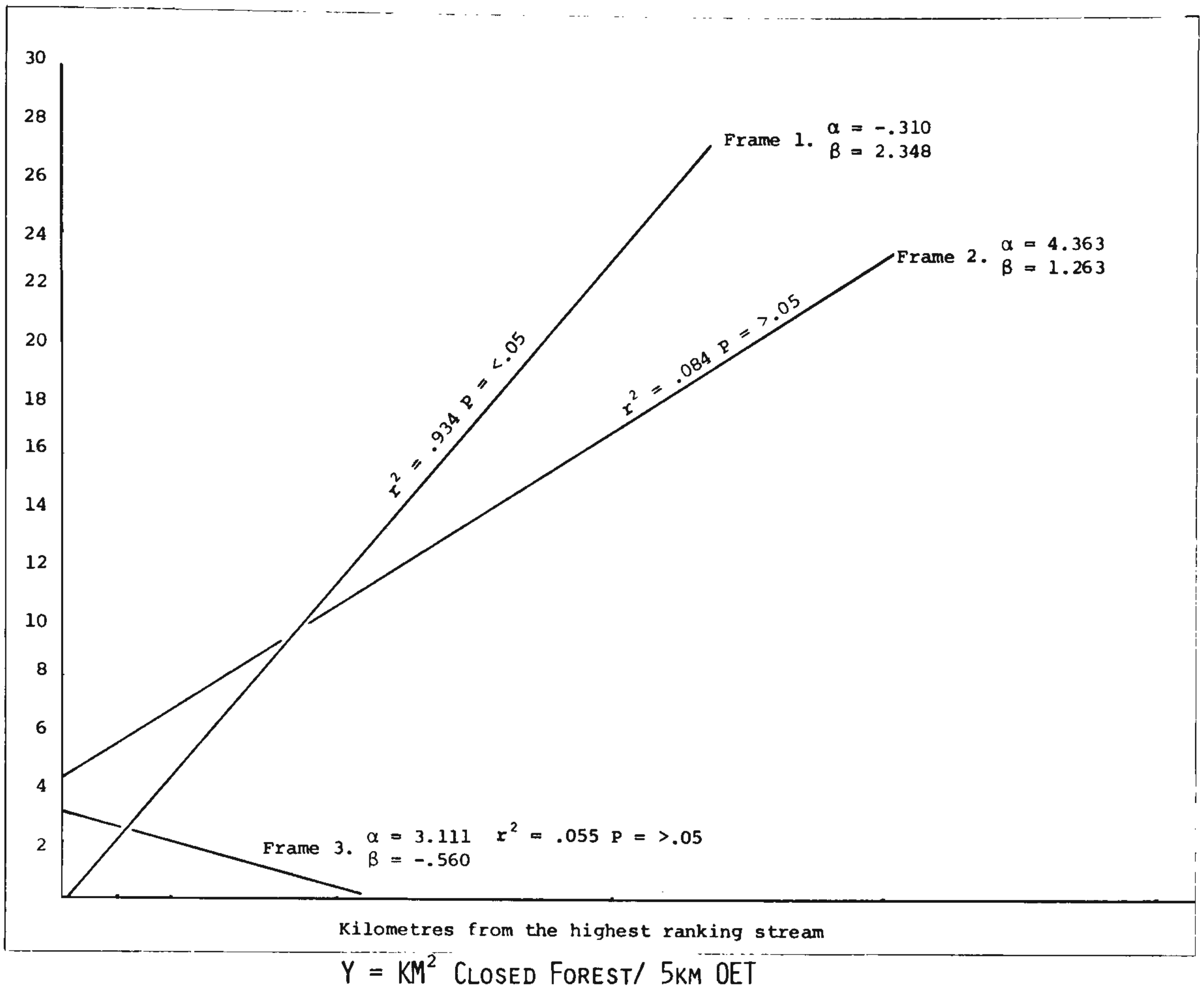
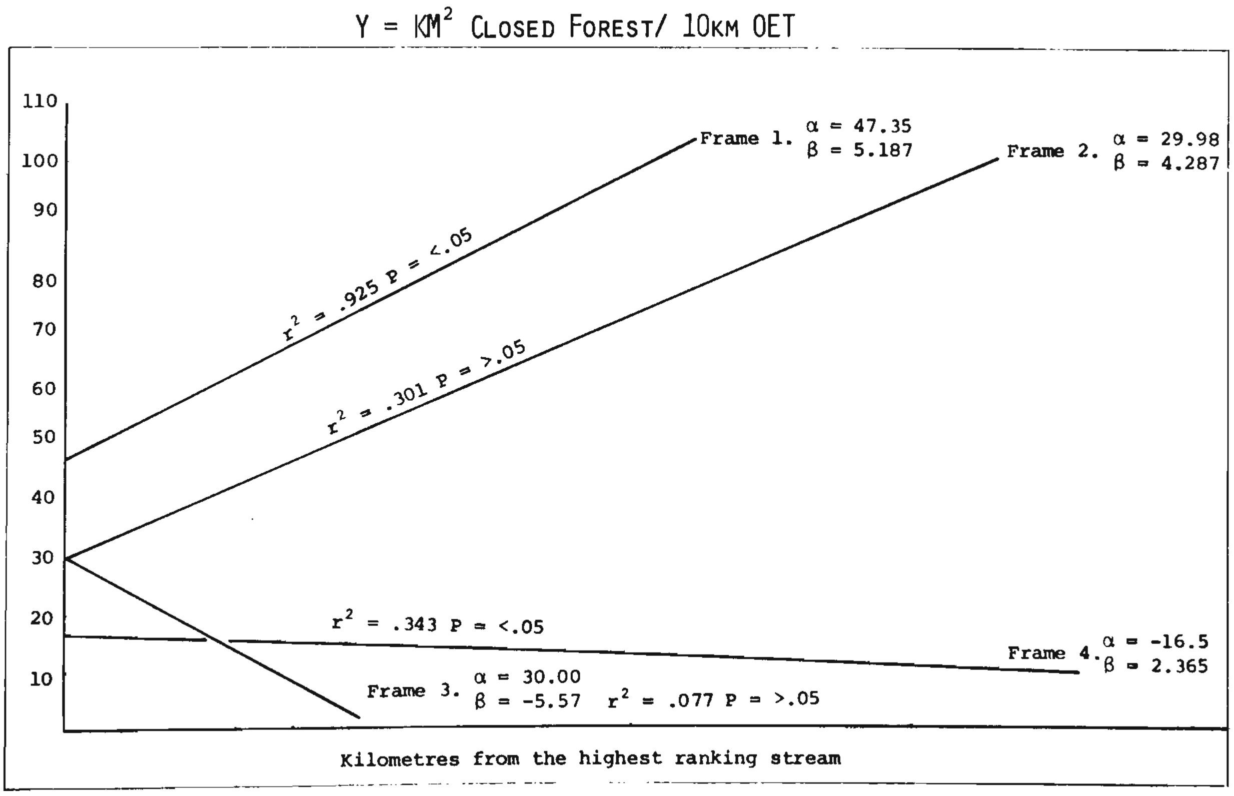


Figure 26. Regression curves for closed forest components of 5km and 10km radius observed exploitation territories.



This does not mean that the analysis of exploitation territories has failed its stated aim. It has simply not refined the picture of site location to the degree initially sought. When the results for all the frames are considered in concert, the non-random minimization of upland forest inclusions in Frames 1 and 2 remains the salient feature. It demonstrates that in those localities where it is *possible* for hypothetical hunting and foraging ranges to incorporate substantial areas of upland open forest, site clusters should be centred in those places dominated by lowland open forest.

On-Site Resources

Soil

Large-scale soil maps were produced from smaller scale maps and enlarged sections of 1:250,000 geological maps (Cranfield *et al.* 1976), and were spot-checked for accuracy in the field. Due to the generalized presentation of the baseline information, the maps were not highly detailed; nonetheless they were adequate for the task. As stated earlier, duplex or texture contrast soils are the most prevalent types in the subcoastal zone, and of these the grey or mottled yellow subsoil subgroups are the most common. In each of the frames this dominance is clear; duplex soils underlie 40-80% of all frame areas. If the null hypothesis of no association between soils and site location is to be discredited, there should be an extraordinary bias to one or perhaps two soil types. To agree with the model, there should be a pronounced association between sites and sandy, stone-free soils.

Test results show there is a marked bias towards duplex soils in general and towards the grey and mottled yellow groups in particular. When all frames are lumped, and every soil present in the combined area is entered into the analysis, it is apparent that this bias is significantly stronger than would be expected if sites were distributed at random in relation to soil type (Table 15). Similar results are obtained when each frame is considered separately. There is a statistically significant bias towards duplex soils in every case. Duplex soils are sandy, with moderate to good permeability, and little or no surface stone (Northcote 1971). The results of this test series clearly support Hi. The occurrence of only five sites on non-duplex soils indicates that there is no relationship between on-site soil and distance from the drainage mouth.

Landforms

Five landform categories are included in these tests: floodplain, stream bank, stream terrace, hill slope, and hill top. Strict definition of these features is eschewed to avoid complications in data manipulation. In the field the only classes which proved occasionally ambiguous were terrace and hill slope. This happened when sites occurred at the interface of upper terraces and colluvial slopes, or where terraces had been smoothed by modern landuse and/or other degenerative processes. In the few doubtful cases the landform was designated hill slope. Aerial photographs were used to identify the landforms upon which the random points occur.

The null hypothesis states that there will be no significant differences between observed and random patterns as regards on-site landform. Supporting the model, Hi states that there should be a statistically significant bias towards terraces. The all-cases test shows that this bias does obtain (Table 16). Similarly significant biases are also apparent in Frames 1, 2 and 4. In Frame 3 only two sites (40%)

OVERALL

SOIL	AREA (km^2)	% TOTAL	N expected	N observed
Le	2	.317	.120	0
pi	4	.635	.241	0
YG	12	1.9	.722	1
Ca	19	3.02	1.147	0
pj	26	4.13	1.569	2
Sc	29	4.61	1.75	0
RB	29	4.61	1.75	3
GC	35	5.56	2.112	0
BE	52	8.26	3.138	0
RC	56	8.9	3.39	0
GA	56	8.9	3.39	11
Lc	76	12.08	4.6	0
Cf	112	17.80	6.764	2
GE	121	19.23	7.307	19

$\chi_c^2 = 64.84$ P = < .001 df = 13 H_o rejected

Legend

Le	Shallow leached loams
pi	Yellow mottled acid structured earths
YG	Neutral yellow/grey leached duplex soils
Ca	Shallow non-cracking clays
pj	Grey-brown acid structured earths
Sc	Shallow leached sands
RB	Acid red bleached duplex soils
GC	Acid mottled bleached yellow/grey duplex soils, sandy surface
BE	Neutral brown duplex soils, soft surface
RC	Neutral red duplex soils
GA	Acid mottled bleached yellow/grey duplex soils
Lc	Shallow leached loams
Cf	Dark deep cracking clays
GE	Neutral mottled bleached yellow/grey duplex soils

Table 15. Percentage point results for on site soil type.

FRAME 1

SOIL	AREA (km^2)	% TOTAL	N expected	N observed
Le	2	1.0	.08	0
pi	4	2.0	.16	0
BE	7	3.5	.28	0
Sc	20	10.0	.8	0
RB	29	14.5	1.16	3
Rc	33	16.5	1.32	0
GE	40	20.0	1.6	5
Lc	65	32.5	2.6	0

χ^2_c = 24.22 P = < .005 df = 7 H_o rejected

FRAME 2

SOIL	AREA (km^2)	% TOTAL	N expected	N observed
Sc	9	7.9	.72	0
Lc	11	9.65	.87	0
RC	23	20.15	1.81	0
GE	26	22.8	2.05	9
BE	45	39.5	3.55	0

χ^2_c = 32.08 P = < .001 df = 4 H_o rejected

FRAME 3

SOIL	AREA (km^2)	% TOTAL	N expected	N observed
GA	12	6.85	.35	0
GC	35	20.0	1.0	0
GE	55	31.43	1.57	5
Cf	73	41.72	2.08	0

χ^2_c = 12.97 P = < .005 df = 3 H_o rejected

FRAME 4

SOIL	AREA (km^2)	% TOTAL	N expected	N observed
YG	12	8.57	1.3712	1
Ca	19	13.57	2.1712	0
Pj	26	18.57	2.9712	2
Cf	39	27.86	4.4576	2
GA	44	31.43	5.0288	11

χ^2_c = 12.48 P = < .025 df = 4 H_o rejected

Table 15, continued.

OVERALL

Landform	N. expected	N. observed
Floodplain	6	0
Bank	1	2
Terrace	5	24
Hill slope	22	7
Hill top	4	5
$\chi_c^2 = 86.72$	P = < .001 df = 4	H_o rejected

FRAME 2

Landform	N. expected	N. observed
Floodplain	0	0
Bank	0	0
Terrace	2	8
Hill slope	7	1
Hill top	0	0
$\chi_c^2 = 21.16$	P = < .001 df = 4	H_o rejected

FRAME 4

Landform	N. expected	N. observed
Floodplain	4	0
Bank	0	0
Terrace	2	8
Hill slope	6	4
Hill top	4	4
$\chi_c^2 = 21.29$	P = < .001 df = 4	H_o rejected

FRAME 1

Landform	N. expected	N. observed
Floodplain	1	0
Bank	0	0
Terrace	1	6
Hill slope	6	2
Hill top	0	0
$\chi_c^2 = 25.87$	P = < .001 df = 4	H_o rejected

FRAME 3

Landform	N. expected	N. observed
Floodplain	1	0
Bank	1	2
Terrace	0	2
Hill slope	3	0
Hill top	0	1
$\chi_c^2 = 6.58$	P = < .25 df = 4	H_o retained

Table 16. Random plot results for on site landform.

Table 17. Contingency tests for association between on site variable and distance from the highest ranking stream (A-C). D shows flood susceptibility and distance from permanent water.

LANDFORM	DISTANCE FROM DRAINAGE MOUTH < 5km	> 5km	T
BANK	3	0	3
TERRACE	8	17	25
HILLSLOPE	5	3	8
HILLTOP	3	2	5
Total	19	22	41

χ_c^2 = 7.246 τ_b = .07 Ho retained

A. LANDFORMS
(excluding floodplain; no values)

DISTANCE	DISTANCE FROM DRAINAGE MOUTH < 5km	> 5km	T
500m	15	8	23
500m	3	15	18
Total	18	23	41

χ_c^2 = 9.806 τ_b = .48 Ho rejected

B . PERMANENT WATER

CLASS	DISTANCE FROM DRAINAGE MOUTH < 5km	> 5km	T
0	3	6	9
1	9	14	23
2	6	3	9
Total	18	23	41

χ_c^2 = 2.740 τ_b = .02 Ho retained

C. FLOOD SUSCEPTIBILITY

CLASS	DISTANCE FROM PERMANENT WATER < 100m	1-500m	> 500m	T
0	0	2	4	6
1	1	13	12	26
2	3	4	2	9
Total	4	19	18	41

χ_c^2 = 9.216 τ_b = .1 Ho retained

D. FLOOD SUSCEPTIBILITY

were on terraces, the others being on banks and hill tops. This pattern does not differ statistically from random. It is likely that differential visibility in the areas surveyed is responsible for this anomaly. The discrepancy does not seriously reduce the weight of the results for the all-cases and Frames 1, 2 and 4 tests. I contend that they are sufficient to reject Ho. There is no relationship between landform and distance from the highest ranking stream (Table 17).

Altitude

Mapping altitude zones in each frame was straightforward. The areas of five zones were measured with a planimeter on a 1:100,000 base map. As expected, given the physiography of the study area, Zones 1 (0-100m a.s.l) and 2 (101-200m a.s.l.) incorporate the greatest area overall. This is also the case in all frames except Frame 1. In the other frames low altitude areas comprise 73-90% of the total areas, while in Frame 1 they only make up about 48% of the area. This is, however, more than any other single zone. Taking this and the premise of the percentage point test into account, the null hypothesis states that most sites should be found in Zones 1 and 2 in all frames. The competing hypothesis states that significantly more than 70% of sites (overall) should be below 200m a.s.l. (the critical percentage will vary in individual frame tests). All but two sites are situated in either Zone 1 or 2. At both the overall and individual frame levels the results plainly support Hi (Table 18). These results obviate the need for tests of variation through space; there is no relationship between on-site altitude and distance from the highest ranking stream.

Aspect

This variable was not featured in the earlier discussion of camp

OVERALL

CLASS	AREA (km^2)	% TOTAL	N. expected	N. observed
< 100m	186	29.57	11.24	18
101-200m	255	40.54	15.40	18
201-300m	96	15.26	5.80	2
301-400m	67	10.65	4.04	0
> 400m	25	3.98	1.52	0
χ_c^2 = 14.74 P = < .01 df = 4 H_o rejected				

FRAME 1

CLASS	AREA (km^2)	% TOTAL	N. expected	N. observed
< 100m	30	15.00	1.20	6
101-200m	67	33.50	2.68	2
201-300m	45	22.50	1.80	0
301-400m	48	24.00	1.92	0
> 400m	10	5.00	.40	0
χ_c^2 = 23.90 P = < .001 df = 4 H_o rejected				

FRAME 2

CLASS	AREA (km^2)	% TOTAL	N. expected	N. observed
< 100m	28	24.57	2.20	1
101-200m	56	49.13	4.42	8
201-300m	19	16.66	1.50	0
301-400m	7	6.14	.553	0
> 400m	4	3.50	.317	0
χ_c^2 = 10.23 P = < .05 df = 4 H_o rejected				

FRAME 3

CLASS	AREA (km^2)	% TOTAL	N. expected	N. observed
< 100m	90	51.42	2.571	5
101-200m	68	38.85	1.9425	0
201-300m	11	6.29	.3145	0
301-400m	4	2.29	.1145	0
> 400m	2	1.15	.0575	0
χ_c^2 = 15.32 P = < .005 df = 4 H_o rejected				

FRAME 4

CLASS	AREA (km^2)	% TOTAL	N. expected	N. observed
< 100m	38	27.14	4.4	6
101-200m	64	45.71	7.3	8
201-300m	21	15.00	2.4	2
300-301m	8	5.72	.9	0
> 400m	9	6.43	1.0	0
χ_c^2 = 5.04 P = < .25 df = 4 H_o retained				

Table 18. Percentage point results for on site altitude.

placement criteria. However, viewed as a factor which might affect the liveableness of a particular place, aspect could be an appropriate addition to a final set of location parameters. As in the other tests the null hypothesis posits that there will be no significant differences between observed and random patterns. Evidence from other regions (Sullivan 1976:66-67) suggests that most sites should face away from prevailing winds. In the two northeastern frames the dominant winds are northeasterly (summer) and southwesterly (winter), and in Frames 3 and 4 are easterly - southeasterly (summer) and westerly (winter) (per Commonwealth Bureau of Meteorology). Taking these differences into account, Hi states that there should be a statistically significant majority of sites facing northeast and/or southwest in Frames 1 and 2, and northwest and/or northeast on Frame 3 and 4.

The aspect of each site was measured with a compass and recorded as a mean of a range of values. By far the greatest number of sites overall face north of east or west (ie. between 270^0 and 90^0). When Frames 1 and 2 are lumped a slight majority face in the expected directions (53% NW, 12% SE). When Frames 3 and 4 are combined a clear majority of sites face in the anticipated directions (37% NE, 46% NW). The statistical comparison of these value ranges with random selections are not as favourable to Hi as these figures may imply.

Two non-directional one-sample Kolmogorov-Smirnov tests are used to assess biases in each frame (Table 19). The first tests for bias towards one or more 90^0 classes, the second for bias towards predicted directions. The latter involved collapsing the four direction classes used in the first test into two classes. In all tests the expected values are calculated as simple proportions; 25%/cell in the first test

OVERALL

Aspect^0	% Observed	% Expected	Difference
0 - 90	.421	.25	.17
>90 - 180	.55	.5	.05
>180 - 270	.6	.75	-.15
>270 - 359	1	1	0
n = 38	α = .2207	H_o retained	

FRAME 1

Aspect^0	% Observed	% Expected	Difference
0 - 90	.25	.25	0
>90 - 180	.5	.5	0
>180 - 270	.625	.75	-.125
>270 - 359	1	1	0
n = 8	α = .457	H_o retained	

FRAME 2

Aspect^0	% Observed	% Expected	Difference
0 - 90	.222	.25	.028
>90 - 180	.222	.5	.278
>180 - 270	.333	.75	.417
>270 - 359	1	1	0
n = 9	α = .432	H_o retained	

FRAME 3

Aspect^0	% Observed	% Expected	Difference
0 - 90	.4	.25	.15
>90 - 180	.8	.5	.3
>180 - 270	.8	.75	.05
>270 - 359	1	1	0
n = 5	α = .565	H_o retained	

FRAME 4

Aspect^0	% Observed	% Expected	Difference
0 - 90	.625	.25	.375**
>90 - 180	.687	.5	.187
>180 - 270	.687	.75	-.063
>270 - 359	1	1	0
n = 16	α = .328	H_o rejected (**)	

A

FRAME 1

Aspect^0	% Observed	% Expected	Difference
>90 - 180 + >270 - 359	.625	.5	.125
0 - 90 + >180 - 270	1	1	0
n = 8	α = .457	H_o retained	

FRAME 2

Aspect	% Observed	% Expected	Difference
>90 - 180 + >270 - 359	.666	.5	.16
0 - 90 >180 - 359	1	1	0
n = 9	α = .432	H_o retained	

FRAME 3

Aspect^0	% Observed	% Expected	Difference
>270 - 359 + 0 - 90	.6	.5	.1
>90 - 180 + >180 - 270	1	1	0
n = 5	α = .565	H_o retained	

FRAME 4

Aspect^0	% Observed	% Expected	Difference
>270 - 359 + 0 - 90	.9375	.5	.4375**
>90 - 180 + >180 - 270	1	1	0
n = 16	α = .328	H_o rejected (**)	

B

Table 19. Kolmogorov-Smirnov results for on site aspect: A. standard
B. collapsed

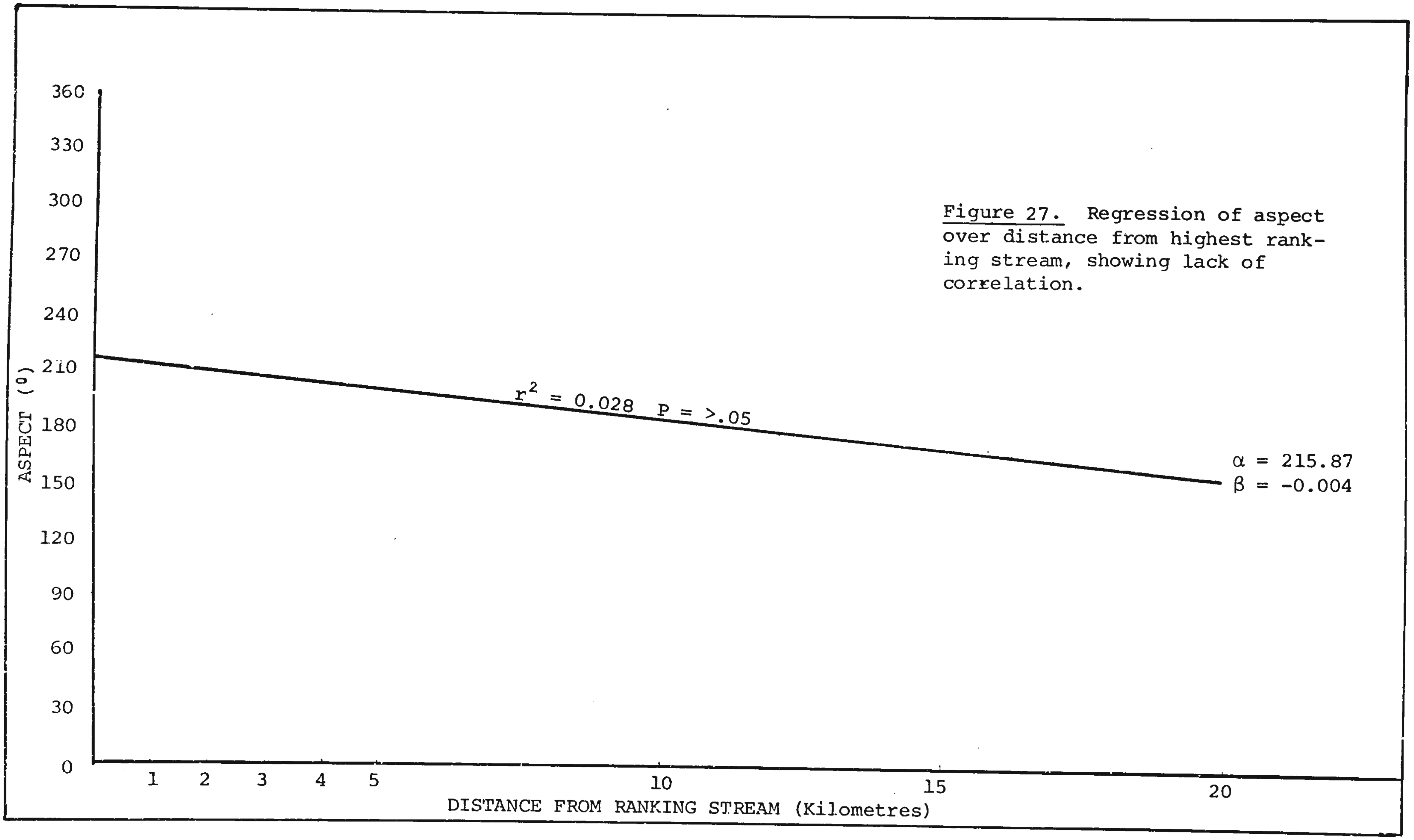


Figure 27. Regression of aspect over distance from highest ranking stream, showing lack of correlation.

and 50%/cell in the second. The only significant deviations occur in Frame 4 where there is a pronounced bias towards the 0-90^0 class and a bias towards the predicted directions (ie. NE, NW). The deviation emerges because there is only one site facing between 90^0-270^0. These results alone are not adequate grounds for the rejection of the null hypothesis. There is no relationship between aspect and distance from the drainage mouth (Fig. 27).

Vegetation

Vegetation maps show lowland open forest dominating the subcoastal zone. This situation obtains in all frames, where this habitat constitutes 50-80% of frame araeas. Other habitats are either restricted in their distribution, as is the case with gallery forests, or are (often patchily) distributed on or near the perimeter of the study area. If on-site forest type is inconsequential to site location, it could be expected that 50-80% of sites (depending on the frame) would be situated in lowland open forest. Other sites would occur in other habitats in numbers reflecting the areas of those habitats. For the null hypothesis to be rejected and support for the model shown, test results should demonstrate a significant bias towards lowland open forest rather than upland open forest or vineforest.

Thirty-eight sites (92%) are situated in lowland forest. When all frames are lumped and treated as if they constitute one large area, the probability of this number of sites being thus situated by chance is minimal (Table 20). When the frames are considered severally, Frames 1 and 2 conform with the overall pattern at statistically significant levels. In Frame 3 there is a significant deviation towards fringing forest as two (40%) of the sites are located in this habitat, while less

OVERALL

FOREST	AREA (km^2)	% TOTAL	N. expected	N. observed
Fringing	7.79	1.24	.47	2
Open lo	458.14	72.83	27.68	36
Open hi	100.55	15.99	6.07	0
Closed	62.52	9.94	3.78	0

$X_c^2 = 16.42$ P = < .001 df = 3 H_o rejected

FRAME 1

FOREST	AREA (km^2)	% TOTAL	N. expected	N. observed
Fringing	1.38	.69	.05	0
Open lo	94.35	47.17	3.77	8
Open hi	59.58	29.80	2.40	0
Closed	44.69	22.34	1.78	0

$X_c^2 = 16.16$ P = < .005 df = 3 H_o rejected

FRAME 2

FOREST	AREA (km^2)	% TOTAL	N. expected	N. observed
Fringing	1.08	.95	.085	0
Open lo	91.12	79.93	7.20	9
Open hi	3.97	3.48	.315	0
Closed	17.83	15.64	1.40	0

$X_c^2 = 8.9$ P = < .05 df = 3 H_o rejected

FRAME 3

FOREST	AREA (km^2)	% TOTAL	N. expected	N. observed
Fringing	4.737	2.7	.135	2
Open lo	135.26	77.0	3.85	3
Open hi	35.00	20.3	1.015	0
Closed	0.0	0.0	0.0	0

$X_c^2 = 16.53$ P = < .001 df = 3 H_o rejected

FRAME 4

FOREST	AREA (km^2)	% TOTAL	N. expected	N. observed
Fringing	.59	.42	.067	0
Open lo	137.41	98.15	15.7	16
Open hi	2.0	1.43	.228	0
Closed	0.0	0.0	0.0	0

$X_c^2 = 7.12$ P = < .1 df = 3 H_o retained

Table 20. Percentage point results for on site vegetation type.

than 3% was expected. It should be noted, however, that most sites were in lowland open forest. No significant deviations from random appear in Frame 4, despite the fact that all sites occur in lowland open forest. Nearly all sites *should* occur there (according to the premise of the method) as the other forest zones make up less than 2% of the frame area.

Again the dichotomy between the northeastern and western frames emerges as a fundamental consideration. Clearly Ho cannot be rejected in Frames 3 and 4 regardless of the fact that the majority of sites in both frames occur in lowland open forest. As was the case with ET analysis, the results are less of a refinement than originally hoped. In general terms the model is supported by the all-cases outcome. However, the results of the individual frame tests indicate that it is only in those areas where it is possible for large numbers of sites to be situated in upland forest or closed forest that lowland open forest can be accepted as a critical on-site resource. That only three sites were not found in lowland forest implies that there is no relationship between on-site vegetation and distance from the highest ranking stream.

Distance to Water Sources

Two classes of water sources are included in this test series: permanent streams and lagoons and intermittent streams. Water sources were categorized on the basis of mapped information and the observations of local informants and myself. The tests have two aims; 1, to discover if most sites are consistently situated within a restricted range of distances from one or both source types, and 2, to determine whether there are systematic changes in distance to either source type as a function of distance to the drainage mouth.

It should be recalled that distance to permanent water is checked by the percentage point method. To facilitate the tests, the areas of five distance classes were measured on 1:100,000 base maps with a planimeter. The total area within one kilometre of a permanent source was subtracted from the total frame area, permitting the calculation of expected proportions in the >1000m class (Class 5). The areas of the four zones within 1000m were found by subtraction. The tests for distance to intermittent water compare observed patterns with random point patterns, as in the landform tests. Percentage point tests are not used because of the difficulties in using 1:100,000 base maps to measure the required distance classes.

Permanent Water

In this series, in contrast with the other tests, it is the competing hypothesis rather than the null hypothesis which calls for agreement between observed and randomly generated patterns. If the model approximates reality, access (and therefore proximity) to permanent water would *not* have been critical in the location of *most* sites. I argue that the annual fragmentation of large winter groups would have resulted in a proliferation of summer sites as more, smaller groups dispersed away from the central rivers. If, as described, distance to permanent water is a function of distance from the central rivers, this means that most sites should be located more than one kilometre from permanent water.

To argue that "most sites" should be reflected as a statistically significant majority would be misleading. Given the small size of the test sample, this would require virtually all sites to be more than one kilometre from a permanent source. This would do the model a disservice as it could imply an almost total exodus into non-riverine areas, which is doubtful. Of the five distance classes measured in each frame, it was found that Zone 5 (> 1000m) constituted between 60-70% of every catchment. This means that 60-70% of the sites in each frame should be more than one kilometre from permanent water if this factor was not critical in the location of most sites. A majority of this order would be most consistent with the model.

Taking these arguments into consideration, the null hypothesis states that there will be a moderate to strong positive correlation between distance to permanent water and distance from the highest ranking stream but a statistically significant number of sites will be *less than* one kilometre from permanent water. The competing hypothesis states that there will be a similar relationship between distance to permanent water and distance from the drainage mouth and that there will be no significant deviation between observed and theoretically expected patterns.

An all cases regression shows that there is a significant positive relationship of moderate strength between distance to permanent water and distance from the drainage mouth (Fig. 28). When all frames are lumped, there is a significant bias towards the two classes incorporating 100-1000m (Table 21). The greatest positive deviation is in the 100-500m class. Taken together, these findings seem to corroborate the environmental reconstruction but call the strategy model into question, thus prompting the acceptance of Ho. However there are inconsistencies with this general picture when the frames are examined individually. When variation through space is considered (Fig. 29), significant moderately strong positive curves result in all frames except Frame 1, where a weak, nonsignificant negative correlation obtains. The tests against

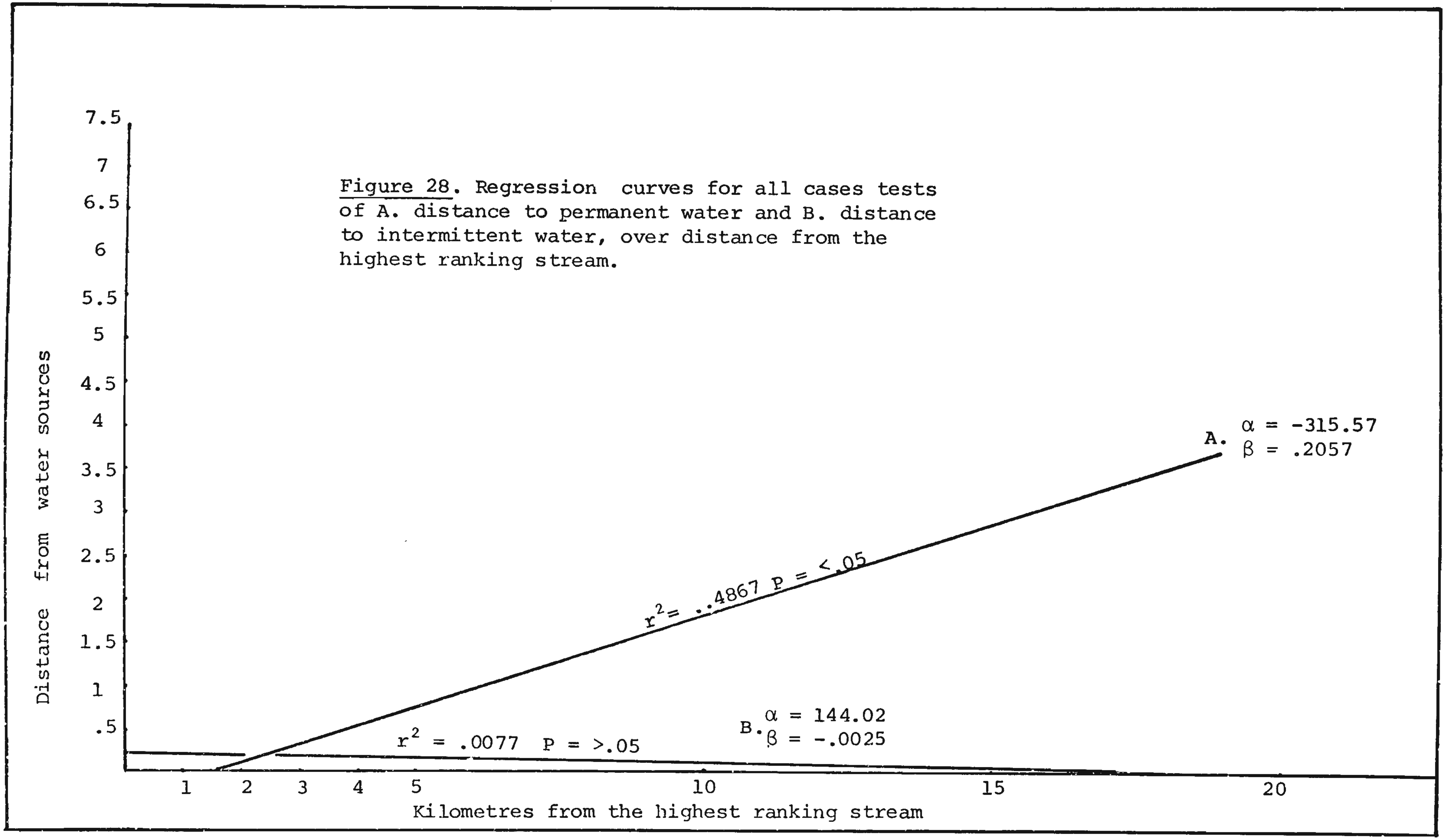


Figure 28. Regression curves for all cases tests of A. distance to permanent water and B. distance to intermittent water, over distance from the highest ranking stream.

OVERALL

DISTANCE	AREA (km^2)	% TOTAL	N expected	N observed
0 - 50m	11.55	1.7725	.6735	2
51 - 100m	11.25	1.7725	.6735	1
101 - 500m	89.19	14.18	5.3885	17
501 - 1 km	111.49	17.725	6.7355	5
> 1 km	406.02	64.55	24.529	13

$\chi^2_c = 30.61$ P = < .001 df = 4 H_o rejected

FRAME 1

DISTANCE	AREA (km^2)	% TOTAL	N expected	N observed
0 - 50m	3.95	1.975	.158	0
51 - 100m	3.95	1.975	.158	0
101 - 500m	31.6	15.8	1.264	8
501 - 1 km	39.5	19.75	1.58	0
> 1 km	121.0	60.5	4.84	0

$\chi^2 = 44.87$ P = < .001 df = 4 H_o rejected

FRAME 2.

DISTANCE	AREA (km^2)	% TOTAL	N expected	N observed
0 - 50m	2.975	1.7	.085	1
51 - 100m	2.975	1.7	.085	0
101 - 500m	23.80	13.6	.68	3
501 - 1 km	29.75	17.0	.85	0
> 1 km	115.5	66.0	3.3	1

$\chi^2_c = 15.44$ P = < .01 df = 4 H_o rejected

FRAME 3.

DISTANCE	AREA (km^2)	% TOTAL	N expected	N observed
0 - 50m	2.394	2.1	.189	1
51 - 100m	2.394	2.1	.189	1
101 - 500m	19.152	16.8	1.512	3
501 - 1 km	23.94	21.0	1.89	1
> 1 km	66.12	58.0	5.22	3

$\chi^2_c = 4.10$ P = < .5 df = 4 H_o retained

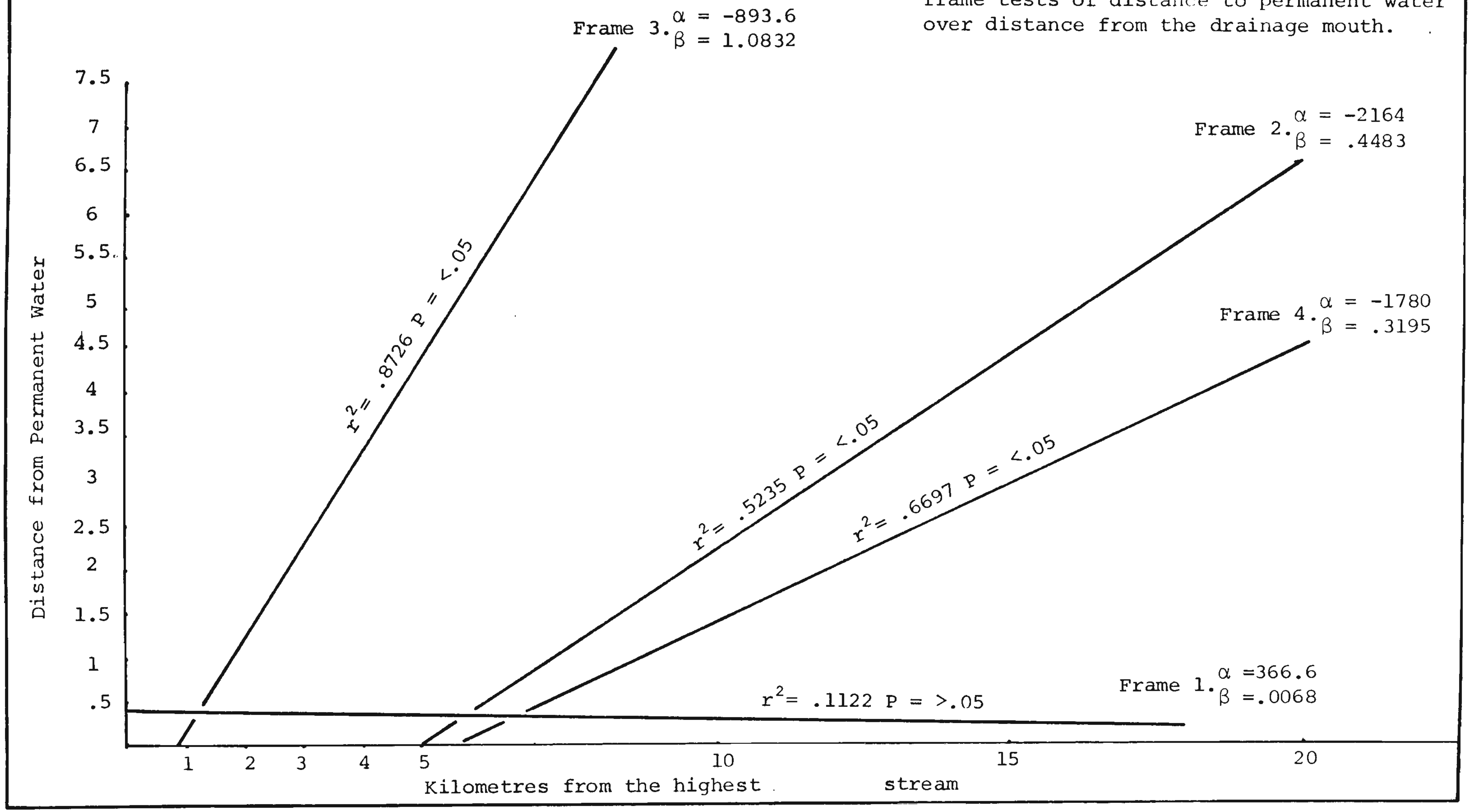
FRAME 4.

DISTANCE	AREA (km^2)	% TOTAL	N expected	N observed
0 - 50m	1.82	1.3	.208	0
51 - 100m	1.82	1.3	.208	0
101 - 500m	14.56	10.4	1.664	3
501 - 1 km	18.2	13.0	2.08	4
> 1 km	103.6	74.0	11.84	9

$\chi^2_c = 7.14$ P = < .25 df = 4 H_o retained

Table 21. Percentage point results for distance to permanent water.

Figure 29. Regression curves for individual frame tests of distance to permanent water over distance from the drainage mouth.



random in Frames 1 and 3 conform with the overall tests, with significant majorities of sites between 100-500m of permanent water. The patterns in Frames 2 and 4 do not differ significantly from random.

The divergent results can be explained relatively easily. In Frame 3, all sites were within five kilometres of the highest ranking stream, relatively close to permanent water. Again, I think this is primarily due to visibility problems, as sites are found in the middle to upper-middle catchments of immediately adjacent valleys (personal observation, and Mr. W. Webster, Buaraba, pers comm.). As intimated by the regression results, Frame 1 is an exception to the rule-of-thumb regarding the distribution of permanent water. Reedy Creek is considered permanent for the greater part of its length (and was seen to be flowing during recent droughts, when all comparable subcoastal streams were dry). Also, in the upper-middle catchment there is a large rock-bottomed waterhole (Diana's Bath) which does not appear to be affected by seasonal or medium-term water shortages. Hence sites more than ten kilometres from the Brisbane River can be situated close to permanent water.

The results for the other frames indicate that Frame 1 is an exception to a viable general rule (i.e. Hi). The regressions for Frames 2-4 show that in most areas distance from permanent water is a direct function of distance from the drainage mouth. The percentage point tests for Frames 2 and 4 (which pertain to 60% of sites overall) show that, generally, most sites should be more than one kilometre from permanent water. That these facts indicate a compliance with the model is clearly demonstrated by an all cases two by two contingency test (Table 17). The results show a significant positive relationship of moderate strength between distance to permanent water and distance from the highest ranking stream.

Specifically, the test shows that sites five kilometres or less from the drainage mouth are more likely to be within 500m of permanent water than sites more than five kilometres away. In short, while proximity to permanent water is not important in the location of most sites, it can be accepted as a critical variable for sites within five kilometres of the highest ranking stream.

Intermittent Water

The null hypothesis for these tests is that there will be no significant variation between observed and randomized patterns nor any systematic change in the distance to non-permanent water with increased distance from the drainage mouth. The competing hypothesis states that a significant majority of sites will be 100-500m from an ephemeral stream and that there will be a significant negative correlation between distance to non-permanent water and distance from the highest ranking stream. This argument is based on the assumption that proximity to impermanent water will be less critical for sites in lower to lower-middle catchments due to their comparatively greater proximity to reliable water sources.

Only one site is more than 500m from an intermittent water source: the majority are within 100m. There is no statistically significant difference in any frame between this pattern and randomly plotted distributions (Table 22). The results imply that a site could be virtually anywhere in any frame and be 500m at most from a non-perennial water source. As might be expected, given these results, regressions of distance to intermittent water over distance from the drainage mouth are inconclusive. Overall, there is a very weak, nonsignificant tendency for sites in upper-middle to upper catchments to be closer to intermittent water than those closer to the central rivers (Fig. 28). This tendency is

OVERALL

Distance	N. expected	N. observed
0 - 50m	13	23
51 - 100m	6	4
101 - 500m	15	10
501 - 1 km	2	1
> 1 km	2	0
$\chi^2_c = 14.24$	P = < .01 df = 4	H_o rejected

FRAME 2

Distance	N. expected	N. observed
0 - 50m	5	7
51 - 100m	3	2
101 - 500m	1	0
501 - 1 km	0	0
> 1 km	0	0
$\chi^2_c = 3.45$	P = < .5 df = 4	H_o retained

FRAME 4

Distance	N. expected	N. observed
0 - 50m	4	8
51 - 100m	2	2
101 - 500m	7	5
501 - 1 km	1	1
> 1 km	0	1
$\chi^2_c = 4.33$	P = < .25 df = 4	H_o retained

FRAME 1

Distance	N. expected	N. observed
0 - 50m	3	6
51 - 100m	0	0
101 - 500m	5	2
501 - 1 km	0	0
> 1 km	0	0
$\chi^2_c = 4.53$	P = < .5 df = 4	H_o retained

FRAME 3

Distance	N. expected	N. observed
0 - 50m	1	2
51 - 100m	0	0
101 - 500	2	3
501 - 1 km	1	0
> 1 km	1	0
$\chi^2_c = 4.87$	P = < .5 df = 4	H_o retained

Table 22. Random plot results for distance to intermittent water.

mirrored in all frames except Sandy-Middle Creeks, where a nonsignificant positive relationship obtains. An experiment running distance to permanent water as the independent variable found a similar pattern of nonsignificant curves, the interesting difference being that the curves are positive in Frames 1 and 2. I do not think these inter-frame differences warrant in-depth attention. None of the results are statistically significant, illustrating the tenuous nature of the emergent relationships.

The main result of this test series is that the majority of sites were found within 100m of impermanent water, including those close to a permanent water source. Despite this concentration, the null hypothesis must be retained because the pattern so closely approximates a random distribution. Distance to non-perennial water cannot be accepted as a critical variable in site location.

Flood Susceptibility

Like aspect, this variable was not considered when modelling camp placement, but has been included here as a factor potentially affecting the liveableness of different places. The null hypothesis states that sites are distributed at random in relation to flood susceptibility, (sites will not be concentrated in either floodable or non-floodable locations) and that there will be no relationship between flood susceptibility and distance from the highest ranking stream.

It could be expected that unfloodable or rarely flooded places would, in fact, have been selected in preference to those prone to regular inundation. This would be most important for summer camps, when normal heavy rains and/or cyclones greatly increase the frequency and severity of floods. The bulk of sites occur close to streams in middle and upper catchments and are assumed by the model to be summer sites. The bulk of sites could therefore have been in potential danger from flooding, and should be in less floodable localities. Put more succinctly, Hi states that a significant majority of sites will be in unfloodable or rarely flooded places, and that there should be a significant negative correlation between flood susceptibility and distance from the drainage mouth.

Three flood susceptibility levels were recorded: 1. not floodable, 2. rarely flooded, and 3. often or regularly flooded. The status of each site was assessed by observation of flood features coupled with local information about the periodicity and severity of flooding. Areas never flooded or regularly flooded were easy to identify. The yardstick for the intermediate category was the local maximum flood height recorded during the catastrophic 1974 and/or 1893 floods.

Two non-directional, one-sample Kolmogorov-Smirnov tests are used to check biases in each frame (Table 23). The first used the three classes listed above, the expected proportions being calculated at 33.33% cases/cell. In the second test classes 1 and 2 are collapsed and the expected proportion reset at 50% cases/cell. The only significant deviations from random were in the collapsed all cases test and in both tests in Frame 4. The success of all three tests can be attributed to the total absence of sites in class three in the Franklin Vale catchment. I argue that these results are not sufficient to reject the first element of Ho, as they stem from a single local anomaly. Further, all cases contingency tests show there is no relationship between either flood susceptibility and distance from the highest ranking stream or between flooding and distance to permanent water (Table 17). The results thus fail to reject either part of the null hypothesis.

Table 23. Kolmogorov-Smirnov results for flood susceptibility: A = standard
B = collapsed

A

OVERALL

Flooding	% Observed	% Expected	Difference
None	.22	.33	.11
Rare	.78	.66	.12
Regular	1	1	0
n = 38	α = .2207	H_o retained	

FRAME 1

Flooding	% Observed	% Expected	Difference
None	.125	.33	-.208
Rare	.75	.66	.084
Regular	1	1	0
n = 8	α = .457	H_o retained	

FRAME 2

Flooding	% Observed	% Expected	Difference
None	. 0	.33	-.33
Rare	.555	.66	-.11
Regular	1	1	0
n = 9	α = .432	H_o retained	

FRAME 3

Flooding	% Observed	% Expected	Difference
None	.2	.33	-.133
Rare	.6	.66	-.066
Regular	1	1	0
n = 5	α = .565	H_o retained	

FRAME 4

Flooding	% Observed	% Expected	Difference
None	.4375	.33	.104
Rare	1	.66	.334**
Regular	0	1	-1
n = 16	α = .328	H_o rejected (**)	

B

OVERALL

Flooding	% Observed	% Expected	Difference
None + Rare	.78	.5	.28**
Regular	1	1	0
n = 38	α = .2207	H_o rejected (**)	

FRAME 1

Flooding	% Observed	% Expected	Difference
None + Rare	.75	.5	.25
Regular	1	1	0
n = 8	α = .457	H_o retained	

FRAME 2

Flooding	% Observed	% Expected	Difference
None + Rare	.55	.5	.05
Regular	1	1	0
n = 9	α = .432	H_o retained	

FRAME 3

Flooding	% Observed	% Expected	Difference
None + Rare	.6	.66	-.06
Regular	1	1	0
n = 5	α = .565	H_o retained	

FRAME 4

Flooding	% Observed	% Expected	Difference
None + Rare	1	.5	.5**
Regular	0	1	-1
n = 16	α = .328	H_o rejected (**)	

Discussion

The foregoing has isolated seven factors which, in statistical terms, best define late Holocene subcoastal surface site locations:

1. the presence of other sites within a 1500m radius
2. the domination of exploitable territories by lowland open forest in areas containing extensive upland open forests
3. sandy, permeable on-site soils,
4. local stream terracing
5. altitude below 200m a.s.l.
6. on-site lowland open forest in those areas containing extensive upland open forests and/or closed forests
7. permanent water within 500m for sites within five kilometres of a drainage mouth.

The following were found to be statistically inconsequential to site location:

1. the configuration of exploitable territories in areas dominated by lowland open forest
2. on-site aspect
3. on-site vegetation in areas dominated by lowland open forest
4. distance to permanent water for sites more than five kilometres from a drainage mouth
5. distance to intermittent water, and
6. on-site flood susceptibility.

On first consideration the predictive strength of the critical set may not seem great. Only 46% of all sites occur where they "should", namely where all significant factors co-occur. A success rate of this order is not particularly encouraging. However, 18 (84%) of the anomalous sites fail on only one or two variables, while four sites (18%) fail on three. All site locations feature at least four of the seven critical variables. These results engender a more positive view of the set when it is recalled that it aims towards a polythetic definition of site locations.

A polythetic set lists those parameters which are most typical of most cases of the phenomena in question (in this instance late Holocene surface sites). There are two main provisos (Williams et al. 1973:219):

1. each of the individuals in question must possess a large number of the variables in the set, and
2. each variable in the set must be possessed by a large number of the individuals in question.

There is a third, more rigorous condition that no individual should possess all the variables in the set. In the present instance this qualification can be disregarded, as it is intended simply to ensure the set remains fully polythetic. In other words it precludes the development of a monothetic definition of the phenomena (Williams et al. 1973: 219). The second condition is fulfilled here by the statistically demonstrated biases towards the variables in the set. With regard to the first proviso, the determination of agreement thresholds is an arbitrary process. Following Williams et al. (1973:226-228) it proposed that agreement on five out of seven variables constitutes an acceptable threshold. This would reduce the number of anomalous sites to four (9.7% of all sites). In short, the set provides an adequate polythetic definition of location for 90% of sites.

The results demonstrate congruity between the observed distribution of archaeological sites and patterns of base camp placement modelled on environmental, historical and ethnographical evidence. That the factors listed above were found to be non-significant does not constitute a divergence between the model and the results sufficiently pronounced to necessitate a reordering of hypotheses or a review of analytical techniques. Those factors shown to reflect non-random patterning are those upon which the model rests. While this does not suggest the test results provide proof of the model's veracity, agreement between projections and results on these pivotal factors prompts confidence in the explanatory value of the model and the predictive potential of the set of locational criteria drawn from it.

Further justification for confidence comes from the preliminary results of work being done near the study area. Mr. D. Gillieson (Dept of Geography, University of Queensland) and Mr. B. McQueen (Archaeology Branch, D.A.I.A., Brisbane) conducted a stratified survey in the Upper Albert River valley, in the extreme southeast of this State. They worked with large field crews, intensively examining quadrats in several environmental strata. At the time of writing, analysis of the data had only recently been completed and published. The statistical results regarding site distributions indicate that many of the factors identified by this study are (in retrospect) useful predictors of surface site locations (Gillieson 1981).

Problems do remain. Of the three basic sources of random error - sample error, content error, and analytical error (Thomas 1976:444-447) - the first is the most problematical here. The validity of the results *per se*, and their applicability as tests of the model hinge on the sample being representative of Late Holocene subcoastal domestic sites. Of the obstacles to sample representativeness differential visibility due to post-depositional degradation and/or adverse field conditions is one of the most readily identifiable.

As stated, environmental conditions in the subcoastal zone are not conducive to high archaeological visibility. Consequently, all but a few sites were found on eroding surfaces in cleared and/or improved pasture. This introduces the possibility that the site distribution described above is a function of land use and degradation patterns, rather than regularities in prehistoric camp placement strategies. Only two in-depth studies of land degradation have been completed in the study zone (Johnston 1979, Shaw 1979). Both were undertaken in areas with severe erosion problems, and only Johnston covers any of the frames included in this study (Frame 4). The results of both projects can, however, provide insights pertinent in all frames.

There are two problems to be considered: 1. variable exposure and 2. variable destruction of sites (holding constant such factors as site abundance and obtrusiveness, accessibility, and survey coverage and intensity (Schiffer *et al.* 1978:4-10, Schiffer and Gumerman 1977:184-187). Any sites in uncleared areas - particularly the uplands - are unlikely to be detected, due to a lack of exposure. Johnston (1979:28) found statistically significant negative correlations between slope and clearing, and between clearing and total erosion. In contrast, any sites formed on stream terraces and banks or in stream beds are not likely to have survived. In addition to disastrous floods on the scale of those recorded in 1893 and 1974, post-contact landuse has led to frequent high-intensity erosive flooding and increased streambank erosion (Johnston 1979:83-86, Shaw 1979:27-28). In short, this evidence indicates that the probability of site discovery is highest in areas between the forested ranges and the eroding streams.

Johnston did not find any significant relationships between specific landuses (other than non-cleared land) and either total degradation or specific types of erosion (1979:28). This implies that there is little or no patterning of land degradation within the high visibility zone broadly defined above. An experiment with Frame 4 data reinforces this interpretation. All but one site in the Franklin Vale catchment were found in cleared, moderately sloping pasture. This pattern is markedly different from the distribution of randomly plotted points. However, there are *no* significant differences between observed and random patterns as regards the types of erosion upon which sites and points occur (Table 24). These tests were followed by an all-cases experiment based on my own (qualitative) erosion classification. I found no significant correlations between the types of erosional features upon which sites occur and any other on-site features. Together, these results show there is a minimal chance that sites will be found more frequently in particular localities within cleared areas due to consistently better visibility.

It is difficult to gauge the nature and extent of distortion due to the large scale variations in archaeological visibility outlined above. The information underpinning the model indicates there should be no domestic sites in the forested uplands and few, if any, in areas subject to erosive flooding. Any sites missed in those areas are more likely to be extraction points; shell middens, for example, such as those recorded by the early explorers along the Brisbane River in the vicinity of Platypus Rockshelter, which are no longer present (Lockyer in Steele 1972:193). Thus, if the model is a reasonably accurate reflection of past reality, it is possible that most distortion of domestic site distributions can be accounted for. That this problem remains unresolved

A. EROSION

CLASSIFICATION	N expected	N observed
Negligible	7	8
Sheet only	3	0
Rill only	0	1
Medium gully	5	6
Severe gully	0	1
$\chi_c^2 = 4.1687$	$P = < .5$ $df = 4$	H_o retained

B. LAND USE

CLASSIFICATION	N expected	N observed
Cultivated	2	0
Grazing	6	16
Regrowth	3	0
Uncleared	5	0
$\chi^2 = 28.298$	$P = < .001$ $df = 3$	H_o rejected

Table 24 : A and B. Random Plot test results showing (in A) a lack of bias in on-site erosion type, and (in B) the bias towards cleared grazing pasture in on-site landuse. Applicable to Frame 4 only.

should not preclude the judicious use of the model and set of locational criteria as planning aids and/or interpretative guides for research into, and management of, the archaeological record. Indeed, it could be argued that the existence of this problem is advantageous in both contexts, as it provides a focus for further inquiry.

Implications for Future Work

As stated at the outset, most new work in the subcoastal zone will be undertaken in response to continuing development and land modification. Such studies will be faced with time constraints, specific problems requiring special approaches, and the responsibility of making useful contributions to regional prehistory. This project has a number of implications for archaeology done under these conditions. The main ramifications stem from the capacity of the results presented here to predict "when we can and cannot reasonably expect research effort to be rewarded with substantive results" (Schiffer and House 1977:251), where the terms research and substantive are interpreted broadly enough to include results pertinent to both research *qua* research, and management.

The predictive set of site location criteria is of central importance. It provides a basis for the stratification of the subcoastal area into zones of archaeological potential and/or sensitivity (cf. King and Hickman 1977:360). It should therefore be of direct utility in the planning of data recovery programmes and evaluating archaeological resources (Schiffer and Gumerman 1977:183-190,211-215). Other aspects of the study enhance the efficacy of the set by furnishing insights into two dimensions of archaeological potential and sensitivity, namely possible avenues of further inquiry and questions concerning significance and impact mitigation. The hypothetical example offered below may best illustrate these claims.

The Queensland Water Resources Commission has decided to build a multipurpose dam on the middle reaches of Purga Creek, a tributary of the Bremer River. The stream drains from the Eastern Escarpment in the vicinity of Cunningham's Gap, to Ipswich, a city about 35 kilometres west of Brisbane (Fig. 30). The main purpose of the dam is to reduce flooding in the Ipswich-Brisbane conurbation. It is also planned that the lake and environs will be developed for public recreation.

Generally the planning and construction of dams is carried out in four stages (per Mr. M. Barry, Planning Section, Queensland Water Resources Commission and Grigg 1977). First, the entire drainage basin in question is examined for sites topographically suited to dam construction. This would be followed by engineering feasibility studies. Once a site is chosen, intensive geological and hydrological investigations would be undertaken, primarily to determine the structural parameters of the dam. This work would involve drilling and possibly seismic surveys. Construction would commence after satisfactory completion of these three initial stages.

In the present instance, the declared catchment of the dam encompasses approximately 147km^2, 32km^2 of which will be inundated when the water and flood storages are full. Materials to be used in dam construction - such as clay for the dam core, gravel for filters and concrete aggregates, and stone for flanking the core - will be extracted from various as yet undesigned points within the ponded area. It is likely that most of this material will be found in stream terrace alluvia and gravel lags in stream beds. Several roads and a considerable number

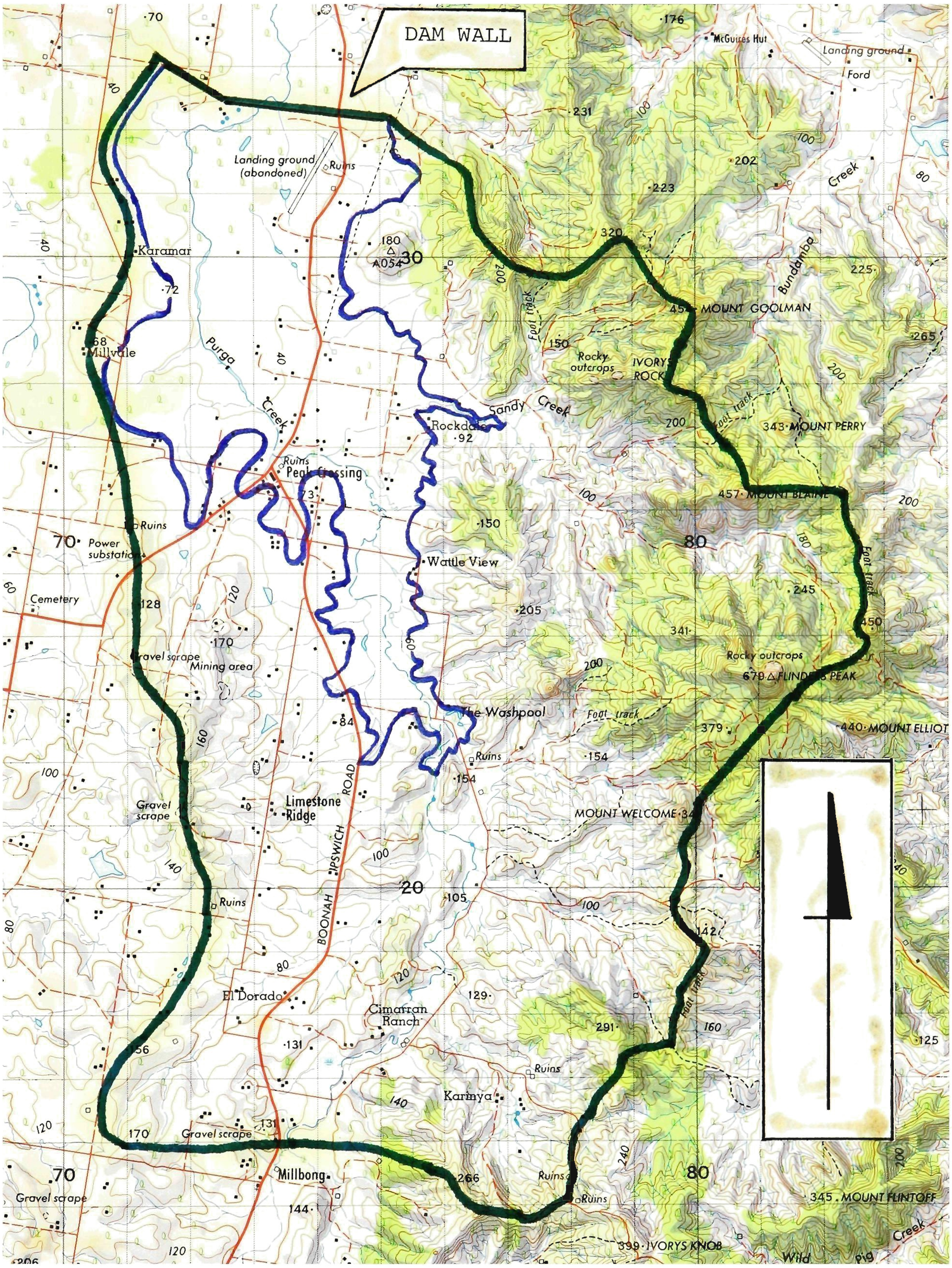


Figure 30 . Location map for dam project, showing declared catchment boundary (green line), ponded area (blue line) and dam wall location. Scale 1:100,000 contour interval 20m.

of buildings will be relocated. It is anticipated that most roadwork will be around the western margin of the lake, where an arterial road is to be re-routed. It is also planned to build tourist facilities on a high point overlooking the eastern section of the lake (Fig. 30).

Archaeologists would probably be called in with other scientists after the feasibility studies had been finished and the choice of dam site confirmed. The archaeologists would be formally required to:

1. survey the declared catchment,
2. assess the likely impact of dam construction on archaeological resources, and
3. recommend measures to mitigate such impact.

From a professional standpoint, it would also be desirable to test hypotheses concerning regional and perhaps continental prehistory. In a baseline study such tests might concentrate on the distribution and assemblage characteristics of surface sites.

It is unlikely that the researchers would be given sufficient lead-time to prepare adequate predictive models for the area in question. This problem could be compounded by a lack of comprehensive regional prehistory from which guidelines or analogies could be drawn. Under these circumstances it would be necessary for the archaeologists to construct *ad hoc* frameworks based on (sometimes tenuous) extrapolations and/or pancontinental generalizations concerning prehistoric behaviour. As a consequence, difficulties could arise in fulfilling both the formal and the professionally desirable requirements of the study.

Operationalizing the information presented in this paper could allow researchers to circumvent most of these problems in the example at hand.

Archaeological sensitivity or potential maps could be entered into the planning process at an early stage to give the developing agency a reliable idea of what to expect, and to act as an initial focus for communication between the agency and cultural resource managers. In this example, the sensitivity map (Fig. 31), suggests that few sites would be located on the poorly terraced, swampy alluvial clays around where the dam wall is to be built. This is an area where foundation testing would be concentrated during the initial feasibility studies. The probable lack of sites reduces the need for intensive survey of that area at an early stage. If the dam wallwere to be built on strongly terraced duplex soils the situation would be different. The point is that such maps allow better informed decisions to be made before any development commences.

The information also provides a planning aid for the researchers actually executing the study. Specifically, the predictive data would facilitate the development of efficient survey strategies for reliable sampling of the area and testing of regional hypotheses. The various sensitivity zones could be equated with survey strata, and the status of each zone might suggest baseline sample fractions within each stratum. If greater resolution was required, the strata could be further divided on additional criteria; low potential mountainous, or low riverine, high riverine, for example.

In the present example, the hypotheses to be tested concern the nature and distribution of Late Holocene subcoastal sites. They could include:

1. The bulk of these sites should be unstratified open sites.
2. Most sites should be located in stream valleys where at least five of the factors listed previously co-occur.

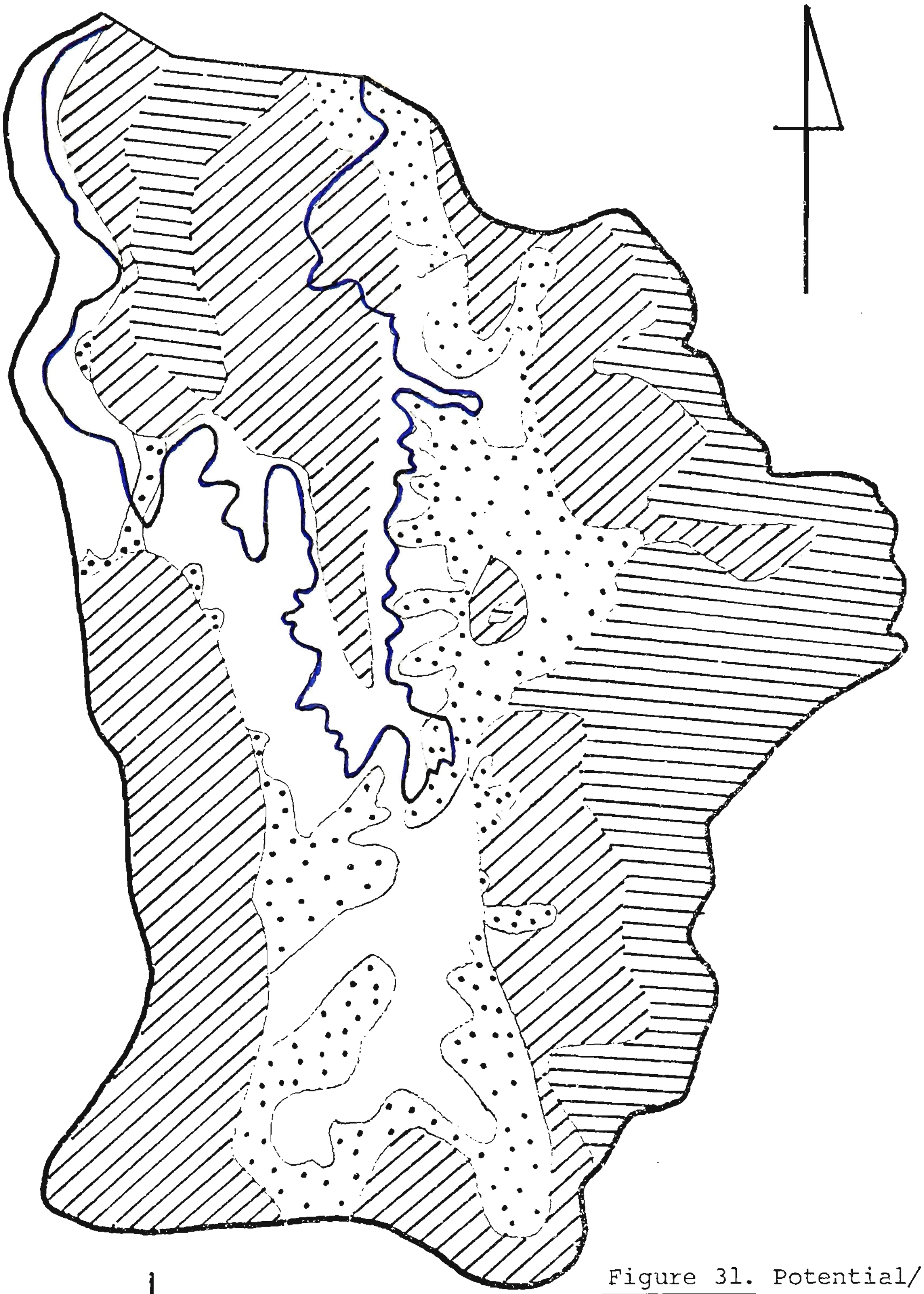


Figure 31. Potential/ sensitivity map for Purga Creek Dam.

Scale: 1km

Key:

□ 100% discovery potential

⁙ 75% discovery potential

▨ 50% discovery potential

▤ <50% discovery potential

3. Assemblages should be characterized by a range of amorphous flaked tools and debitage.

To test these propositions, and adequately fulfil their contractual obligations within the time allowed, the archaeologists choose to undertake a 25% sample of the subject area. They decide to use a stratified random sample with unequal sample fractions to accommodate variations in sensitivity, and to vary the size and number of the survey units to circumvent accessibility problems in some strata. High proportions of both the high and moderate-high sensitivity zones will be examined in .25km^2 units, while medium to low proportions of the other strata will be surveyed in 1.0km^2 units. Subdivisions in the moderate-low and low potential zones will be accounted for, and parts of all subdivisions will be examined.

I stress that the sensitivity strata should not be used to generate self-fulfilling prophecies concerning regional or subregional prehistory. The strata must be viewed as hypothetical divisions of the landscape, and tested as such; all should be sampled. Similarly, the sensitivity ratings should not be employed without due regard for other archaeological considerations (for example, the possible or known locations of non-recent or non-domestic sites) or job-specific factors such as differential impact. Plans for large scale disturbance of medium or low sensitivity areas may necessitate more intensive sampling of parts of those strata than would be suggested by their potential rating. In the present example, tourist facilities will probably be built in a moderate to low sensitivity zone. Archaeologists may choose to nest additional survey units in the area to be developed. This would ensure the area was checked thoroughly, and provide an intensive test of the moderate-low potential hypothesis.

Finally, and importantly, the work presented here provides a framework for statements of scientific significance. Several authors argue that scientific significance can be equated with a site's potential to resolve contemporary research questions (Schiffer and House 1977:249, Schiffer and Gumerman 1977:241). Recalling the foci of current research in the subcoastal area, several types of sites might be considered significant:

> 1. those which are recognizably recent but are atypical in character or location. A large site containing bevel-edged pounders (Hall and Gillieson in press, Kamminga 1980) in a swampy area near Purga Creek would be significant regardless of its condition. A site with a typical array of stone material located in the ranges to the east of the dam would also be important in this context.
>
> 2. those which are representative reflections of modelled subsistence-settlement patterns exhibiting a feature potentially relevant to questions at hand. A site located in a predictable place in a high sensitivity zone and featuring *in situ* subsurface material would be significant in these terms. Excavation of such a site could add significantly to our knowledge of subcoastal adaptations.
>
> 3. sites which cannot be interpreted by reference to the model, except to establish temporal atypicality. A Pleistocene or early to mid Holocene site located anywhere in the study area would be significant. As very little is known about this period of Southeast Queensland prehistory any sites of this age would have research potential.

I am not advocating the use of data presented here in building simplistic rankings of sites. Many task-specific variables come into play in the assessment of scientific significance; using a cook-book approach cannot be justified. Schiffer and Gumerman have stressed that "the outstanding quality of the concept of significance is its relativity", and call for the specification of criteria by which significance might be judged (1977:239-240). The information herein could be used as an aid for the identification of such factors.

Conclusion

The objectives of this paper are to add to our archaeological knowledge of Southeast Queensland and to provide information relevant to cultural resource management in this and other regions. The first has been achieved through the reordering and further testing of the pulsation model of subcoastal subsistence-settlement patterns. The second has been achieved a, through the attainment of the first, and b, through the exploration of useful statistical techniques and the development of a predictive set of site location criteria. I reiterate that this paper is by no means intended as a "cook-book" for the compleat subcoastal archaeologist. A number of questions have yet to be resolved, and probably as many have not even been addressed. It is essential that future work endeavours to more fully develop our understanding of subcoastal adaptations. However, this paper does suggest that predictive modelling is of value to cultural resource management. At a broader level, it demonstrates the reciprocal nature of the relationship between research and archaeological management. Successful management requires research, and management oriented studies can strengthen our knowledge of, and approaches to, Australian prehistory.

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APPENDIX A.

Plant Resources

KEY:

1. Information Codes

A. Environmental Zone	1. fringing forest / aquatic vegetation	
	2. lowland eucalypt open forest	
	3. highland eucalypt open forest	
	4. closed forest	
B. Plant Type	1. trees and shrubs	
	2. climbers and scramblers	
	3. herbs, grasses and sedges	
	4. ferns	
C. Part Used	1. fruit	
	2. seeds	
	3. leaves and shoots	
	4. roots, tubers and bulbs	
	5. flowers	
	6. exudates	a. nectar
		b. gum
		c. manna and lerp
	7. bark	
	8. wood	
D. Specific Use	1. staple food	
	2. supplementary food	
	3. emergency food	
	4. poison	a. fish
		b. other
	5. manufacture	a. canoe
		b. honey rag
		c. shelter
		d. shield
		e. spear
		f. string
		g. vessel
		h. waddy
	6. other	
E. Food Value (kJ/100g)	1. <500	6. 900-1000
	2. 5-600	7. 1000-1500
	3. 6-700	8. 1500-2000
	4. 7-800	9. >2000
	5. 8-900	
F. Toxins	1. yes (part as per C, classed a-h)	
	2. no	

Key cont.)

G. Method of Preparation
1. raw
2. cooked
3. detoxification then 1 or 2
4. unknown

H. Seasonality
1. all year
2. summer
3. winter

2. References (see References Cited)

Blake	Blake 1948
Blom/Blomberry	Blomberry 1967
Boyd	Boyd 1968
Cribb	Cribb and Cribb 1974
Dadswell	Dadswell 1934
Hall	Hall,W.T.K. 1964
McPherson	McPherson 1934
Martin	Martin 1969
Petrie	Petrie 1975
Plowman	Plowman 1969
Smith	Smith *et al.* 1959
Thieret	Thieret 1958
Thozet	Thozet 1972

NAME	A	B	C	D	E	F	G	H	REFERENCES
Acacia farnesiana Prickly Moses	1-4	1	2,7, 6b	2/3 4a	1	2	1	2	Cribb: 77,184 Smith, McPherson
Acacia glaucarpa	2-3	1	8	5e	-	-	-	-	Petrie: 53 Blomberry: 196
Acacia longifolia Boobyalla	1-4	1	2,7, 6b	2/3 4a	1	2	1	2	Cribb: 78,184, Blom: 196 Smith, McPherson
Acalypha nemorum	3	1	3	3	1	2	2	2	Cribb: 104 Blake: 97
Acronychia laevis Logan apple	1,3 4	1	1	2/3	1	2	1	2	Cribb: 21
Acrotriche spp Ground berry	2-3	3	6a	2/3	1	2	1	2	Cribb:181
Alectryon tomentus Red jacket	3-4	1	1	2/3	1	2	1	2	Cribb: 21
Alocasia macrorrhizos Cunjevoi	1,4	3	4	1	1	1 d	3 d	1	Cribb: 144 Plowman
Alpinia caerula Ginger	3-4	3	2,4	2	1	2	1	2	Cribb: 95,145 Smith
Amyema spp Mistletoes	2	1	1	2/3	1	2	1	2	Cribb: 42
Anguilla dioica Blackman's potatoes	1	3	4	2/3	1	2	1	1	Cribb: 146
Apium prostratum Sea celery	1	3	3	2/3	1	2	2	2	Cribb: 115
Aponogeton spp	1	3	4	2/3	1	2	1/2	1	Cribb: 146
Araucaria bidwillii Bunya Pine	4	1	2	2/3	1	2	1/2	2	Cribb: 79 , Smith Petrie:var, Blomberry:207
Archontophoenix cunninghamii Piccabeen palm	1,3, 4	1	3,7	1/2 5g	1	2	1/2	1	Cribb: 110 Petrie: 93
Arytera spp Corduroy tamarind	4	1	1	2/3	1	2	1	2	Cribb: 22
Banksia spp	2-3	1	6a	2/3	1	2	1	2	Cribb: 181 Petrie: 80
Billardiera scandens Apple berry	2-3	2	1	2/3	1	2	1	2	Cribb: 62 Blomberry: 214
Boerhavia diffusia Hogweed	1	3	4	1/2	1	2	2	1	Cribb: 146 Dadswell
Brachychiton populneum Kurrajong	3-4	1	2,3,4	1-3	1	2	1/2	1-2	Cribb: 81,105,138 Smith.
Calamus muelleri Lawyer vine	4	2	1	2/3	1	2	1	2	Cribb: 62 Blake: 96
Capparis spp Native pomegranate	3-4	1	1	2/3	1	2	1	2	Cribb:24 Thozet:229, Blake: 98
Carissa ovata Currentbush or scrub lime	3-4	1	1	2/3	1	2	1	2	Cribb: 25 Thozet:231
Castanospernum australe Moreton Bay Chestnut	1	1	2	1/2	1	1b	3b	3	Cribb: 83 Blake: 94, Smith
Cayratia clematidea Native grape	4	2	1	2/3	1	1a	3a	2	Cribb: 63
Cissus antarctica Native grape	1,3, 4	2	1	2/3	1	2	1	2	Cribb: 64 Blake: 96
Cissus hypoglauca Native grape	3	2	1	2/3	1	2	1	2	Cribb: 64
Cissus opaca Native grape	3-4	2	4	1/2	1	2	1/2	1	Cribb: 140 Blake: 96
Citrobatus spp Native orange	2-4	1	1	2/3	1	2	1	1	Cribb: 25 Blake: 97, Blomberry:323
Cordyline terminalis Palm lily	4	1	4	3	1	2	2	1	Cribb: 138
Crinum spp Lily	1	3	4	2	1	2	2	1	Cribb: 148
Cyathea spp Tree fern	3-4	4	3	2/3	1	2	1/2	2	Cribb: 134
Cymbidium malidum Tree orchid	4	3	3	1/2 6	1	2	1/2	2	Cribb: 119
Cyperus rotundus Nutgrass	2	3	4	2/3	1	2	3	1	Cribb: 157
Dendrobium spp King Orchid	1,4	3	3	1/2	1	2	2	2	Cribb: 119 Blake: 97
Dendrocnide spp Stinging tree	4	1	1,7, 8	2/3, 5b,f,g	1	1a,c	3a	2	Cribb: 28, Petrie: 79,106 Blake: 97
Derris spp	3-4	1	3	4a	-	1c	-	-	McPherson
Dicanthium spp	2	3	6c	2/3	1	2	1	1	Cribb: 186

NAME	A	B	C	D	E	F	G	H	REFERENCES
Dicksonia spp Soft tree fern	3-4	4	3	2/3	1	2	1-2	2	Cribb: 135
Diospyros ferrea Sea ebony	3-4	1	1	2/3	1	2	1	2	Cribb: 29
Diploglottis spp Native tamarind	4	1	1	2/3	1	2	1	2	Cribb: 29
Discorea transversa Yam	3-4	2	4	1	1	2	2	1	Cribb: 141, Petrie: 93 Thozet: 229, Martin
Elaeocarpus grandis Blue Quandong	4	1	1	2/3	1	2	1	2 late	Cribb: 30 Blomberry:246
Elatostema reticulatum	1,4	3	3	2/3	1	2	2	2	Cribb: 121
Eleocharis spp Spike rush, water chestnut	1	3	4	1/2	1	2	2	1	Cribb: 157
Erythrina spp Coral tree	4	1	3,8	3 5d,g	1	2	2	2	Cribb: 106 Petrie: 103, Blake: 97
Eucalyptus acmenoides	2-3	1	7	5a	-	-	-	-	Petrie: 97
Eucalyptus crebra narrow-leaved ironbark	2-3	1	8	5e,h	-	-	-	-	Petrie: 102
Eucalyptus intermedia Pink bloodwood	2/3	1	6a	2/3	1	2	1	2	Cribb: 182
Eucalyptus spp	1-3	1	6c	2/3	1	2	1	2	Cribb: 187
Eugenia coolminiana Lillypilly	4	1	1	2/3	1	2	1	2 late	Cribb: 32 Blomberry: 202
Eugenia smithii Lillypilly	1,4	1	1	2/3	1	2	1	2 late	Cribb: 32 Blomberry: 202
Eupomatia laurina Native guava	3-4	1	1	2/3	1	2	1	2	Cribb: 33
Eustrephus latifolius Wombat berry	2-4	2	4	2/3	1	2	1	1	Cribb: 142
Exocarpus cupressiformis Native cherry	2-3	1	1	2/3	1	2	1	2	Cribb: 33 Petrie: 231, Blake: 95
Exocarpus latifolius Native cherry	3-4	1	1	2/3	1	2	1	2	Cribb: 33
Ficus coronata Sandpaper fig	1	1	1	1/2	1	2	1	1	Cribb: 35,106 Petrie: 94, Thozet: 231
Ficus macrophylla Moreton Bay fig	4	1	1,3 7	1/2 5f	1	2	1/2	1	Cribb: 35,106 Petrie: 94
Flagellaria indica Supplejack	3-4	2	3	2/3 6	1	2	2	1	Cribb: 113 Petrie: 78
Freycinetia spp	4	2	1	2/3	1	2	1	2	Cribb: 65
Gahnia aspera Saw sedge	2-4	3	2	2/3	1	2	1	2	Cribb:101 Smith
Geitonoplesium cymosum Scrambling lily	1-4	2	3	3	1	2	2	2	Cribb: 113
Geranium spp Cranesbill	2	3	4	1/2	1	2	2	1	Cribb: 149
Grevillea robusta Silky oak	1,4	1	6a	2/3	1	2	1	2	Cribb: 182
Glycine tabacina Glycine pea	2-3	2	4	2/3	1	2	1	1	Cribb: 142 Blake: 95
Hibiscus spp	2-3	1	2,3,4 7	2/3 5f	1	2	1/2	2	Cribb: 86,107, Blake: 97 Blomberry: 270, Smith
Hovea spp Purple peas	2	1	1	2/3	1	2	4	2	Cribb: 37 Blomberry: 271, Blake: 96
Hydrocotle spp Pennywort	3-4	3	3	2/3	1	2	2	2	Cribb: 122
Hypoxis hygrometrica Golden weatherglass	3	3	4	2/3	1	2	1	1	Cribb: 150
Ipomoea plebeia Bellvine	2	2	4	2/3	1	2	2	1	Cribb: 142 Dadswell
Jagera psuedorhus Foambark tree	3-4	1	3	4a	-	1c	-	2	Mcpherson
Linospadix monostachys Walking-stick palm	3-4	1	1,3	2/3	1	2	1	2	Cribb: 39
Linum marginale Native flax	2	3	2	2/3	1	2	1	2	Cribb: 97 Smith
Livistonia australis Cabbage tree palm	4	1	3,7	1/2 5g	1	2	1/2	1	Cribb: 110 Petrie: 93
Lomandra longifolia Matrush	1-3	3	3,5	2/3 5f	1	2	2	2	Cribb: 124 Petrie: 107, Blake: 94

NAME	A	B	C	D	E	F	G	H	REFERENCES
Macadamia integrifolia Queensland nut	4	1	2	2/3	9	2	1	2	Cribb: 87 Smith
Macrozamia spp Zamia	2	1	2	1/2	1	1c	3c	2 late	Cribb: 89, Blake: 97 Thieret, Smith, Blom: 287
Malaisia scandens Burney vine	4	2	2,7	2/3 5f	1	2	1/2	2	Cribb: 94 Petrie: 107, Smith
Marsdinea flavescens Native potato	4	2	4	2/3	1	1d	3d	1	Cribb: 143 Dadswell (M. australis)
Marsilea spp Nardoo	4	4	1	2/3	1	2	1	2	Cribb: 71 Blomberry: 56,72
Microcitrus australasica Finger lime	4	1	1	2/3	1	2	1	2	Cribb: 41
Microcitrus australis Native lime	2,4	1	1	2/3	1	2	1	2	Cribb: 42
Morinda spp	4	1	1,3	2/3	1	2	1	2	Cribb: 43
Mucana gigantea Velvet bean	4	2	2	3	1	1b	3b	2	Cribb: 95 Smith
Myoporum debile Amula	2	1	1	2/3	1	2	1	2	Cribb: 44
Myoporum spp Sugarwood	2	1	6c	2/3	1	2	1	2	Cribb: 187
Melaleuca spp Tea tree	1-2	1	6a 7	2/3 5c	1	2	1	2	Cribb:183 Petrie: 99
Nelumbo nucifera Sacred lotus	1	3	2,3	2/3	1	2	1/2	2	Cribb: 98,125 Smith, Boyd
Nymphaea gigantea Giant waterlily	1	3	2,3, 4	1	1	2 1d	1/2 3d	1	Cribb: 98,125 Smith, Boyd
Nymphoides spp Marshwort	1	3	4	2/3	1	2	1	2	Cribb: 151 Boyd
Oxalis corniculata Yellowwood sorrel	2-3	3	3	2/3	1	2	2	2	Cribb: 125
Panicum spp Native millet	1-4	3	2	1/2	1	2	2	2	Cribb: 102 Smith
Passiflora herbertiana Passionfruit	2	2	1	2/3	1	2	1	2	Cribb: 67 Blomberry: 299
Persoonia media Geebung	2	1	1	1/2	1	2	1	3	Cribb: 49 Petrie: 93, Blomberry: 301
Phragmites australis Common reed	1	3	3	1/2	1	2	2	2	Cribb: 126
Physalis minima Native gooseberry	2	3	1	2/3	1	2	1	2	Cribb: 73
Piper novaehollandiae Native pepper	4	2	1	3	1	2	1	2	Cribb: 68
Pittosporum phillyreoides Native willow	2	1	2,6b	2/3	1	2	2	3	Cribb: 92 Smith
Planchonella australis Black apple	4	1	1,7	1/2	1	2	1/2	3 late	Cribb: 49
Podocarpus elatus Brown pine	4	1	1	2/3	1	2	1	2	Cribb: 51
Polygonum hydropiper Water pepper	1	3	3	4a,3	1	1c	3	2	Cribb: 126 Petrie: 73, Boyd
Portulaca oleracea Portulaca	2	3	2,3,4	1	1	2	1/2	1	Cribb: 99,127,153 Dadswell
Pothos longipes Pothos	4	2	1	2/3	1	2	1/2	2	Cribb: 68
Psychotria loniceroides	3-4	1	1	2/3	1	2	1	2	Cribb: 52
Pterstylis spp Ground orchid	1-3	3	4	2/3	1	1d	3d	1	Cribb:151 Petrie: 93, Thozet: 232
Randia spp	3-4	1	1	2/3	1	2	1	2	Cribb: 53
Rauwenhoffia leichardtii	4	2	1	2/3	1	2	1	2	Cribb: 69 Thozet: 229
Rhagondia spp Fragrant saltbush	2-4	1	3	2/3 6	1	2	2	2	Cribb: 111
Rubus rosifolius Native raspberry	2-3	1	1	2/3	1	2	1	2	Cribb:53 Petrie: 94, Thozet: 230
Sambucus australasica Yellow elderberry	4	1	1	2/3	1	2	1	2	Cribb: 55
Sanatalum spp Sandalwood	4	1	1	2/3	1	2	1	2	Cribb: 57
Scirpus spp Club rush	1	3	4	1/2	1	2	2	1	Cribb: 158

NAME	A	B	C	D	E	F	G	H	REFERENCES
Sebania spp Sebania pea	2	3	1	2/3 6	1	2	1	2	Cribb: 73
Sporobolus spp Yakka grass	2	3	2	1/2	1	2	2	2	Cribb: 102 Smith
Stemona australiana Yam	4	2	4	1	1	2	2	1	Cribb: 143
Stephania spp Tapevine	1-3	2	4	4a	1	1d	-	1	McPherson
Tephrosia spp Tephrosia	2		3,4	4a	1	1c d	-	1	McPherson
Tetrastigma nitens Native grape	4	2	1	2/3	1	2	1	2	Blake: 97
Thysanotus tuberosus Fringed lily	2	3	4	2/3	1	2	1	1	Cribb: 154
Trachymene incisa Native carrot	2-3	3	4	2/3	1	2	2	1	Cribb: 155
Trichosanthes palmata Thowan yam	2	2	4	1	1	2	2	1	Cribb: 144
Triglochin spp Water ribbon	1	3	4	2/3	1	2	2	1	Cribb: 155
Tristania suavolens Swamp mahogeny	1-3	1	7	5a	-	-	-	-	Petrie: 97
Typha spp Bulrush	1	3	3,4	1/2	1	2	2	1	Cribb: 133,163, Boyd Petrie: 92, Thozet: 229
Typhonium brownii Black arum lily	3	3	4	1/2	1	1d	3d	1	Cribb: 155 Thozet: 232
Urtica incisa Native nettle	2	3	3	2/3	1	2	1	2	Cribb: 133 Blake: 95
Wahlenbergia spp Australian bluebell	2-4	3	5	2/3	1	2	1	2	Cribb: 163
Xanthorrhoea spp Grasstree	2-3	1	3,6a	1/2	1	2c le	1	3	Cribb: 112,184, Petrie: 80 Hall, Blake:95,Thozet:229

APPENDIX B.

Animal Resources

KEY:

1. Information Codes

A. Environmental Zone
- 1. fringing forest / aquatic
- 2. lowland eucalypt open forest
- 3. highland eucalypt open forest
- 4. closed forest

B. Animal Type
- 1. mammal
- 2. bird
- 3. reptile
- 4. amphibian
- 5. fish
- 6. shellfish/crustaceans

C. Specific Use
- 1. important food
- 2. supplementary food
- 3. emergency food
- 4. other
  - a. bone
  - b. feathers
  - c. quill
  - i tool
  - ii decoration
  - iii clothing

D. Sexual Dimorphism
- 1. yes
  - a. pronounced
  - b. minimal

E. Size (length,cm)
- 1. <10
- 2. 10-15
- 3. 15-30
- 4. 30-60
- 5. 60-100
- 6. 100-200
- 7. >200

F. Weight (adult, kg)
- 1. <.5
- 2. .5-1
- 3. 1-2
- 4. 2-3
- 5. 3-4
- 6. 4-5
- 7. 5-10
- 8. 10-15
- 9. 15-20
- 10. 20-25
- 11. 25-30
- 12. 30-40
- 13. >40

G. Social Habits
- 1. solitary
- 2. gregarious
  - a. large groups
  - b. small groups

H. Abundance
- 1. abundant
- 2. common
- 3. uncommon
- 4. rare

I. Breeding Season
- 1. summer
- 2. autumn
- 3. winter
- 4. spring
- 5. all year

Key cont.)

J. Food Value (kJ/100g)	1. <500	6. 900-1000
	2. 5-600	7. 1000-1500
	3. 6-700	8. 1500-2000
	4. 7-800	9. >2000
	5. 8-900	

2. References (see References Cited)

Anderson	Anderson *et al.* 1971
Augee	Augee *et al.* 1978
Barker	Barker and Grigg 1977
Burrell	Burrell 1927
Calaby	Calaby 1966
Cann	Cann 1978
Cayley	Cayley 1971
Cogger	Cogger 1979
Davis	Davis 1977
Finlayson	Finlayson 1947
Frith	Frith 1967
Goode	Goode 1967
Grant a	Grant,T.R. and Carrick 1978
Grant b	Grant,E.M. 1965
Griffiths	Griffiths and Simpson 1966
Grigg	Grigg 1977
Johnson a	Johnson,P.M. and Bradshaw 1977
Johnson b	Johnson,P.M. 1978
Kirkpatrick	Kirkpatrick and Johnson 1969
Lake	Lake 1967
Lyne	Lyne 1964
McMicheal	McMicheal and Hiscock 1958
Marlow	Marlow 1958
Maynes	Maynes 1973
Merchant	Merchant 1976
Morton	Morton and Burton 1973
Poole	Poole and Pilton 19
Ride	Ride 1970
Riek a	Riek 1951a
Riek b	Riek 1951b
Slater 74	Slater 1974
Slater 70	Slater 1970
Stodart	Stodart 1966
Troughton	Troughton 1973
Tyndale-Biscoe	Tyndale-Biscoe 1973
Wakefield a	Wakefield 1963
Wakefield b	Wakefield 1961
Wood	Wood 1971
Woolard	Woolard *et al.* 1978

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Acrobates pygmaeus Feathertailed glider	2	1	1	lb	2	1	-	2	-	7	Ride, Troughton, Marlow, Finlayson
Aepyprymus rufescens Rufous rat-kangaroo	2-3	1	1	la	5	4-5	1	2	5	7	Ride, Troughton Marlow, Johnson a
Antechinus flavipes Yellowfooted antichinus	1-4	1	2	lb	3	1	1	1	3	7	Ride, Marlow
Antechinus maculatus Pygmy antechinus	2-3	1	2	lb	1	1	1	4	1	7	Ride, Troughton Marlow
Antechinus stuartii Brown antechinus	2-4	1	2	lb	3	1	1	2	3	7	Ride, Troughton
Antechinus swansonii Dusky antechinus	4	1	2	lb	3	1	1	3	3	7	Ride, Troughton Marlow
Bettongia gaimardi Eastern bettong	3-4	1	2	lb	4	3	2b	3	5	7	Ride, Stodart, Marlow, Finlayson
Cercartetus nanus Eastern pygmy possum	2-3	1	2	-	3	1	-	1	-	7	Ride, Troughton Marlow, Wakefield a
Dasyurus hallucatus Little northern native cat	2-3	1	2	lb	4	2	1	2	3	7	Ride, Troughton
Dasyurus maculatus Tiger cat	2-4	1	2	lb	5	2	2b	3	2-3	7	Ride, Troughton
Hydromys chrysogaster Eastern water rat	1	1	2	-	4	2	1	2	4,1	7	Ride Woolard
Isoodon macrourus Shortnosed bandicoot	1-3	1	1	lb	4	2	1	2	3	7	Ride, Troughton Lyne, Marlow
Macropus agilis Agile wallaby	1-2	1	1	la	6	9-10	-	3	5	7	Ride, Merchant Kirkpatrick
Macropus dorsalis Blackstriped wallaby	3-4	1	1	lb	6	7-10	2b	2	-	7	Marlow, Ride
Macropus giganteus Grey kangaroo	1-3	1	1	lb	7	11-12	2a	1	5	7	Ride, Marlow Poole
Macropus parryi Whiptail	2-3	1	1	la	6	8-10	2a	3	5	7	Ride, Marlow Maynes, Calaby
Macropus rufogriseus Red necked wallaby	2-3	1	1	lb	6	6-10	1	2	5	7	Ride, Finlayson Marlow, Calaby
Melomys cerviipes Fawnfooted melomys	1-4	1	2	lb	3	1	1	1	4-2	7	Ride, Wood
Ornithorhyncus anatinus Platypus	1	1	2	la	4	3	2b	2	3-4	7	Ride, Troughton Burrell, Grant a
Petaurus australis Yellow bellied glider	2-3	1	2	-	4	1	-	3	-	7	Ride, Troughton Marlow
Petaurus breviceps Sugar glider	2-3	1	1	-	3	1	2b	2	-	7	Ride, Troughton Marlow, Finlayson
Pertaurus norfolcensis Squirrel glider	2-3	1	2	-	4	1	2b	3	-	7	Ride, Troughton Marlow
Parameles nasuta Long nosed bandicoot	1-4	1	1	lb	3-4	2-3	1	1	5	7	Ride, Troughton Marlow, Lyne
Petrogale pencillata Brushtailed rock wallaby	2-3	1	1	lb	6	6	2a	2	5	7	Ride, Troughton Marlow, Johnson b
Phascogale tapoatafa Tuan	2-4	1	2	lb	3-4	1	1	3	4	7	Ride, Troughton Marlow, Wakefield b
Phascolarctos cinereus Koala	2-3	1	1	lb	5	7-8	2b	4	4-1	7	Ride, Troughton Marlow
Planigale tenuirostris Narrow nosed planigale	2	1	2	lb	1	1	1	3	1	7	Ride, Troughton Marlow
Potorous tridactylus Potoroo	3-4	1	2	lb	3-4	3	1	3	5	7	Ride, Troughton Marlow, Finlayson
Psuedocheirus peregrinus Common ringtail	1-4	1	1,b iii	lb	3	2	2b	2	2-4	7	Ride, Troughton Marlow
Rattus fuscipes Bush rat	1-4	1	2	lb	3	1	1	1	5	7	Ride, Wood
Rattus lutrelus Swamp rat	1,3,4	1	2	-	-	2	1	1	1	7	Ride
Schoinobates volans Greater glider	2-3	1	1	lb	5	4	1	2	-	7	Ride, Troughton Marlow, Finlayson
Sminthopsis murina Dunnart	1-4	1	2	lb	1	1	1	3	-	7	Ride, Troughton Marlow
Tachyglossus aculeatus Echidna	1-4	1	4,c i	lb	3	5-6	1	1	3-4	7	Ride, Calaby, Augee Griffiths, Troughton
Thylogale stigmata Red legged pademelon	3-4	1	1	lb	5	7	2a	2	5	7	Ride, Calaby, Morton Marlow, Troughton
Thylogale thetis Red necked pademelon	3-4	1	1	lb	5	7	2a	1	5	7	Ride, Calaby, Morton Marlow, Troughton
Trichosaurus caninus Bobuck	3-4	1	1	lb	4	4-5	1	2	2	7	Ride, Troughton Marlow

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Trichosaurus vulpecula Brushtailed possum	1-3	1	1b iii	1b	4	4-5	1	1	2	7	Ride, Troughton Marlow, Tyndale-Biscoe
Wallabia bicolor Swamp wallaby	1-2	1	1	-	6	8	1	2	-	7	Ride, Troughton Marlow, Calaby
Acanthiza chrysorrhoa Yellow tailed thornbill	2	2	2	-	1	-	2b	2	3-4	7,3	Slater '74 Cayley
Acanthiza lineata Striated thornbill	2	2	2	-	1	-	2b	-	3-4	7,3	Slater '74 Cayley
A. pusilla Brown thornbill	3-4	2	2	-	1	-	2b	-	3-4	7,3	Slater '74 Cayley
A. nana Little thornbill	2	2	2	-	1	-	2b	-	3-4	7,3	Slater '74 Cayley
A. reguloides Buff tailed thornbill	2	2	2	-	1	-	2b	-	3-4	7,3	Slater '74 Cayley
Acanthorhyncus tenuirostris - Eastern spinebill	1-4	2	2	-	2	-	2b	-	4-1	7,3	Slater '74 Cayley
Accipiter cirrocephalous Collared sparrowhawk	2-3	2	-	-	4	-	2b	-	4	7,3	Slater '70 Cayley
Accipter faciatus Brown goshawk	1-3	2	-	1a	4	-	1	-	4-1	7,3	Slater '70 Cayley
A. novahollandiae Grey goshawk	2-3	2	-	1a	4	-	1	-	4-1	7,3	Slater '70 Cayley
A. radiatus Red goshawk	2	2	-	1b	4	-	-	4	4	7,3	Slater '70 Cayley
Acrocephalous australis Reed warbler	1	2	2	-	3	-	2b	-	4	7,3	Slater '74 Cayley
Aegintha temporalis Red browed finch	2	2	2	-	2	-	2b	-	4-1	7,3	Slater '74 Cayley
Aegotheles cristalis Owlet-nightjar	1-3	2	2	-	3	-	1	-	4-1	7,3	Slater '70 Cayley
Alcyone azurea Azure kingfisher	1	2	2	-	3	-	1	-	4	7,3	Slater '70 Cayley
Alectura lathami Brush turkey	3-4	2	1	-	4	-	2b	2	4-1	7,3	Slater '70 Cayley
Alisterus scapularis King parrot	1-2	2	2 bii	-	4	-	2b	-	4	7,3	Slater '70 Cayley
Anas castanea Chestnut teal	1	2	1	1b	4	2	2a	-	3-4	"	Slater '70 Cayley, Frith
Anas gibberifrons Grey teal	1	2	1	1b	4	1	2a	-	5	"	Slater '70 Cayley, Frith
A. querquedula Garganey	1	2	2	2	4	2	2a	-	-	"	Frith (migrant)
A. rhycotis Bluewinged shoveller	1	2	1	2	4	2	2a	-	3-4	"	Slater '70 Cayley, Frith
A. superciliosa Black duck	1	2	1	1b	4	3	2a	-	4	"	Slater '70 Cayley, Frith
Anhinga rufa Darter	1	2	2	-	5	-	1	-	5	"	Slater '70 Cayley
Anseranas semipalmata Magpie goose	1	2	2	1b	5	4	2a	3	2	"	Cayley Frith
Anthochaera carunculata Red wattlebird	2	2	2	-	4	-	2a	3	4,1	"	Slater '74 Cayley
Anthochaera chrysoptera Little wattlebird	2	2	2	-	3	-	2b	3	3-4	"	Slater '74 Cayley
Aplonis metallica Shining starling	4	2	2	-	3	-	2a	-	3-4, 1	"	Slater '74 Cayley (Migrant)
Apus pacificus Fork tailed swift	2-3	2	2	-	2	-	2a	-	4-1	"	Slater '70 Cayley (Migrant)
Aquila audax Wedgetailed eagle	2-3	2	-	1b	5-6	-	-	2	3	"	Slater '70 Cayley
Ardea novahollandiae White faced heron	1	2	2	-	5	-	2a	-	4-1	"	Slater '70 Cayley
Ardea pacifica White necked heron	1	2	2	-	5	-	2b	-	4-1	"	Slater '70 Cayley
Artanus cyanopterus Dusky wood swallow	2-3	2	2	-	3	-	2a	-	4-1	"	Slater '74 Cayley
Artanus leucorhyncus Whitebreasted wood swallow	1-3	2	2	-	3	-	2a	-	4-1	"	Slater '74 Cayley
A. minor Little wood swallow	2	2	2	-	2	-	2b	3	4-1	"	Slater '74 Cayley
A. personatus Masked wood swallow	2	2	2	-	3	-	2a	-	4-1	"	Slater '74 Cayley
A. superciliosus White browed wood swallow	2	2	2	-	3	-	2a	-	4-1	"	Slater '74 Cayley
Atrichornis rufescens Rufous scrubbird	4	2	2	-	3	-	1	4	4	"	Slater "74 Cayley

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Aviceda subcristata Crested hawk	2	2	-	-	4	-	-	2	4	7,3	Slater '70 Cayley
Aythya australis White eyed duck	1	2	1	1b	4	2	2a	-	5	"	Slater '70,Cayley Frith
Biziura lobata Musk duck	1	2	1	1a	4	3-4	2a	3	4	"	Frith
Botaurus poiciloptilus Brown bittern	1	2	2	-	4	-	1	-	4-1	"	Slater '70 Cayley
Burhinus magnirostris Southern stone curlew	2	2	2	-	4	-	2b	-	4-1	"	Slater '70 Cayley
Cacatua galerita Sulphur crested cockatoo	1-3	2	2 bii	-	4	-	2a	2	3-4	"	Slater '70 Cayley
Cacomantis pyrrhophanus Fan tailed cuckoo	2-3	2	2	-	3	-	-	-	3-4	"	Slater '70 Cayley
Cacomantis variolus Brush cuckoo	2-4	2	2	-	3	-	-	-	4-1	"	Slater '70 Cayley
Caprimulgus macrurus White tailed nightjar	2-3	2	2	-	3	-	-	3	4	"	Slater '70 Cayley
Calidris acuminata Sharptailed sandpiper	1	2	2	-	3	-	-	2	-	7	Slater '70 Northern breeder
Calidris melanotos Pectoral sandpiper	1	2	2	-	3	-	-	4	-	7	Cayley Northern breeder
Calidris ruficolis Red necked stint	1	2	2	-	2	-	2a	2	-	7	Slater '70 Northern breeder
Calyptorhyncus funereus f. Yellow tailed cockatoo	1-4	2	2 bii	-	5	-	2b	-	2-3	"	Slater '70 Cayley
Calyptorhyncus lathami Glossy black cockatoo	2-3	2	2 bii	-	4	-	2b	4	2-3	"	Slater '70 Cayley
Calyptorhyncus magnificus Red tailed cockatoo	1-4	2	2 bii	-	4	-	2b	-	2-3	"	Slater '70 Cayley
Centophus phasianinus Pheasant-cougal	1	2	2	-	4	-	-	-	4-1	"	Slater '70 Cayley
Chalcophaps indica Green-winged pigeon	2-3	2	2	-	3	-	2b	-	5	"	Slater '70 Cayley
Charadrius alexandrius Red capped dotterel	1	2	2	-	3	-	2b	3	4-1	"	Slater '70
Charadrius cinctus Red kneed dotterel	1	2	2	-	3	-	2b	2	4	"	Cayley
Charadrius melanops Black fronted dotterel	1	2	2	-	2	-	2b	-	4	"	Slater '70 Cayley
Chenonetta jubata Wood duck	1	2	1	1b	4	2	2a	-	5	"	Slater '70 Cayley, Frith
Chlidonias hybrida Whiskered tern	1	2	2	-	4	-	2a	-	4	"	Slater '70 Cayley
Chrysococcyx basalis Horsfield bronze cuckoo	2	2	2	-	2	-	-	-	3-4	"	Slater '70 Cayley
Chrysococcyx lucidus plagosus Golden bronze cuckoo	3	2	2	-	2	-	-	-	3-4	"	Slater '70 Cayley
Chrysococcyx malayanus russatus Rufous breasted bronze cuckoo	2	2	2	-	3	-	-	3	4-1	"	Slater '70 Cayley
Chthonicola sagitta Speckled warbler	2	2	2	-	2	-	2b	-	3-1	"	Slater '74 Cayley
Cinclorhamphus cruralis Brown songlark	2	2	2	-	3	-	-	-	4-1	"	Slater '74 Cayley
Cinclorhamphus mathewsii Rufous songlark	2	2	2	-	3	-	2b	-	4-1	"	Slater '74 Cayley
Cinclosoma punctatum Spotted quail thrush	2	2	2	-	3	-	-	-	3-1	"	Slater '74 Cayley
Circus approximans Swamp harrier	1-2	2	-	-	4	-	1-2b	-	4	"	Slater '70 Cayley
Circus assimilis Spotted harrier	2	2	-	1b	4	-	-	3	4	"	Cayley
Cisticola exilis Golden headed cisticolla	1	2	2	-	1	-	2a	-	4-1	"	Slater '74 Cayley
Climacteris erythrops Red browed treecreeper	2-4	2	2	-	2	-	2b	3	4-1	"	Slater '74 Cayley
Climacteris leucaphaea White throated treecreeper	3-4	2	2	-	3	-	2b	-	3-4	"	Slater '74 Cayley
Climacteris picumnus Brown treecreeper	1-2	2	2	-	2	-	2b	-	3-4	"	Slater '74 Cayley
Columba norfolciensis White headed pigeon	3-4	2	2	-	4	-	2b	2	2-3	"	Slater '70 Cayley
Colluricincla harmonica Grey shrike thrush	2-3	2	2	-	3	-	-	4	4-1	"	Slater '74 Cayley
Colluricincla megarhynca Rufous shrike thrush	3-4	2	2	-	3	-	-	-	4-1	"	Slater '74 Cayley

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Conopophila rugogularis Rufous throated honeyeater	2	2	2	-	2	-	2b	3	1	7,3	Slater '74 Cayley
Coracina lineata Barred cuckoo shrike	2-4	2	2	-	3	-	-	-	4-1	"	Slater '74
Coracina novahollandiae Blackfaced cuckoo shrike	2	2	2	-	4	-	2b	-	4-1	"	Slater '74
C. robusta Little cuckoo shrike	2-3	2	2	-	3	-	-	-	4-1	"	Slater '74
C. tenvirostris Cicada bird	2-3	2	2	-	3	-	-	-	4-1	"	Slater '74
Corvus orru Crow	2-3	2	2	-	4	-	2a	-	4-1	"	Slater '74 Cayley
Coturnix pectoralis Stubble quail	1-2	2	2	1b	2	-	2a	-	4-1	"	Slater '70 Cayley
Cracticus nigrogularis Pied butcherbird	2	2	2	-	4	-	-	-	4-1	"	Slater '74 Cayley
Cracticus torquatus Grey butcherbird	2	2	2	-	4	-	-	-	4-1	"	Slater '74 Cayley
Cuculus pallidus Pallid cuckoo	2	2	2	-	3	-	-	-	4-1	"	Slater '70 Cayley
Cuculus saturatus Oriental cuckoo	2	2	2	-	4	-	-	4	-	"	Cayley (migrant)
Cygnus atratus Black swan	1	2	1	1b	6	7	2a	-	2-3	"	Slater '70 Cayley, Frith
Dacelo gigas Kookaburra	2-3	2	2	-	4	-	2b	-	4	"	Slater '70 Cayley
Dacelo leachii Blue winged kookaburra	1-2	2	2	-	4	-	-	3	4	"	Slater, 70 Cayley
Dasyornis brachypteris Brown bristlebird	3	2	2	-	3	-	-	-	3-4	"	Slater '74 Cayley
Dendrocygna arcuata Water whistleduck	1	2	1	2	4	3	2a	3	1	"	Frith
Dendrocygna eytonia Grass whistleduck	1	2	1	1b	4	2	2a	-	4	"	Slater '70 Cayley, Frith
Dicaeum hirundinaceum Mistletoe bird	1-4	2	2	-	1	-	-	2	4-1	"	Slater '74 Cayley
Dicrurus bracheatus Spangled drongo	3-4	2	2	-	3	-	-	-	4-1	"	Slater '74 Cayley
Dromaius novahollandiae Emu	2	2	1	1b	7	12	2b	2	2-3	"	Cayley
Dupetor flavicollis Black bittern	1	2	2	-	4	-	1	-	4-1	"	Slater '70 Cayley
Egretta albis White egret	1	2	2	-	5	-	2a	-	1	"	Slater '70 Cayley
Egretta garzetta Little egret	1	2	2	-	4	-	2a	-	1	"	Slater '70 Cayley
Egretta intermedia Plumed egret	1	2	2	-	4	-	2a	-	4-1	"	Slater '70 Cayley
Elanus notatus Black shouldered kite	2	2	-	-	4	-	1	-	2-3	"	Slater '70 Cayley
Emblema bella Beautiful firetail	2	2	2	-	2	-	2b	3	4-1	"	Slater '74 Cayley
Emblema guttata Diamond firetail	2	2	2	-	2	-	2b	3	4-1	"	Slater '74 Cayley
Entomyzon cyanotis Blue faced honeyeater	2	2	2	-	3	-	2b	2	3-1	"	Slater '74 Cayley
Eolophus roseicapillus Galah	1-2	2	2 bii	-	4	-	2a	2	4	"	Slater '70 Cayley
Eosaltria capito Pale yellow robin	4	2	2	-	2	-	-	-	3-4	"	Slater '74 Cayley
Eosaltria chrysorrhoa Northern yellow robin	3-4	2	2	-	2	-	-	-	3-4	"	Slater '74 Cayley
Eudynanys scolopacea Koel	3	2	2	-	4	-	-	-	4-1	"	Slater '70 Cayley
Eurostopodus mystacalis White throated nightjar	2	2	2	-	4	-	1	-	4	"	Slater '70 Cayley
Eorystomas orientalis Dollarbird	1-2	2	2	-	3	-	-	-	4-1	"	Slater '70 Cayley
Excalfactoria chinensis King quail	1-2	2	2	-	1	-	2a	-	4-1	"	Slater '70 Cayley
Falco berigora Brown falcon	2	2	-	1b	4	-	1-2 b	-	3-4	"	Slater '70 Cayley
Falco cenchroides Nankeen falcon	2	2	-	1b	4	-	1-2 b	-	4	"	Slater '70 Cayley
F. hupoleucos Grey falcon	2	2	-	1b	4	-	-	4	3-4	"	Slater '70 Cayley

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Falco longipennis Little falcon	2	2	-	1b	3	-	-	2	4	7,3	Cayley
F. peregrinus Peregrine	1-3	2	-	1b	4	-	-	4	4	"	Slater '70 Cayley
F. subniger Black falcon	3	2	-	1b	4	-	-	4	3-4	"	Cayley
Falcunculus frontatus Eastern shrike tit	2-3	2	2	-	3	-	2b	-	4-1	"	Slater '74 Cayley
Fulica atra Coot	1	2	2	-	4	-	2a	-	4-1	"	Slater '74 Cayley
Gallingano hardwickii Japanese snipe	1	2	2	-	3	-	2b	3	4-1	"	Slater '70, Cayley (migrant)
Gallinula olivacea Bush hen	1-4	2	2	-	3	-	-	3	4-1	"	Slater '70 Cayley
Gallinula tenebrosa Dusky moorhen	1	2	2	-	4	-	2b	-	4	"	Slater '74 Cayley
Gelochelidon nilotica Gullbilled tern	1	2	2	-	4	-	2a	-	4-1	"	Slater '70 Cayley
Geopelia cuneata Diamond dove	1-2	2	2	-	3	-	2b	-	4-1	"	Slater '70 Cayley
Geopelia humeralis Bar shouldered dove	1-2	2	2	-	3	-	2b	-	4-1	"	Slater '70 Cayley
Geopelia striata Peaceful dove	2-3	2	2	-	3	-	2b	-	5	"	Slater '70 Cayley
Gerygone olivacea White throated warbler	1-3	2	2	-	2	-	-	-	3-4	"	Slater '74 Cayley
Gerygone mouki Brown warbler	4	2	2	-	1	-	2b	-	4-1	"	Slater '74 Cayley
Gerygone palpebrosa flavida Fairy warbler	4	2	2	-	2	-	2b	3	4	"	Slater '74 Cayley
Glossopsitta concinna Musk lorikeet	2-3	2	2 bii	-	2	-	2a	-	3-4	"	Slater '70 Cayley
Glossopsitta porphyrocephala Purple crowned lorikeet	2	2	2 bii	-	2	-	2a	3	4	"	Slater '70 Cayley
Glossopsitta pusilla Little lorikeet	2-3	2	2 bii	-	2	-	2a	-	3-4	"	Slater '70 Cayley
Grallina cyanoleuca Magpie lark	1-2	2	2	-	3	-	2a	-	5	"	Slater '74
Grus rubicunda Brolga	1	2	2	-	6	-	2a	-	4-1	"	Slater '74 Cayley
Gymnorhina tibicen Black backed magpie	2	2	2	-	4	-	2a	-	3-1	"	Slater '74 Cayley
Halcyon mackayi Forest kingfisher	2	2	2	-	3	-	-	-	4-1	"	Slater '70 Cayley
Halcyon pyrrhopygia Red backed kingfisher	2	2	2	-	3	-	-	-	4	"	Slater '70 Cayley
Halcyon sanctata Sacred kingfisher	1-2	2	2	-	3	-	-	-	4-1	"	Slater '70 Cayley
Haliaetus morphnoides Little eagle	2-3	2	-	1a	4	-	2b	-	4	"	Slater '70 Cayley
Haliaetus luecogater White breasted sea eagle	1	2	-	1a	5	-	2b	-	3-4	"	Slater '70 Cayley
Haliastur indus Brahminy kite	1	2	-	1a	4	-	1	3	3-4	"	Slater '70 Cayley
Haliastur sphenurus Whistling kite	1-3	2	-	-	4	-	2b	-	5	"	Slater '70 Cayley
Haminrostra melanosternum Black breasted buzzard	2	2	-	-	4	-	-	4	4	"	Slater '70 Cayley
Himantropus himantropus Blackwinged stint	1	2	2	-	4	-	-	-	-	"	Slater '70
Hirundapus candacutus Spine tailed swift	3	2	2	-	3	-	2a	-	4-1	"	Slater '70
Hirundo neoxena Welcome swallow	1-2	2	2	-	2	-	2a	2	3-4	"	Slater '70 Cayley
Hydrprogne caspia Caspian tern	1	2	2	-	4	-	2b	-	4-1	"	Slater '70 Cayley (coastal breeder)
Ixobrychus minutus Little bittern	1	2	2	-	3	-	1	-	4	"	Slater '70 Cayley
Jacana gallinacea Lotus bird	1	2	2	-	2	-	2a	-	4-1	"	Slater '74 Cayley
Lalage leucemela Varied triller	3-4	2	2	-	3	-	-	-	4-1	"	Slater '74
Lalage suerii White winged triller	2	2	2	-	3	-	-	-	4-1	"	Slater '74
Larus novahollandiae Silver gull	1	2	2	-	4	-	2a	-	5	"	Slater '70

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Lathamus discolor Swift parrot	2-3	2	2 bii	-	3	-	2a	3	4-1	7,3	Slater '70 Cayley
Leucosaria melanoleuca Wonga pigeon	4	2	2	-	4	-	2b	3	4	"	Slater '70 Cayley
Lichmera indistincta Brown honeyeater	2-3	2	2	1b	2	-	-	-	3-1	"	Slater '74 Cayley
Limosa lapponica Bar tailed godwit	1	2	2	-	4	-	2a	4	-	"	Slater '70, Cayley (migrant)
Lonchura castaneothorax Chestnut breasted finch	1-2	2	2	-	1	-	2b	-	2-1	"	Slater '74 Cayley
Lophoictinia isura Square tailed kite	2	2	-	-	4	-	-	3	4	"	Slater '70 Cayley
Lopholaimus antarcticus Topknot pigeon	3-4	2	2	-	4	-	2a	-	4	"	Slater '70 Cayley
Macropygia amboinensis Brown pigeon	3-4	2	2	-	4	-	2b	-	4	"	Slater '70 Cayley
Malaorhyncus membanaceus Pink eared duck	1	2	1	1b	4	2	2a	2	4	"	Frith
Malurus cyaneus Superb blue wren	2-3	2	2	-	2	-	2b	-	3-4	"	Slater '74 Cayley
Malurus lamberti Variegated wren	2-3	2	2	-	2	-	2b	-	4	"	Slater '74 Cayley
Malurus melanocephalous Red backed wren	1-2	2	2	-	2	-	2b	-	3-1	"	Slater '74 Cayley
Manorina melanophrys Bell miner	2-3	2	2	-	3	-	2a	3	3-4	"	Slater '74 Cayley
Massorina melanocephala Noisy miner	2	2	2	-	3	-	-	-	3-1	"	Slater '74 Cayley
Megaloprepia magnifica Woompoo pigeon	4	2	2 bii	-	4	-	2b	-	4-1	"	Slater '70 Cayley
Megalurus gramineus Tawny grassbird	1	2	2	=	3	-	2b	-	4-1	"	Slater '74 Cayley
Megalurus timoriensis Tawny grassbird	1	2	2	-	3	-	2b	-	4-1	"	Slater '74 Cayley
Meliphaga chrysops Yellow faced honeyeater	2-3	2	2	-	2	-	2a	2	3-1	"	Slater '74 Cayley
Meliphaga fusca Fuscous honeyeater	2	2	2	-	2	-	2b	2	3-4	"	Slater '74 Cayley
M. lewinii Lewin honeyeater	4	2	2	-	2	-	-	-	4-1	"	Slater '74 Cayley
M. melanops Yellow tufted honeyeater	3-4	2	2	-	3	-	2b	3	3-4	"	Slater '74 Cayley
Melithreptus albogularis White throated honeyeater	2	2	2	-	2	-	-	-	3-1	"	Slater '74 Cayley
Melithreptus gularis Black chinned honeyeater	2	2	2	-	3	-	-	-	3-4	"	Slater '74 Cayley
Melithreptus lunatus White naped honeyeater	2	2	2	-	2	-	2b	2	3-4	"	Slater '74 Cayley
Menura alberti Albert lyrebird	4	2	2	1a	5	-	-	4	3	"	Slater '74 Cayley
Menura superba Superb lyrebird	3-4	2	2	1a	4-5	-	1	2	3	"	Slater '74
Merops ornatus Rainbowbird	2	2	2	-	3	-	-	-	4-1	"	Slater '74 Cayley
Microeca leucophaea Brown flycatcher	2	2	2	-	2	-	2b	-	3-4	"	Slater '74 Cayley
Milvus migrans Black kite	2	2	-	-	4	-	2a	-	4	"	Slater '70 Cayley
Monarcha leucotis White eared flycatcher	4	2	2	-	2	-	2b	3	4-1	"	Slater '74 Cayley
Monarcha melanopsis Black faced flycatcher	3	2	2	-	3	-	-	-	1	"	Slater '74 Cayley
Monarcha trivigata Spectacled flycatcher	2-3	2	2	-	3	-	-	-	4-1	"	Slater '74 Cayley
Myiagria cyanolueca Satin flycatcher	3	2	2	-	2	-	-	-	4-1	"	Slater '74 Cayley
Myiagria inquieta Restless flycatcher	2	2	2	-	3	-	-	-	4-1	"	Slater '74 Cayley
Myiagria rubecula Leaden flycatcher	2-3	2	2	-	3	-	-	3	4-1	"	Slater '74 Cayley
Myzomela obscura Dusky honeyeater	2-4	2	2	-	2	-	2b	3	4	"	Slater '74 Cayley
Myzomela sanguinolenta Scarlet honeyeater	2	2	2	-	1	-	2a	-	4-1	"	Slater '74 Cayley
Neophema pulchella Turquoise parrot	2	2	2 bii	-	3	-	-	3	4	"	Slater '70 Cayley

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Neositta leucocephala White headed sitella	2-3	2	2	-	2	-	2b	-	4-1	7,3	Slater '74 Cayley
Nettapus coramandelianus White pygmy goose	1	2	2	1b	4	2	2b	3	4	"	Frith
Nettapus pulchellus Green pygmy goose	1	2	2	1b	4	2	2b	3	1	"	Frith
Ninox connivens Barking owl	2	2	2	-	4	-	1	-	4-4	"	Slater '70 Cayley
Ninox novaeseelandiae Boobook owl	1-3	2	2	-	4	-	1	2	4-1	"	Slater '70 Cayley
Ninox strenna Powerful owl	3-4	2	2	-	4	-	-	3	3	"	Slater '70 Cayley
Numenius minutus Little whimbrel	2	2	2	-	4	-	-	-	-	"	Slater '70,Cayley (migrant)
Nycticorax cledonicus Nankeen night heron	1	2	2	-	4	-	2a	-	5	"	Slater '70 Cayley
Nymphicus hollandicus Cockateil	1-2	2	2 bii	-	4	-	2a	2	4	"	Slater '70 Cayley
Ocyphaps lophotes Crested pigeon	2	2	2	-	3	-	2a	-	5	"	Slater '70 Cayley
Oriolus sagittatus Olive backed oriole	2	2	2	-	3	2b	-	-	4-1	"	Slater '74 Cayley
Orthonyx temmincki Southern logrunner	4	2	2	-	3	-	-	2	3-4	"	Slater '74 Cayley
Oxyura australis Blue billed duck	1	2	1	1b	4	2	2a	3	1	"	Frith
Pachycephala olivacea Olive whistler	2-3	2	2	-	3	-	-	-	4-1	"	Slater '74 Cayley
Pachycephala pectoralis Golden whistler	2-3	2	2	-	3	-	-	-	4-1	"	Slater '74 Cayley
Pachycephala rufiventris Rufous whistler	1-3	2	2	-	3	-	2b	2	4-1	"	Slater '74 Cayley
Pardalotus melanocephalus Black headed pardalote	2	2	2	-	1	-	2b	-	3-4	"	Slater '74 Cayley
Pardalotus ornatus Yellow tipped pardalote	2-3	2	2	-	1	-	2b	-	3-4	"	Slater '74 Cayley
P. punctatus Spotted pardalote	2-3	2	2	-	1	-	2b	-	3-4	"	Slater '74 Cayley
P. striatus Eastern striated pardalote	2-3	2	2	-	1	-	2b	-	3-4	"	Slater '74 Cayley
Pelecanus conspicullatus Pelican	1	2	2	-	6	-	2a	-	4-1	"	Slater '70 Cayley
Petrochelidon ariel Fairy martin	2-3	2	2	-	2	-	2a	-	4-1	"	Slater '74
Petrochelidon nigricans Tree martin	2	2	2	-	2	-	2a	-	4-1	"	Slater '74
Petroica goodenouii Red capped robin	2-3	2	2	-	2	-	2b	-	4	"	Slater '74 Cayley
Petroica multicolor Scarlet robin	2	2	2	-	2	-	2b	-	3-4	"	Slater '74 Cayley
P. phoenicea Flame robin	2	2	2	-	2	-	2b	-	4-1	"	Slater '74 Cayley
P. rosea Rose robin	3-4	2	2	-	1	-	2b	-	4	"	Slater '74 Cayley
Petrophassa scripta Squatter pigeon	2	2	2	-	3	-	2b	3	4	"	Slater '70 Cayley
Phalacrocorax carbo Black cormorant	1	2	2	-	5	-	2b	-	3-4	"	Slater '70 Cayley
Phalacrocorax melanoleucos Little pied cormorant	1	2	2	-	4	-	2b	-	4-1	"	Slater '70 Cayley
P. sulcirostris Little black cormorant	1	2	2	-	4	-	2b	-	3-4	"	Slater '70 Cayley
P. varins Pied cormorant	1	2	2	-	5	-	2b	-	5	"	Slater '70 Cayley
Phaps chalcoptera Common bronzewing	2-3	2	2	-	2	-	2b	-	4-1	"	Slater '70 Cayley
Phaps elegans Brush bronzewing	3-4	2	2	-	2	-	2b	-	4-1	"	Slater '70 Cayley
Philemon citriogularis Little friarbird	2	2	2	-	3	-	-	-	4-1	"	Slater '74 Cayley
Philemon corniculatus Noisy friarbird	2	2	2	-	3	-	-	-	4-1	"	Slater '74 Cayley
Philemon niger White cheeked honeyeater	1-2	2	2	-	3	-	2b	-	5	"	Slater '74 Cayley
Philomachus pugnax Ruff	1	2	2	-	3	-	-	4	-		Cayley (migrant)

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Philidornis novahollandiae New Holland honeyeater	2	2	2	-	3	-	2b	3	5	7,3	Slater '74 Cayley
Pitta versicolor Noisy pitta	4	2	2	-	3	-	-	2	4-1	"	Slater '74 Cayley
Platalea flavipes Yellow billed spoonbill	1	2	2	-	5	-	2a	-	4-1	"	Slater '70
Platalea regina Royal spoonbill	1	2	2	-	5	-	2a	-	4-1	"	Slater '70
Platycerus adscitus Paleheaded rosella	1-2	2	2 bii	-	3	-	2b	2	5	"	Slater '70 Cayley
Platycerus elegans Crimson rosella	1-4	2	2 bii	-	4	-	2b	2	4-1	"	Slater '70 Cayley
Platycerus eximus Eastern rosella	1-2	2	2 bii	-	3	-	2b	1	4-1	"	Slater '70 Cayley
Plectrorhynca lanceolata Striped honeyeater	2	2	2	-	3	-	2b	-	3-4	"	Slater '70 Cayley
Plegadis falcinellus Glossy ibis	1	2	2	-	5	-	2a	-	4-1	"	Slater '70 Cayley
Podargus ocellatus pluiferus Plumed frogmouth	4	2	2	-	4	-	-	4	4	"	Slater '70 Cayley
Podargus strigoides Tawny frogmouth	1-3	2	2	-	4	-	1	-	3-4	"	Slater '70 Cayley
Podiceps cristatus Great crested grebe	1	2	2	-	4	-	2b	-	4-1	"	Slater '70 Cayley
Podiceps novahollandiae Little grebe	1	2	2	-	3	-	2b	-	4-1	"	Slater '70 Cayley
Podiceps poliocephalus Hoary headed grebe	1	2	2	-	3	-	2b	-	4-1	"	Slater '70 Cayley
Pomatostomas temporalis Grey crowned babbler	2	2	2	-	3	-	2b	-	3-4	"	Slater '70 Cayley
Porphyrio porphyrio Swamp hen	1	2	2	-	4	-	2a	-	4-1	"	Slater '74 Cayley
Porzana fluminea Spotted crake	1	2	2	-	2	-	2b	-	4-1	"	Slater '74 Cayley
Porzana pusilla Marsh crake	1	2	2	-	2	-	2b	-	4-1	"	Slater '74 Cayley
Psephotus haematonatus Red rumped parrot	2	2	2 bii	-	2	-	2b	3	4	"	Slater '70 Cayley
Psephotus pulcherrimus Paradise parrot	2	2	2 bii	-	2	-	2b	2	4-1	"	Slater '70 Cayley
Psittaculirostris diophtalma c. Bluebrowed fig parrot	4	2	2 bii	-	2	-	2b	4	4	"	Slater '70 Cayley
Psophotes olivaceus Eastern whipbird	3-4	2	2	-	3	-	-	-	3-4	"	Slater '74 Cayley
Ptilinopus superbus Purple crowned pigeon	3-4	2	2	-	3	-	-	3	4-1	"	Slater '74 Cayley
Ptilonorhynchus violaceus Satin bowerbird	4	2	2	-	3	-	1	3	4	"	Slater '74 Cayley
Ptiloris paradiseus Paradise riflebird	4	2	2	-	3	-	1	2	4	"	Slater '74 Cayley
Rallus pectoralis Lewin waterrail	1	2	2	-	2	-	1-2b	-	4-1	"	Slater '74 Cayley
Rallus philippensis Banded waterrail	1	2	2	-	2	-	-	3	4-1	"	Slater '74 Cayley
Recurvirostra novahollandiae Red necked avocet	1	2	2	-	4	-	2b	4	4	"	Slater '70 Cayley
Rhipidura fuliginosa Grey fantail	2-3	2	2	-	2	-	-	-	4-1	"	Slater '74 Cayley
Rhipidura leucophrys Willie wagtail	1-3	2	2	-	3	-	2b	-	3-4	"	Slater '74 Cayley
Rhipidura rufifrons Rufous fantail	2-3	2	2	-	3	-	2b	-	4-1	"	Slater '74 Cayley
Rostratula benghalensis Painted snipe	1	2	2	-	3	-	2b	3	4-1	"	Slater '74 Cayley
Scythrops novahollandiae Channelbilled cuckoo	2-3	2	2	-	4	-	2b	-	4	"	Slater '70 Cayley
Sericornis frontalis bevigaster Buff breasted scrub wren	1-2	2	2	-	2	-	2b	-	4	"	Slater '74 Cayley
Sericornis frontalis frontalis White breasted scrub wren	1-2	2	2	-	2	-	2b	2	3-4	"	Slater '74 Cayley
S. lathami Yellow throated scrub wren	4	2	2	-	2	-	2b	-	3-1	"	Slater '74 Cayley
S. magnirostris Large billed scrub wren	2-3	2	2	-	2	-	-	-	3-1	"	Slater '74 Cayley
Sericulus chrysocephalus Regent bowerbird	4	2	2	-	3	-	2b	2	4-1	"	Slater '74 Cayley

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Smicrornis brevirostris Weebill	2	2	2	-	1	-	2b	-	3-4	7,3	Slater '74 Cayley
Specotheres vieilloti Southern figbird	2-3	2	2	-	3	-	2b	-	4-1	"	Slater '74 Cayley
Stictonetta naevosa Freckled duck	1	2	1	1b	4	2	2a	-	4	"	Slater '70 Cayley
Stiltia isabella Praticole courser	2	2	2	-	3	-	2a	-	4-1	"	Slater '70 Cayley
Stripiturus malachurus Southern emu wren	2-3	2	2	-	2	-	2b	-	3-4	"	Slater '74 Cayley
Stizoptera bichenouii Double bar finch	2	2	2	-	2	-	2b	-	4-1	"	Slater '74 Cayley
Strepera graculine Pied currawong	2	2	2	-	4	-	2b	-	4-1	"	Slater '74 Cayley
Synoicus australis Brown quail	1-2	2	2	-	2	-	2a	-	4-2	"	Slater '70 Cayley
Threskiornis molucca White ibis	1	2	2	-	5	-	2a	-	4-1	"	Slater '70 Cayley
Threskiornis spinicollis Straw necked ibis	2	2	2	-	5	-	2a	-	4	"	Slater '70 Cayley
Tribonyx ventralis Black tailed native hen	1	2	2	-	3	-	2a	-	4	"	Slater '74 Cayley
Trichoglossus chlorolepidotus Scaly parrot	2-3	2	2 bii	-	3	-	2a	-	4	"	Slater '70 Cayley
Trichoglossus naematodus Rainbow lorikeet	2	2	2 bii	-	3	-	2a	3	4-1	"	Slater '70 Cayley
Tringa glareola Wood sandpiper	1	2	2	-	3	-	-	4	-	"	Cayley (migrant)
Tringa hyposleucos Common sandpiper	1	2	2	-	3	-	-	3	-	"	Slater '70, Cayley (migrant)
T. nebularia Greenshank	1	2	2	-	4	-	2b	3	-	"	Slater '70, Cayley (migrant)
T. stagnatilis Little greenshank	1	2	2	-	3	-	1	3	-	"	Slater '70, Cayley (migrant)
Turnix maculosa Red backed quail	2	2	2	-	3	-	-	3	4-1	"	Slater '70 Cayley
Turnix melanogaster Black breasted quail	3-4	2	2	-	3	-	-	2	2	"	Slater '70 Cayley
Turnix varia Painted quail	1	2	2	1a	2	-	-	-	5	"	Slater '70 Cayley
Tyto alba Barn owl	1-2	2	2	-	4	-	1	-	2-3	"	Slater '70 Cayley
Tyto capiensis longimembris Grass owl	2	2	2	-	4	-	-	4	2-3	"	Slater '70 Cayley
T. novahollandiae Masked owl	2-3	2	2	-	4	-	1	3	2-3	"	Slater '70 Cayley
T. tenebricosa Sooty owl	3-4	2	2	1a	4	-	-	4	5	"	Slater '70 Cayley
Vanellus miles novahollandiae Spurwing plover	2	2	2	-	3	-	2a	-	3-4	"	Slater '70 Cayley
Vanellus tricolor Banded plover	2	2	2	-	3	-	2a	-	3-4	"	Slater '70 Cayley
Xenorhynchus asiaticus Jabiru	1	2	2	-	6	-	2b	-	5	"	Slater '70
Zanthomiza phrygia Regent honeyeater	2	2	2	-	3	-	-	3	4-1	"	Slater '74 Cayley
Zoothera dauma Ground thrush	3-4	2	2	-	3	-	-	-	4	"	Slater '74 Cayley
Zosterops lateralis Grey breasted silvereye	1-3	2	2	-	2	-	2b	-	4-1	"	Slater '74 Cayley
Acanthophis anarcticus Death Adder	2-3	3	3	-	5	-	1	2	-	3	Cogger
Amphibolurus barbatus Bearded dragon	2-3	3	1	-	4	-	1	1	-	3	Cogger
Amphibolurus nobbi Nobbi	2	3	2	-	2	-	1	3	-	3	Cogger
Amphiesma mairii Keelback	1	3	2	-	5	-	1	2	-	3	Cogger
Anomalopus ophiosimus	4	3	2	-	3	-	1	2	-	3	Cogger
Anomalopus reticulatus	4	3	2	-	4	-	1	3	-	3	Cogger
A. trucncatus	4	3	2	-	3	-	1	4	-	3	Cogger
A. verreauxii	2-4	3	2	-	4	-	1	2	-	3	Cogger

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Anotis graciloides	4	3	2	-	3	-	1	4	-	3	Cogger
Boiga irregularis Brown tree snake	2-4	3	2	-	6	-	1	2	-	3	Cogger
Brachyurophis australis Coral snake	2	3	2	-	4	-	1	2	-	3	Cogger
Cacophis harriettae White naped snake	2	3	2	-	4	-	1	2	-	3	Cogger
Cacophis kreffti Dwarf crowned snake	2-4	3	2	-	3	-	1	2	-	3	Cogger
Cacophis squamulosus Golden crowned snake	2-4	3	2	-	5	-	1	2	-	"	Cogger
Carlia burnetti	2	3	2	-	1	1	1	2	-	"	Cogger
Carlia foliorum	2	3	2	-	1	1	1	2	2	"	Cogger
C. pectoralis	2	3	2	-	1	1	1	2	-	"	Cogger
C. schmeltzii	2	3	2	-	1	1	1	3	-	"	Cogger
C. tetradactyla	2-3	3	2	-	1	-	-	3	-	"	Cogger
Chelodina expansa Northern snapping turtle	1	3	1	-	3	-	1	2	1	"	Cogger Goode
Chelodina longicollis Snake necked turtle	1	3	1	-	4	-	1	2	4	"	Cogger Goode
Chlamydosaurus kingii Frilled lizard	2	3	2	-	4	-	1	3	-	"	Cogger
Cryptoblepharus boutonii	2-3	3	2	-	1	1	1	2	-	"	Cogger
Cryptophis nigrescens Small eyed snake	2-4	3	2	-	5	-	1	2	-	"	Cogger
Ctenotus robustus Skink	2	3	2	-	3	-	1	2	-	"	Cogger
Ctentotus taeniolatus Copper tailed skink	2	3	2	-	3	-	1	2	-	"	Cogger
Delma plebeia	2	3	2	-	4	-	1	3	-	"	Cogger
Delma tincta	2	3	2	-	3	-	1	2	-	"	Cogger
Delma torquata	2	3	2	-	3	-	1	4	-	"	Cogger
Demansia atra Black whip snake	2	3	2	-	5	-	1	3	-	"	Cogger
Demansia psammophis Yellow faced whip snake	2-3	3	2	-	5	-	1	2	-	"	Cogger
Dendrelaphis punctulatus Tree snake	2-4	3	2	-	6	-	1	2	-	"	Cogger
Diplodactylus vittatus Wood gecko	2	3	2	-	1	1	1	2	-	"	Cogger
Diporophora spp	2	3	2	-	1	1	1	2	-	"	Cogger
Drepanodotis daemelii	2	3	2	-	4	-	1	2	-	"	Cogger
Egernia bungana Skink	4	3	2	-	3	-	1	3	-	"	Cogger
Egernia cunninghami Cunningham's skink	2-3	3	2	-	3	-	1	3	-	"	Cogger
E. dorsalis Yakka skink	2	3	2	-	4	-	1	2	-	"	Cogger
E. major Skink	2-4	3	2	-	4	-	1	2	-	"	Cogger
E. modesta Skink	2	3	2	-	3	-	1	3	-	"	Cogger
E. whitii Skink	2-3	3	2	-	3	-	1	3	-	"	Cogger
Elseya latisternum Saw shelled turtle	1	3	1	-	3	-	1	2	4	"	Cogger Cann
Enydura kreffti Krefft's turtle	1	3	2	-	3	-	1	3	1	"	Cogger Cann, Goode
Enydura macquarii Murray turtle	1	3	2	-	3	-	1	3	1	"	Cogger Goode
Furina diadema Red naped snake	2	3	2	-	4	-	1	2	-	"	Cogger
Gehyra australis Northern dtella	2	3	2	-	1	1	1	2	-	"	Cogger

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Glyphodon dunmalli Dunmal's snake	2	3	2	-	5	-	1	2	-	3	Cogger
Goniocephalus spinipes Angleheaded dragon	3-4	3	2	-	2	-	1	3	-	"	Cogger
Hemiaspis signata Blackbellied swamp snake	2-4	3	3	-	4	-	1	2	-	"	Cogger
Heteronotia binoei Bynoe's gecko	2	3	2	-	1	1	1	2	-	"	Cogger
Hoplocephalus bitorquatus Pale headed snake	2	3	3	-	4	-	1	2	-	"	Cogger
Hoplocephalus stephensii Stephen's banded snake	4	3	3	-	4	-	1	3	-	"	Cogger
Leiolopisma challengeri	4	3	2	-	2	-	1	2	-	"	Cogger
Leiolopisma delicata	4	3	2	-	2	-	1	2	-	"	Cogger
Leiolopisma guichenoti	2-3	3	2	-	2	-	1	2	-	"	Cogger
Lerista fragilis	2	3	2	-	2	-	1	2	-	"	Cogger
Lialis burtonis Burton's scale lizard	2-3	3	2	-	3	-	1	2	-	"	Cogger
Liasis childreni Children's python	1-4	3	2	-	5	-	1	2	-	"	Cogger
Menetia greyi	2	3	2	-	1	1	1	2	-	"	Cogger
Morelia spilotes variegata Carpet snake	2-4	3	2	-	7	-	1	2	-	"	Cogger
Morethia boulengeri	2	3	2	-	1	1	1	2	-	"	Cogger
Morethia taeniopleura Firetailed skink	2	3	2	-	1	1	1	2	-	"	Cogger
Notechis scutatus Tiger snake	4	3	3	-	6	-	1	3	-	"	Cogger
Oedura rhombifer Gecko	2	3	2	-	2	1	1	2	-	"	Cogger
Oedura robusta Robust velvet gecko	2	3	2	-	2	1	1	2	-	"	Cogger
Oedura tryoni Spotted velvet gecko	2	3	2	-	2	1	1	3	-	"	Cogger
Oxyuranus scutellatus Taipan	4	3	3	-	6	-	1	2	-	"	Cogger
Paradelma orientalis	2	3	2	-	4	-	1	4	-	"	Cogger
Phyllurus caudiannulatus Gecko	4	3	2	-	2	1	1	2	-	"	Cogger
Phyllurus cornatus Leaftailed gecko	4	3	2	-	3	1	1	3	-	"	Cogger
Phyllurus salebrosus Gecko	2-4	3	2	-	2	1	1	2	-	"	Cogger
Physignathus leseurii Water dragon	1	3	2	-	4	-	1	2	-	"	Cogger
Psuedechis guttatus Spotted black snake	2	3	3	-	6	-	1	2	-	"	Cogger
Psuedechis porphryiacus Redbellied black snake	2-4	3	3	-	6	-	1	2	-	"	Cogger
Psuedonaja textilis Brown snake	2-3	3	3	-	6	-	1	2	-	"	Cogger
Pygopus lepidopodus Common scaly foot	2-4	3	2	-	5	-	1	3	-	"	Cogger
Pygopus nigriceps	2	3	2	-	4	-	1	2	-	"	Cogger
Saiphus equalis	2-4	3	2	-	2	-	1	3	-	"	Cogger
Spenomorphus murrayi	4	3	2	-	3	-	1	2	-	"	Cogger
Spenomorphus quoyii Water skink	1	3	2	-	2	-	1	2	-	"	Cogger
S. scutirostrum	2-4	3	2	-	1	1	1	2	-	"	Cogger
S. tasciolatus Narrow banded sand swimmer	2	3	2	-	2	-	1	2	-	"	Cogger
S. tenuis	2-3	3	2	-	2	-	1	2	-	"	Cogger
Suta carpentariae Carpentaria whip snake	2	3	2	-	4	-	1	2	-	"	Cogger

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Tiliqua gerradii Pink tongued lizard	3-4	3	2	-	4	-	1	2	-	3	Cogger
Tiliqua scinoides Blue tongued lizard	2	3	2	-	4	-	1	2	-	"	Cogger
Tropidechis carinatus Rough scaled snake	3-4	3	3	-	5	-	1	3	-	"	Cogger
Typlina spp	1-4	3	2	-	3	-	1	2	-	"	Cogger
Varanus gouldii Gould's goanna	2-3	3	1	-	6	-	1	2	-	"	Cogger
Varanus tristus Goanna	2	3	1	-	5	-	1	2	-	"	Cogger
Varanus varius Goanna	2-4	3	1	-	6	-	1	2	-	"	Cogger
Vermicella annulata Bandy bandy	2-3	3	3	-	4	-	1	2	-	"	Cogger
Underwoodisaurus milii Thicktailed gecko	2	3	2	-	2	1	1	2	-	"	Cogger
Adelotus brevis Tusked frog	1-4	4	2	1b	1	1	1	2	5	"	Cogger Barker
Cyclorana brevipes Marbled cannibal frog	2	4	2	-	1	1	1	2	1	"	Cogger Barker
Cylcorana novahollandiae Broad mouthed cannibal frog	2	4	2	-	1	1	1	2	1	"	Cogger Barker
Kyarranus kundagungan Brown mountain frog	4	4	2	-	1	1	1	2	4-1	"	Barker
Kyarranus loveridgei Red & Yellow mountain frog	4	4	2	-	1	1	1	4	4-1	"	Barker
Lechroides fletcheri Fletcher's frog	4	4	2	1b	1	1	1	3	1	"	Cogger Barker
Limnodynastes dumerilli Poddlebonk	1-3	4	2	-	1	1	1	2	4-1	"	Cogger Barker
Limnodynastes ornatus Ornate burrowing frog	2	4	2	-	1	1	1	2	1	"	Cogger Barker
L. peroni Striped marsh frog	1-3	4	2	-	1	1	1	2	4-2	"	Cogger Barker
L. salmini Salmon striped frog	2	4	2	-	1	1	1	2	4-1	"	Cogger Barker
L. tasmaniensis Marbled marsh frog	2	4	2	-	1	1	1	2	5	"	Cogger Barker
L. terraereginae Banjo frog	1-4	4	2	-	1	1	1	2	4-2	"	Cogger Barker
Litoria alboguttata Striped cannibal frog	2	4	2	-	1	1	1	2	1	"	Cogger
Litoria brevipalmata	2	4	2	-	1	1	1	3	4-1	"	Cogger Barker
L. casrulea Green tree frog	1-4	4	2	-	1	1	1	2	1	"	Cogger Barker
L. chloris Orange eyed tree frog	4	4	2	-	1	1	1	2	4	"	Cogger Barker
L. dentata Bleating tree frog	1-3	4	2	-	1	1	1	2	1	"	Cogger Barker
L. gracilenta Graceful tree frog	1-3	4	2	-	1	1	1	2	4-1	"	Cogger Barker
L. inermis Bluntnosed rocket frog	2	4	2	-	1	1	1	2	4	"	Cogger Barker
L. latopalmata Broadpalmed rocket frog	1-3	4	2	-	1	1	1	2	4-1	"	Cogger Barker
L. lesuerii Rocky creek frog	1	4	2	-	1	1	1	2	4-2	"	Cogger Barker
L. nasuta Striped rocket frog	-	4	2	-	1	1	1	-	1	"	Cogger Barker
L. pearsoni Pearson's tree frog	4	4	2	-	1	1	1	3	4-1	"	Barker
L. peronii Emerald spotted tree frog	1-3	4	2	-	1	1	1	2	4	"	Cogger Barker
L. rothi Red eyed tree frog	1-4	4	2	-	1	1	1	2	4	"	Cogger Barker
L. rubella red-purple tree frog	1-3	4	2	-	1	1	1	2	1	"	Cogger Barker
L. verreauxii Whistling tree frog	3-4	4	2	-	1	1	1	2	5	"	Cogger Barker
L. fallax Least green tree frog	1-3	4	2	-	1	1	1	2	4-1	"	Cogger Barker
Mixophes balbus Barred river frog	3-4	4	2	1b	1	1	1	3	4	"	Cogger Barker

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Mixophyes fasciolatus Barred river frog	3-4	4	2	1b	1	1	1	2	4	3	Cogger Barker
Mixophyes iteratus Giant barred river frog	3-4	4	2	1b	2	1	1	2	4	"	Cogger Barker
Ranidella parinsignifera Screeching froglet	2	4	2	-	1	1	1	2	5	"	Barker
Ranidella signifera Common froglet	2	4	2	-	1	1	1	2	5	"	Barker
Taudactylus diurinus Day frog	4	4	2	-	1	1	1	4	4-2	"	Cogger Barker
Uperoleia laevigata Yellow spotted toadlet	2	4	2	-	1	1	1	2	1	"	Cogger Barker
Uperoleia marmota Northern toadlet	2	4	2	-	1	1	1	2	1	"	Cogger Barker
Ambassis nigripinnis Olive perchlet	1	5	1	-	1	1	-	-	-	2	Lake Grant a, Grigg
Anguilla australis shortfinned eel	1	5	1	-	5	4	-	-	-	7	Grant Grigg
Anguilla reinhardti Long finned eel	1	5	1	-	6	6	-	-	-	7	Grant Grigg
Craterocephalus majoriae Hardy head	1	5	1	-	1	1	-	-	1	2	Lake Grant, Grigg
Fluvialosa elongata Bony bream	1	5	1	-	3	3	2b	-	-	1	Lake Grigg
Glossaria aprion Mouth almighty	1	5	1	-	2	1	-	-	-	2	Lake Grant, Grigg
Hypseleotris compressus Carp gudgeon	1	5	1	-	1	1	-	1	-	2	Lake Grant, Grigg
Hypseleotris galii Firetail gudgeon	1	5	1	1a	1	1	-	-	1	2	Lake, Anderson Grant, Grigg
Maccullochella macquariensis Murray cod	1	5	1	-	6	11- 13	-	-	4-1	2	Grant Lake
Mogurnda australis Striped gudgeon	1	5	1	-	2	1	-	-	-	2	Grant Grigg, Lake
Mogurnda mogurnda Trout gudgeon	1	5	1	-	1	1	-	-	-	2	Lake Grant, Grigg
Mugil cephalus Sea mullet	1	5	1	-	5	7	-	-	4-1	2	Lake Grant, Grigg
Nematocentrus fluviatilus Rainbow fish	1	5	1	-	3	3	-	-	-	2	Lake Grant, Grigg
Notesthes robusta Bullroat	1	5	1	-	2	1	-	-	-	2	Grant
Percalates colonorum Bass	1	5	1	-	3	4	-	-	-	2	Grant
Psuedomugil signifer Blue eye	1	5	1	-	1	1	-	-	-	2	Lake Grant, Grigg
Retropinna salmoni Smelt	1	5	1	-	2	1	-	-	-	2	Grant Grigg
Tandanus tandanus Freshwater catfish	1	5	1	1b	5	4	-	-	1	2	Davis, Grant Lake, Grigg
Therapon unicolor Spangled perch	1	5	1	-	2	1	-	1	4-1	2	Llewellyn, Grant Grigg, Lake
Trachystoma petardi Freshwater mullet	1	5	1	-	4	5	-	1	-	2	Lake Grant, Grigg
Alythyria pertexta pertexta Mussel	1	6	2 ai	2	2	1	2	2	-	1	McMicheal
Atya striolata Freshwater prawn	1	6	2	1b	1	1	2	-	-	1	Riek a
Caridina indistincta Freshwater prawn	1	6	2	1b	1	1	2	-	-	1	Riek a
Cherax depressus Crayfish	1	6	2	1b	1	1	2	2	-	1	Riek b
Cherax dispax Crayfish	1	6	2	1b	1	1	2	-	-	1	Riek b
Cherax rotundus Crayfish	1	6	2	1b	1	1	2	2	-	1	Riek b
Cucumerunio novahollandiae New Holland mussel	1	6	2 ai	2	2	1	2	2	-	1	McMicheal
Euastacus hystricosus Crayfish	1	6	2	1b	3	1	2	2	-	1	Riek b
Euastacus sulcatus Crayfish	1	6	2	1b	3	1	2	2	-	1	Riek b
Euastacus valentulus Crayfish	1	6	2	1b	3	1	2	2	-	1	Riek b
Hyridella australis Mussel	1	6	2 ai	2	2	1	2	2	-	1	McMicheal

NAME	A	B	C	D	E	F	G	H	I	J	REFERENCES
Hyridella depressa Mussel	1	6	2 ai	2	2	1	2	2	-	1	McMicheal
Hyridella drapeta Mussel	1	6	2 ai	2	2	1	2	2	-	1	McMicheal
Macrobrachium atactum atactum Freshwater prawn	1	6	2	la	1	1	2	-	-	1	Riek a
Macrobrachium atactum i. Freshwater prawn	1	6	2	la	1	1	2	-	-	1	Riek a
Macrobrachium australiense Freshwater prawn	1	6	2	lb	1	1	2	-	-	1	Riek a
Paratya atacta Freshwater prawn	1	6	2	lb	1	1	2	-	-	1	Riek a
Paratya australiensis arrostra Freshwater prawn	1	6	2	lb	1	1	2	-	-	1	Riek a
Velesunio ambiguus Mussel	1	6	2 ai	2	1	1	2	2	-	1	McMicheal

APPENDIX C.

Site Inventory

KEY:

1. Site Type	1. rockshelter deposit 4. disturbed surface site 6. isolated item 9. modified tree 10. ceremonial site
2. Soil Type (Northcote 1971)	1. Dr2.21,Dr3.21 2. Dy3.42 3. Dy2.22 4. Gn3.22,.92 5. Ug5.15,.16 6. Dy3.31,.41,.61,.81
3. Landform	1. floodplain 2. bank 3. terrace 4. hillslope 5. hilltop
4. Altitude (m a.s.l.)	1. <100 2. 101-200 3. 201-300 4. 301-400 5. >400
5. Vegetation type	1. fringing forest 2. lowland eucalypt open forest 3. highland eucalypt open forest 4. closed forest
6. Distance to Permanent Water (m)	1. <50 2. 50-100 3. 101-500 4. 501-1000 5. >1000
7. Distance to Intermittent Water	as per 6.
8. Flood Susceptibility	0 = not floodable 1 = extraordinary floods only 2 = ordinary floods
9. Site Erosion	0 = none 1 = negligible 2 = moderate 3 = severe

Site number	Frame number	Site type	Distance from drainage mouth (km)	Nearest neighbour distance (km)	Fringing forest 5km (km^2)	Fringing forest 10km (km^2)	Lowland open forest 5km (km^2)	Lowland open forest 10km (km^2)	Upland open forest 5km (km^2)	Upland open forest 10km (km^2)	Closed forest 5km (km^2)	Closed forest 10km (km^2)	Soil	Landform	Altitude	Aspect (^{0})	Vegetation	Distance to permanent water	Distance to intermittent water	Flood susceptibility	Erosion	Number of cultural items	Number of scrapers	Number of used edges	Number of choppers	Number of non-utilized flakes	Number of non-utilized cores	Number of other stone artefacts	Number of scarred trees
1	1	1/2	11.5	1.3	.87	2.86	31.2	125.00	21.0	85.0	25.5	101.34	1	3	2	350	2	3	1	0	1	45	1	-	1	30	12	1	-
2	1	10/2	0.4	0.4	.615	1.98	76.44	261.22	-	-	1.5	51.0	2	3	1	45	2	3	3	1	1	2	-	-	-	2	-	-	-
3	1	4	2.3	0.4	.71	2.32	72.84	240.88	-	-	5.0	71.0	2	3	1	185	2	3	1	2	0	23	-	-	-	20	3	-	-
4	1	4	2.6	0.4	.71	2.32	72.84	240.88	-	-	5.0	71.0	2	4	1	325	2	3	1	2	3		1	1	-	6	1	-	-
5	1	4	4.0	1.4	.71	2.32	72.84	240.88	-	-	5.0	71.0	2	4	1	155	2	3	1	1	3	10	-	-	1	7	2	-	-
6	1	4	8.4	3.1	.87	2.86	31.2	125.00	21.0	85.0	25.5	101.34	1	3	1	355	2	3	1	1	3	16	2	-	-	10	3	1	-
7	1	4	11.7	1.3	.87	2.86	31.2	125.00	21.0	85.0	25.5	101.34	1	3	2	90	2	3	1	1	3	8	1	-	-	4	3	-	-
8	1	4	0.4	0.4	.615	1.98	76.44	261.22	-	-	1.5	51.0	2	3	1	115	2	3	3	1	2	23	1	-	-	18	4	-	-
9	2	4/9	4.8	0.4	.73	2.37	56.82	239.83	10.0	20.0	11.0	52.0	2	3	1	315	2	2	1	2	2	4	-	-	-	4	-	-	3
10	2	4	7.8	1.0	.77	2.57	72.78	238.62	1.0	24.0	4.0	49.0	2	3	2	335	2	3	2	1	3	7	-	-	1	6	-	-	-
11	2	4	8.9	0.5	.71	2.54	50.84	189.66	5.0	45.0	22.0	77.0	2	3	2	25	2	5	1	1	3	10	3	-	-	7	-	-	-
12	2	4	8.5	0.5	.71	2.54	50.84	189.66	5.0	45.0	22.0	77.0	2	3	2	90	2	5	1	1	3	5	-	-	1	3	-	-	-
13	2	9	7.5	1.6	.71	2.54	50.84	189.66	5.0	45.0	22.0	77.0	2	3	2	275	2	5	1	2	1	0	-	-	-	-	-	-	1
14	2	6	6.05	0.3	.73	2.37	56.82	239.83	10.0	20.0	11.0	52.0	2	3	2	325	2	1	1	2	1	1	1	-	-	-	-	-	-
15	2	6	5.7	0.3	.73	2.37	56.82	239.83	10.0	20.0	11.0	52.0	2	3	2	240	2	3	1	2	3	1	-	-	1	-	-	-	-
16	2	6/9	4.55	0.4	.73	2.37	56.82	239.83	10.0	20.0	11.0	52.0	2	4	2	325	2	3	1	1	2	1	-	-	-	1	-	-	1

Site number	Frame number	Site type	Distance from drainage mouth (km)	Nearest neighbour distance (km)	Fringing forest 5km (km2)	Fringing forest 10km (km2)	Lowland open forest 5km (km^2)	Lowland open forest 10km (km^2)	Upland open forest 5km (km^2)	Upland open forest 10km (km^2)	Closed forest 5km (km^2)	Closed forest 10km (km^2)	Soil	Landform	Altitude	Aspect (^{0})	Vegetation	Distance to permanent water	Distance to intermittent water	Flood susceptibility	Erosion	Number of cultural items	Number of scrapers	Number of used edges	Number of choppers	Number of non-utilized flakes	Number of non-utilized cores	Number of other stone artefacts	Number of scarred trees
17	2	4/9	8.5	1.0	.77	2.57	72.78	238.62	1.0	24.0	4.0	49.0	2	3	2	295	2	4	2	1	3	2	-	-	-	1	-	1	1
18	3	4	1.0	0.2	.41	1.43	72.16	259.78	-	-	6.0	53.0	2	3	2	275	1	3	1	2	3	18	-	-	-	17	1	-	-
19	3	4	1.5	0.2	.41	1.43	72.16	259.78	-	-	6.0	53.0	3	3	2	310	2	3	3	1	2	1	-	-	-	1	-	-	-
20	3	4/9	1.0	2.55	.41	1.43	72.16	259.78	-	-	6.0	53.0	4	4	2	330	2	2	2	1	3	14	4	-	-	8	1	2	2
21	3	4/9	0.8	0.3	2.74	6.11	75.79	304.59	-	-	-	3.5	2	3	1	125	2	3	3	1	3	128	9	6	-	94	19	-	1
22	3	4	0.7	0.3	2.74	6.11	75.79	304.59	-	-	-	3.5	2	5	1	90	2	3	3	0	3	32	2	-	-	30	-	-	-
23	3	4	0.6	0.3	2.74	6.11	75.79	304.59	-	-	-	3.5	2	2	1	115	1	1	1	2	2	40	-	-	-	35	5	-	-
24	3	4	4.5	3.45	2.80	6.38	75.74	285.82	-	22.0	-	-	2	2	1	15	1	5	1	2	3	3	-	-	-	2	1	-	-
25	3	4	2.2	3.45	2.90	5.62	75.65	298.58	-	8.0	-	2.0	2	3	1	315	2	3	3	1	3	84	2	1	-	77	4	-	-
26	4	4	3.4	1.5	.47	1.93	78.00	924.27	-	8.0	-	10.0	4	3	1	90	2	3	2	1	3	87	-	1	1	83	1	1	-
27	4	4	20.5	2.15	.42	1.97	68.13	218.22	10.0	26.0	-	68.0	5	3	2	80	2	5	2	1	3	31	2	1	-	23	5	-	-
28	4	4	17.5	2.25	.46	2.02	69.09	290.17	9.0	18.0	-	4.0	6	3	2	275	2	5	1	1	3	62	3	2	-	48	9	-	-
29	4	4	16.2	1.25	.46	2.02	69.09	290.17	9.0	18.0	-	4.0	6	3	2	85	2	5	4	1	3	1	-	-	-	-	1	-	-
30	4	4	12.5	0.6	.50	1.85	78.04	306.35	-	6.0	-	-	6	3	1	275	2	3	3	0	3	57	4	3	-	48	2	-	-
31	4	4	12.0	0.6	.50	1.85	78.04	306.35	-	6.0	-	-	6	4	2	345	2	4	1	0	2	45	4	-	-	39	2	-	-
32	4	4	11.1	0.85	.50	1.85	78.04	306.35	-	6.0	-	-	6	4	2	20	2	5	1	0	3	13	1	-	-	11	1	-	-

Site number	Frame number	Site type	Distance from drainage mouth (km)	Nearest neighbour distance (km)	Fringing forest 5km (km^2)	Fringing forest 10km (km^2)	Lowland open forest 5km (km^2)	Lowland open forest 10km (km^2)	Upland open forest 5km (km^2)	Upland open forest 10km (km^2)	Closed forest 5km (km^2)	Closed forest 10km (km^2)	Soil	Landform	Altitude	Aspect (^{0})	Vegetation	Distance to permanent water	Distance to intermittent water	Flood susceptibility	Erosion	Number of cultural items	Number of scrapers	Number of used edges	Number of choppers	Number of non-utilized flakes	Number of non-utilized cores	Number of other stone artefacts	Number of scarred trees
33	4	4	10.2	0.85	.50	1.85	78.04	306.35	-	6.0	-	-	5	3	1	40	2	5	1	1	3	31	1	-	-	30	-	-	-
34	4	4	11.1	0.95	.50	1.85	78.04	306.35	-	6.0	-	-	6	4	1	345	2	4	1	1	3	38	3	2	-	28	4	1	-
35	4	4	14.5	2.7	.53	1.94	73.01	288.26	5.0	18.0	-	6.0	3	5	3	115	2	5	1	0	1	12	-	-	-	12	-	-	-
36	4	4	8.9	1.2	.42	1.99	78.13	307.20	-	1.0	-	4.0	6	3	1	80	2	3	3	1	2	61	3	1	1	51	5	-	-
37	4	4	8.4	1.2	.42	1.99	78.13	307.20	-	1.0	-	4.0	4	5	2	55	2	5	3	0	3	20	1	-	-	17	2	-	-
38	4	4	16.1	12.5	.53	1.94	73.01	288.26	5.0	18.0	-	6.0	6	3	2	45	2	5	1	1	1	81	-	-	-	79	2	-	-
39	4	4	4.7	0.3	.47	1.93	78.0	294.27	-	8.0	-	10.0	6	5	1	90	2	4	3	0	3	1	-	-	-	-	1	-	-
40	4	4	5.0	0.3	.47	1.93	78.0	294.27	-	8.0	-	10.0	6	5	1	320	2	4	3	0	3	1	-	-	-	-	-	1	-
41	4	4	22.2	2.25	.42	1.97	68.13	218.22	10.0	26.0	-	68.0	6	4	3	77	2	5	1	1	2	17	-	-	-	17	-	-	-