ASPECTS OF PIG PRODUCTION AND USE IN COLONIAL SINASINA,

PAPUA NEW GUINEA

Robin Lamond Hide

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CONVENTIONS

Weights and measures

All metric, unless quoting historical sources.

Currency

Until 1966, Papua New Guinea used Australian pounds, shillings and pence : after 1966, and until 1975, Australian dollars and cents.

Orthography

The alphabet used here for transcribing terms and names in the dialect of the Sinasina language spoken by Nimai is the same as that used by Nilles (1969:ii) and others for the related Kuman language : that is, without the symbols 'c', 'f', 'h', 'j', 'q', or 'v'. The symbols used here approximate English usage (of the standard southern variety) with the following exceptions or specific applications :

a as in 'father', but slightly shorter.

e as in 'met', though between consonants and without accent, closer to the mid-central vowel of 'the'.

g as in 'go'.

i commonly short as in 'pin' (e.g. amil, nut pandanus), but occasionally long as the 'ee' in 'feet' (e.g. di, gourd).

n similar to English except when it occurs in the same syllable as 'i' when it is often close to the 'ny' sound in 'canyon'.

ng represents here either a simple velar nasal as in the English 'singer' (e.g. pinga pinga, Lima bean), or a cluster of nasal plus voiced stop as in the English 'finger' (e.g. gingi, squash).

o as in 'hot'.

r with a trill or alveolar flap.

s fluctuates between 'sell' and the 'ts' sound as in 'hats'.

u either short as in 'put' or long as in 'chute'.

CONVENTIONS

Place and group names

The documents and literature concerned with Sinasina display considerable variation in the spelling of place and group names, partly as a result of individual idiosyncracy and partly because of dialect differences. Where my transcriptions differ from earlier ones they may be assumed to reflect Nimai pronounciation.

Abbreviations

ANGAU	Australia New Guinea Administrative Unit
AR	Annual Report
CPR	Chimbu Patrol Report
DASF	Department of Agriculture, Stock, and Fisheries
DDA	Department of District Administration
HCU	Human Consumer Unit
HF	Harvesting Frequency
KCS	Kundiawa Coffee Society
LGC	Local Government Council
MHA	Member of the House of Assembly
MR	Monthly Report
PAMBU	Pacific Manuscripts Bureau (Canberra)
PR	Patrol Report
PU	Pig Unit
SD	Standard Deviation
SDA	Seventh Day Adventist
TPNG	Territory of Papua New Guinea
WU	Worker Unit

CHAPTER 1

Introduction

Aims, issues, and perspective

This study is concerned with pig production and use in Sinasina, an area of the Chimbu Province in the Papua New Guinea highlands. In particular, I seek to analyse some of the more important changes bearing on production and exchange which affected Sinasina during 40 years of colonial incorporation (1933-73), and the cyclical characteristics of pig management and use as observed in the early 1970s. It is not therefore an ethnography of pre-colonial or 'traditional' Sinasina practice or ideas, but a partial account of a society undergoing the process of articulation with a colonial state. My focus on pigs within a general perspective emphasising ecological and sociological questions follows from three main considerations: the controversial status of ecological interpretations of certain pig husbandry practices in New Guinea, the marked significance of pigs in Sinasina daily and ceremonial life at the time of research, and the lack of field studies explicitly concerned with the production of these animals.

Anthropological and other writers have devoted a considerable amount of attention to aspects of Melanesian pig husbandry over the past twenty years. The continuing state of such discussion is due both to the importance of pigs in many social and ecological systems of the region, and to debates within the social sciences concerning the appropriateness of different approaches for the understanding of social action and ideas. The explicit cultural significance of the animals is not at issue: their position as the largest of the domesticated animals, and their roles in ritual activity and in systems of trade and ceremonial exchanges have been extensively documented[1]. Interpretations of their roles in ecological systems, however, have been contested with some vigour. Three inter-related issues have attracted most discussion: the contribution to human nutrition provided by pigs, the functions of periodic pig slaughters conducted by groups or communities, and the utility of models, concepts, and principles derived from the biological sciences for understanding human social behaviour.

The sustained attempt by some anthropologists working with an ecological approach to demonstrate the latter point (Vayda, Leeds and Smith 1961; Rappaport 1968; Vayda and Rappaport 1967; Vayda 1972), has met with criticism ranging from rejection of the project on the grounds that the paradigm is inappropriate (Friedman 1974, 1979; Murphy 1970; Sahlins 1976; Wagner 1977), to suggestions, at a more empirical level, concerning apparent discrepancies between parts of the conceptual framework and case materials from other parts of New Guinea (Brookfield 1972, 1973a, 1973b,; Brown 1979; Clarke 1977; Salisbury

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[1]The literature is now huge since there are few studies which make no mention of them. A short list of contributions ranging from prehistory to physiology might include the following: Baldwin 1978; Brookfield 1973b; Brown 1978; S. Bulmer 1975; Dwyer 1978a; Feachem 1973; Hughes 1970, 1977; Feil 1976; Malynicz 1970, 1973a, 1973b,; Meggitt 1974; Morren 1977; Oliver 1949; Rappaport 1968; Strathern 1971a, 1971c; Vayda 1972; Vayda et al. 1961; Watson 1977.

1975)[2].

Of central concern is the ecosystemic model of periodic pig slaughters of the kind reported widely from the New Guinea central highlands. First outlined by Vayda *et al.* (1961), this model was later refined and applied in detail by Rappaport in his study of the Tsembaga Maring on the highland fringe (1968). It was essentially based on the generalisation that "...biological reactions are controlled not so much by the average amounts of essential factors in the environment as by extremes in the presence of these factors" (Vayda *et al.* 1961:70), and upon assumptions about the limited availability of either energy foods (Vayda *et al.* 1961:70-71), or protein (Rappaport 1968: 66-8; cf. Vayda *et al.* 1961:69; Morren 1977), and the destructive or competitive potential of excessive local numbers of pigs (Vayda *et al.* 1961:71; Rappaport 1968: 157-162). The former assumption allowed the conclusion that the production of some pigs was 'necessary', either to provide mobile food reserves as buffers in lean years when meteorological factors resulted in poor harvests (Vayda *et al.* 1961), or, following Rappaport's examination of the energy costs of Maring pig raising (cf. Aschmann 1965:265), and his dismissal of the relevance of food shortages (1968: 63-5), to convert relatively abundant energy foods into scarce and essential protein and fat the use of which was further enhanced by rules channelling consumption to those suffering misfortune

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[2]The literature referred to in this paragraph is highly selective. For responses and re-thinking, see especially Kelly and Rappaport (1975); Rappaport (1977, 1979); Vayda and McCay (1975, 1977). For further discussion, commentary, and debate, see Anderson (1973); Bennett (1976); Bergman (1975); Hardesty (1977); McArthur (1974, 1977); Shantzis and Behrens (1973); Watson (1969).

and hence probably physiological stress (ibid., 66-8, 78-87). The second assumption, which was combined, in Vayda et al's model, with a correlation between pig numbers and meteorological factors (1961:71), and, in Rappaport's version, with a relation between pig population size and the incidence of human misfortune (1968:82, 156), provided the means for arguing that festival slaughters served, at the level of local ecosystems, to remove a system-endangering threat (1961:71-2; 1968:164).

The notion that basic food supplies may have been marginal in pre-capitalist societies, and the common suggestion made by ecologically oriented anthropologists in the late 1950s-early 1960s that such marginality provided a possible key for understanding certain kinds of large-scale prestations of produce and other goods (e.g. Harris 1959; Piddocke 1965; Suttles 1960; Vayda 1961)[3] were both widely questioned by the early 1970s (Brookfield 1972; Sahlins 1971, 1972)[4]. Writing of the Pacific in particular, Brookfield called for "....a much more adequate theory of production ...(one) which will relate production to society as a whole, and rid the subject of its long-lived calorific

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[3]Harris is characteristically succinct; "the real nature of Melanesian surpluses has been consistently obscured by the emphasis placed upon the conspicuous non-metabolic uses to which food is put. But the use of food for prestige purposes is perfectly compatible with severe food shortages measured in decades rather than months"(1959:192).

[4]To contextualise my field research: I heard Brookfield deliver a version of this paper in Canberra on my way to New Guinea in 1971. However, I saw neither of Sahlins's publications, nor, unfortunately, Brookfield's re-analysis of his Chimbu material (1973b), until I had left Sinasina.

obsession" (1972:46). As a first step in this direction he suggested an analytic need to distinguish three kinds of agrarian production: 'subsistence production', or production for use (i.e. "for auto-consumption by the grower,his family and immediate associates"), 'social production' (i.e. that produced for the use of others in prestation, ceremony and ritual), and 'trade or cash production' ("goods produced for sale, barter or other means of obtaining some immediately unavailable commodity" (ibid., 38). Elsewhere, he demonstrated the potential use of these distinctions in re-analysing thirteen years of agrarian change among the central Chimbu of the New Guinea highlands, a period which had been marked by fluctuating concern with 'social' and 'cash' production (Brookfield 1973a, 1973b).

In this account, Brookfield drew an explicit contrast between his analysis of the dynamics of the Chimbu pig cycle and that proposed by Rappaport for the Tsembaga, suggesting that "(i)t does not seem likely in Chimbu, nor perhaps in most other central highland societies, that the (periodicity of the) cycle is determined by the demographic and ecological conditions of pig production" (1973b:136; parenthesis added). Chimbu cycles were instead "(s)ocially determined" (1973a:14), and their festivals "are not held primarily to dispose of pigs; they have complex objectives in the maintenance and reinforcement of the whole system of social relationships" (1973b:155). The difference, he suggested, was that the

> "...highly elaborated husbandry systems of the central highlanders permit them a freedom of choice in the spatial management of their activities greater than that seemingly enjoyed by fringe groups of simpler technology....such quasi-automatic regulatory mechanisms as Rappaport postulates would hardly be conceivable

among the numerous Chimbu with their interlocking cycles" (ibid., 154-5).

This dichotomy is over-drawn, I think, on three counts. Whereas Rappaport describes the Tsembaga Maring in the early stages of colonial penetration, Brookfield's Chimbu data refer to a period 25 to 38 years after contact, and the long inter-ceremonial period he describes was influenced by a temporary abandonment of pig festivals in favour of coffee production. Secondly, Rappaport's analysis of the periodicity of the Maring cycle emphasises that the pig population variable is itself dependent on the fortunes of the human population (1968:156), and thus Brookfield's location of 'determination' is strictly incorrect. Further, the contrast between festivals held to dispose of pigs, and festivals with complex social objectives, appears to confuse functions reached by analysis (and framed in terms of an analytic model), and actors' goals. Nevertheless real differences remain, in that Brookfield proposes a different interpretation of the discrepancy between the minimum inter-ceremonial period and the actual duration of a cycle, from which he infers both that Chimbu exercise close control of pig demography, and that the 'social' production of pigs for use in exchange imposes imperatives which outweigh the production of pork for consumption by producers.

Tentatively, he suggests that the rebuilding of a Chimbu pig population after a festival might be accomplished in as little as four years (cf. Brown 1972:47, not less than three). This period, determined by the maximum possible rate of accumulation through breeding and trade, contrasts with the actual duration which is normally much longer (1973b:

136). Brookfield relates this discrepancy to two factors: since the Chimbu lack any centralised authority, a large scale undertaking such as a festival poses severe organizational problems. A time-lag of several years between intention and achievement is therefore to be expected. Secondly, assuming that pig demography is under human control, he suggests that festivals do not occur because the pig population reaches "a level at which stress becomes evident", but that the pig population is deliberately held below stressful levels "until the organizing of a new pig-killing ceremony becomes desirable for other reasons" (1973a:14). The decision to hold a festival is therefore dependent, not upon the number of pigs within a given area of land, but upon "the pressure of social needs, as it becomes necessary to repay obligations" (1973b:136).

For the Chimbu, Brookfield thus posits a cycle consisting of roughly three phases. During the first which follows a festival, a pig population is rebuilt rapidly by both reproduction and trade to an "intermediate" level (1973b:155). This presumably lasts rather less than four years, the minimum time needed to rebuild a "full" population (1973b:136). The second phase, of indeterminate length, is characterized by a pig population managed at "about this level" (i.e. intermediate), ending when "the need for a ceremony arises" from 'social' causes (1973b:155). During the final phase, the pig population is again "permitted to increase", a moratorium on the use of pigs in minor ceremonies is declared (i.e. by the blowing of flutes), and a festival is organized and completed. In summary, this view places greater emphasis on both human skills in pig management (cf. Baldwin 1978), and the interdependence of local production strategies with events and processes occurring on a wider level than that bounded by the local community (cf. Meggitt 1972, 1974; Moylan 1973; Watson 1977).

This discussion highlights the need for fuller information on pig husbandry. Twenty years ago, UNESCO was urgently recommended to promote "...socio-economic investigation into the traditional animal husbandry of preliterate societies in South-east Asia and Tropical Oceania" (UNESCO/TPNG 1960:402), and, the following year, Vayda _et al_. listed the kind of information they considered useful for understanding husbandry strategies in Melanesia (1961:74). Yet, after more than a decade of intensive rural research later, Brookfield could still note, along with others (cf. Hughes 1970:272; Vayda 1972:907), that "(r) emarkably little is known about the ecology, nutrition and demography of pigs" (1973b:135)[5]. A major aim of this study is therefore to describe certain aspects of Sinasina pig production and use, orienting my account in relation to this discussion.

It is relevant to note, however, that I did not foresee or plan an intensive study of husbandry. My earlier experience in Sinasina, and recent writing on other parts of the region (Brookfield 1966, 1968; Hughes 1966), had led me to expect a relatively strong commitment to cash cropping, council activity, and other new social, economic and political forms. There seemed a strong possibility that the great pig

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[5]The situation has improved since then, particularly in regard to experimental work conducted at Goroka (see references to Malynicz). Studies under rural conditions, however, are still few and far between (Boyd 1975; Feil 1976; Malynicz 1976; Potter nd.)

festivals of the Chimbu area were about to disappear (if they had not already done so) in the face of such innovations (Brookfield 1968: 105-6, 114; Brown 1969:89; Criper 1965:126), and the questions I posed before fieldwork began centred around the environmental bases and consequences of changes resulting from nearly forty years of colonial incorporation. After a few weeks of residence in Sinasina, however, it rapidly became evident that not only did pigs retain a major place in the production strategies followed by most people, but that inter-group exchange and the large-scale festivals were a dominant concern. Although the Nimai, amongst whom my research was conducted, did not hold a festival during this time (their last one was in 1969), two were celebrated by major Sinasina groups during 1972 and others were planned for the near future. Since much Nimai activity was oriented in relation to these, pigs were, for better or worse, thrust on me. Nevertheless, my lack of preparation for the task is evident in my partial coverage of an important subject.

The study: form and overview

The field research on which this study is largely based was carried out over 18 months during 1971-73 in the Sinasina area of what was then the Chimbu District, and is now the Chimbu (sometimes Simbu) Province (see Appendix 1 for research details)[6]. There is now a very substantial body of research and writing dealing with

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[6]Districts became Provinces in 1975 at Independence. At the same time the spelling of Chimbu within the Province was largely changed to Simbu. To contextualise this study historically I use Chimbu throughout. However, except where historical necessity demands it (or to avoid confusion) I replace the term District with Province.

the ethnography, environment, history, and other social aspects of the densely populated northern part of Chimbu in which Sinasina is located[7]. The existence of this extensive record relieves me of the obligation of a lengthy account of Sinasina ethnography, and allows me to focus explicitly, in Parts II and III which contain the substantive part of this study, on description and analysis of material directly related to my major subject. In Chapter 2 I describe the setting of the study in Sinasina, providing an account of the general characteristics of both the physical and social environments, and detailing the more specific ecological and economic conditions which obtained during the period of research.

Part II contains three chapters, each one concerned with a major aspect of Sinasina life which has undergone (and continues to undergo) significant alteration or disruption as a consequence of colonial incorporation. Chapter 3 examines recent population trends, Chapter 4 changes in the valuation and use of the major goods, including pigs, transferred in Sinasina exchange and trade, and Chapter

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[7]The monograph-length studies are (an asterisk denotes substantial concern with Sinasina): Bergmann (1971) and Nilles (1943/44, 1950, 1953, and 1969) for general ethnographic accounts by long-term missionary residents; Brookfield and Brown (1963) on land use and social organization; Brown (1972) general ethnography and socio-economic change; Bouchard (1973) on transport; Criper (1967) ceremonial exchange and group structure; Hatanaka* (1972) socio-economic change and leadership; Hide* (1973) colonial land legislation; Hughes* on both cash cropping (1966) and pre-colonial trade (1977); Howlett _et al_. (1976) development issues; Siefert* (1976) migration; Standish (1979) provincial government; Sterly (1973) ethno-medicine; Tomasetti (1976) religion; Venkatachalam* (1962) nutrition and health; Young (1977) migration. Besides papers by many of the above, and other workers, there are many substantial accounts of the languages, and in recent years, an increasing number of papers by writers of Chimbu origin (i.e. Gande 1974; Koma 1976; Komba 1978; Kuabal* 1976; Kuange 1977).

5 adjustments, as revealed in the patterns of settlement and enclosure, in the spatial organization of people, cultivations, and livestock. Confronted by change, witnessed firmly by both oral and documentary sources, and personally biased toward a perspective favouring the medium if not the longer term, I have attempted in these chapters to avoid holding Sinasina action in the chilly analytic embrace of the ethnographic present, opting instead for a presentation which emphasises processes of historical change since 1933.

Although some of these changes can be traced to 'events', i.e. epidemics, the introduction of money, the establishment of mission stations, the promulgation of a council rule, my interest lies not in their occurrence per se - most after all are the commonplace of colonial penetration - but in their consequences. In particular in the sequences of action and reaction which, I try to demonstrate, have resulted in the empirical patterns evident in Sinasina in the early 1970s. Further, although each of these three chapters is concerned with a relatively bounded feature, or set of phenomena, they are only partially discrete. Underlying them is a common concern with the fundamental questions - ecological, certainly, but also no less sociological - relating to variations, both over space and through time, in the size and distribution of both human and domestic pig populations in the Sinasina region[8]. More pragmatically, my choice of subjects in these chapters is also closely related to the availability

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[8]With Braudel, I assume that "....everything, both in the short and long term, and at the level of local events..., is bound up with the numbers and fluctuations of the mass of people" (1973:2).

in both the Chimbu and wider highland literature, of a substantial amount of prior discussion.

In contrast to the diachronic perspective of Part II, the three main chapters of Part III present a largely synchronic account of Sinasina production centred on pig husbandry and use. The description is primarily based on investigations among members of the small clan of Nimai Waula during 1972-73: for some topics, the whole clan, for other, more detailed studies, small samples of ten or less households. Chapter 6 discusses pig production within the wider frame of the general agricultural system, detailing in turn the major temporal, spatial, and social dimensions of labour, land, and livestock. Levels of production of the two major crops, sweet potato and coffee, are examined separately in Chapter 7, with attention paid to the proportion of the former fed to pigs, and to the extent to which purchased foods are used to substitute for, or supplement, local food crop production. Pig production and use are described in Chapter 8, with comparative material from another small Sinasina group, Dom Kumgau Barikane, drawn on in an attempt to explicate the cyclical features of these activities[9].

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[9]An earlier analysis (Hide 1974) of some of the material presented in this chapter was prepared for 1974 AAA Symposium on "The use and management of pigs in the New Guinea Highlands", but it was embedded in, and exploited, a sharp dichotomy which I posited between 'ecological' and 'social' models of highland cycle dynamics, and I did not present the paper. It was, however, circulated among a small number of people both prior to the conference and after (since, although troubled by the framework, I felt the data was new and useful). For stimulating comments and discussion on that version, I acknowledge R. Barrett, N. Bowers, P. Brown, M. Harris, C. Lowman, G.L. Malynicz, M. Meggitt, G. Morren, A. Rosman, P. Rubel, A.P. Vayda, and B. White.

In placing pigs at the forefront of investigation, I follow the lead suggested by recent studies (especially Boyd 1975; Brookfield 1973b; Criper 1967; Rappaport 1968; Waddell 1972a), all of which indicate a major proportion of sweet potato production fed to pigs, and a relationship between changes in pig numbers and variations in the levels of agricultural production[10].

According to Brookfield demands on resources varied through a factor of more than two among the central Chimbu Naregu between 1958 and 1971, and he expressly warns that

> "No interpretation of man/land balance, or of spatial organization of activity, can be valid unless it takes account of this repeated expansion and contraction. Long-duration cycles occur in many production systems, and any form of static analysis applied to such systems can be dangerously misleading" (1973b: 159).

This might suggest that the present short-term study of a production system for which longitudinal data are virtually absent is critically handicapped from the start. Up to a point this is true. Many questions concerning land use, yields, and other significant factors cannot receive full answers. The strategy adopted here is

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[10]Although a stronger term than 'indicate' for the latter relationship could be claimed for Brookfield's and Rappaport's studies, a close reading shows the former arguing from measurements from air photos, the latter from a comparison between areas put under cultivation in two consecutive 'years'. There are problems with both kinds of evidence. It would be interesting to know if, or to what extent, cross-sectional analysis of Rappaport's data on the entire Tsembaga (i.e. household size, household pig herds, and areas cultivated) would match the conclusions reached on the small Tuguma sample by longitudinal analysis. In the main, all these studies place agriculture rather than husbandry to the fore, an emphasis similar to that remarked upon by Postan (1973:214) for studies of medieval England.

therefore a compromise. Much of the data, particularly that concerning land, labour, and production levels, is synchronic, referring to a particular group of Sinasina farmers during one year. Where possible, however, I relate this material, not to some indistinct Sinasina or Waula 'average', but to specific conditions of household composition, pig herd size, and other relevant factors. Within limits, this allows me to use some of the variability between units to explore questions pertinent to the longer term. In addition, much of the information on pigs is drawn from two groups at differing stages of their respective cycles, again providing the opportunity for inferences beyond the synchronic straitjacket.

Units of analysis and quantification

Description and analysis in this study are presented at several levels. The most inclusive is that of the 'Sinasina region', covering an area of some 200 km^2 and including a population of nearly 26,000. While my definition of this region (Chapter 2) follows boundaries created for council purposes, and reflects my research location amongst the centrally situated Nimai, use of such a wider unit follows Read's suggestion, made a quarter century ago, that single community studies were inadequate for handling the scale of central highland social life (1954:32 ff.). It was therefore necessary "....to consider each region as a social whole..." (ibid., 43; cf. Meggitt 1972). Nevertheless, reification is not intended, and material in Chapters 2 and 8 indicate the extent to which 'Sinasina' is a situational entity. Below this level I make use of, variously, 'north' and 'south' Sinasina, and units which, following Brown (1960), I term tribes, clans, men's house groupings, and households. _Pace_ Wagner (1974)[11], and leaving aside the important question of whether and to what extent colonial incorporation has influenced the salience of group definition and functioning at different levels, the named segmentary levels above the men's house units are significant for framing much Sinasina action.

There are many anthropologists who hold no truck with numbers. For them, I have undoubtedly exceeded tolerable limits. For others, though my margin of safety may in places be slim, I hope that I have avoided worshipping the "false god of precision" which Marc Bloch warned historians to beware. "Each type of phenomenon", he suggested, has its own particular dimension of measurement and, so to speak, its own specific decimal" (1953:183-4). However, finding, or making, the measure appropriate to the phenomenon is, while important, a secondary issue since quantity alone, "apart from a presupposed pattern... determines nothing" (Whitehead, quoted in Finley 1973:25). One test, then, of the utility of any quantification is the presupposed pattern, or, in Wallerstein's more rigorous phrasing, "the extent that it speaks to the questions which derive from the conceptual exercise" (1974:8). As described in the first section of this chapter many of the questions to which this study is addressed arise from the application of ecological concepts to highland pig husbandry practices. Choice of a

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[11] I am sceptical of the utility of launching a critique of models addressed to central highland realities from the very different conditions of Karimui on the highland fringe. Further, Wagner's 'western-non western' dichotomy reifies an idealised western model of group participation and discrete membership which must be the envy of everyone who has ever struggled to find a quorum.

different paradigm dissolves such questions without answering them. Here I choose the stonier road requiring information aimed at some of the original questions. I would also add the qualification that, in a study based on field research, analysis necessarily goes hand in hand with description, which, if it is to avoid generalizations of the form 'the Sinasina do this' (which are difficult to sustain under the increasingly differentiated social conditions of today), and the ambiguities of 'most' or 'some', requires some simple measures of distribution which may not speak to the immediate argument.

CHAPTER 2

Sinasina: the setting

My main purpose in this introductory chapter is to describe the setting, in both general and specific terms, of this study in Sinasina, a region of the Chimbu Province in the Papua New Guinea central highlands (Map 2.1).

Introduction: name and definition

In late 1933, when J.L. Taylor returned eastward from the first exploratory journey through the central highlands, he camped, on October 14, at 'Ai-ina'. There were, he reported, ".....crowds of friendly people about, and they state that they belong to the China-Shiva tribe" (Taylor, Mt. Hagen Patrol 1933, p.206). Taylor had in fact camped near a low ridge where, in the early 1970s, the territories of three of the seven major Sinasina groups, or tribes, march: the Tabari, Dinga, and Nimai. The names of the two segments of the Tabari and Dinga which share a boundary at Aina are Sine and Siba, and it is a reasonable assumption that Taylor's China-Shiva derives from these latter names (i.e. China from Sine, cf. Chimbu from the more exactly pronounced Simbu, and Shiva from Siba)[1]. Be that as it may, Taylor's term appeared on the first published map of these early journeys (Spinks 1936), and Chinnery (1934:119) applied the name generally to groups in the area.

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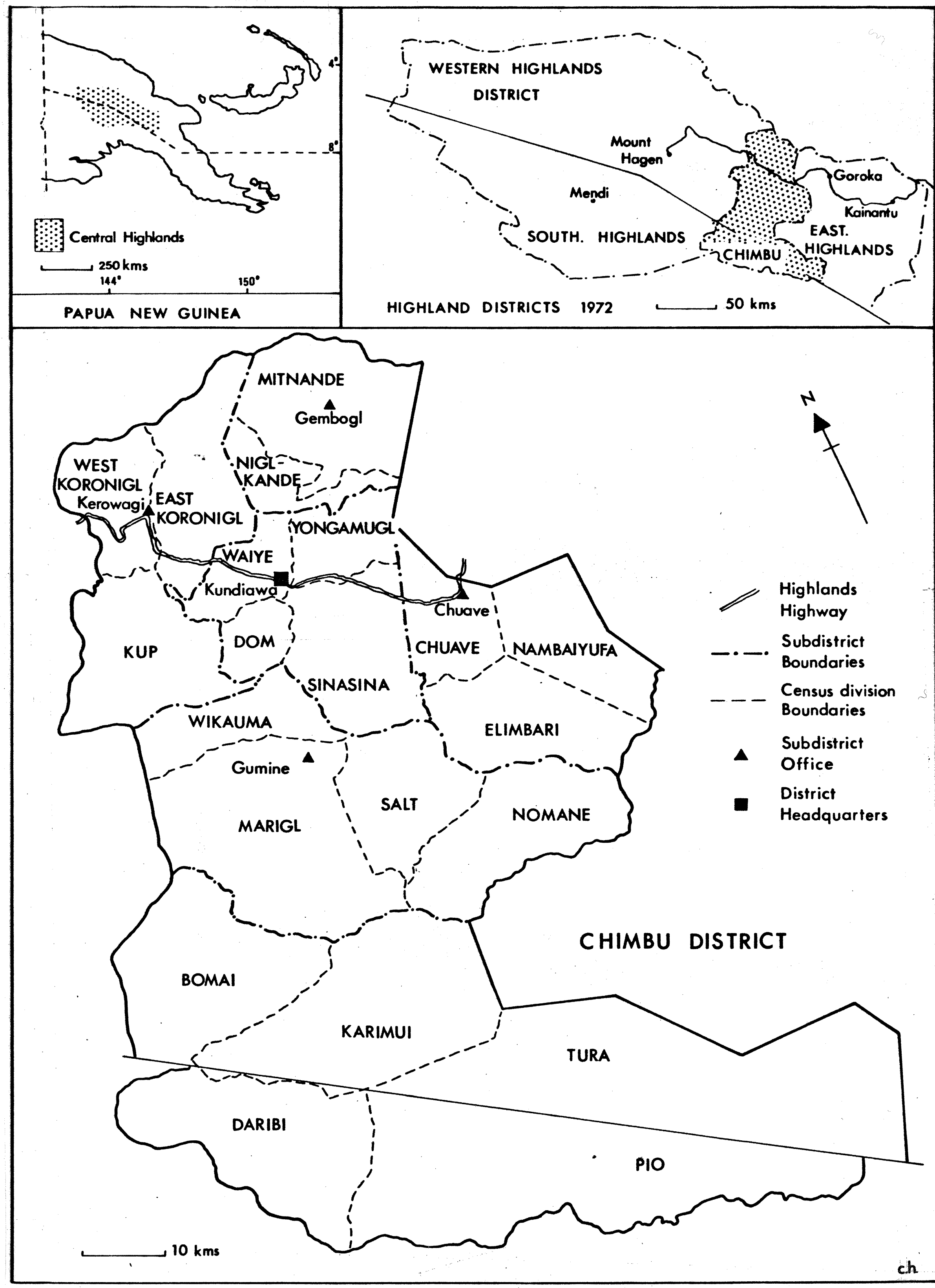
[1]cf. Parker (CPR 9, 1964/5, Appendix A, p.3), McLay (CPR 1, 1971/72, p.3), and Hatanaka (1972: 25, fn.2).



Map 2.1 Chimbu District : administrative subdivisions (1972)

Four years later, although occasionally still spelt as China Shiva (e.g. Chimbu-Wahgi Post, Station Diary, 14 July 1937), but more usually as China Sina (ibid., 28 January 1937, 27 April 1937), the name was used to refer specifically to one of the groups occupying the area in the present territory of the Tabari (e.g. "Kimba Kimba and China Sina fighting", ibid., 28 April 1937). Such usage continued over the next few years, though with some variants (e.g. "China Sina (Mani) people fighting Du people...."ibid., 10 May 1937; "Natives of China Maimi in....", ibid., 1 August 1938). Government officers at this time characteristically used a mixture of group and place names, and it seems probable that besides using China Sina to refer to one group of Tabari (a name noticeable by its absence before 1940, when it first began to appear as 'Tambandi', presumably a term in the neighbouring Kuman language), they also used it for the general area of what is now northern Sinasina. By the time of the first census, the former reference is explicit, with China Sina defined as a 'clan' of the 'Tambandi' tribe (Downs, PR, 28 March - 9 April, 1940, p.1). Factors contributing to the elevation of the name to its wider regional reference may have included the numerical size of the 'clan' (3288 persons in 1941, Warner Shand, CPR M.10, 1941/42), the significance of its government-recognised leader, Yure Maima (Downs, CPR, 21 July-1 August, 1940) and the earlier salience accorded it by Taylor, Spinks and Chinnery.

In the mid-1940s, the spelling of the group name, after one or two early but sporadic appearances of "SinaSina" (Kundiawa Station Diary, 29 July 1938), and "Sinasina" (Downs, CPR 21 July-1 August, 1940, p.1), fluctuated between Sinasina and Sina-Sina (Dennis, CPR 6, 1944/45, p.1; CPR 11, 1944/45, p.1). It first appeared as the official name for the whole of the north Sinasina area (i.e. including the Tabari, Nimai, Dinga and Kere, see Map 2.2), in 1951 (Kelaart, CPR 2, 1951/52, p.1), when this area became an administrative "Patrol Subdivision", and, soon after, a census division. This usage continued until c.1965, still not including, at least officially, the three southern groups of Dom, Gunangi, and Kebai which were divided, respectively, among the Dom, Salt, and Chuave census divisions. On the eve of the establishment of the local government council which was to include both northern and southern groups, a meeting of village officials was held at Koge (on 19 January 1965), and, by a vote of 65 to 32, Sinasina was chosen as the new council's name (Parker, CPR 9, 1964/65, Appendix A, p.2).

At the time of research then, Sinasina referred to a Chimbu council area, and to the population of some 25,679 officially[2] living within its borders. This regional reference of the term, which will be used throughout this study[3], is thus of colonial origin, as also are both the administrative unity, and the emergent social identity, of the seven large social and territorial tribes composing the population.

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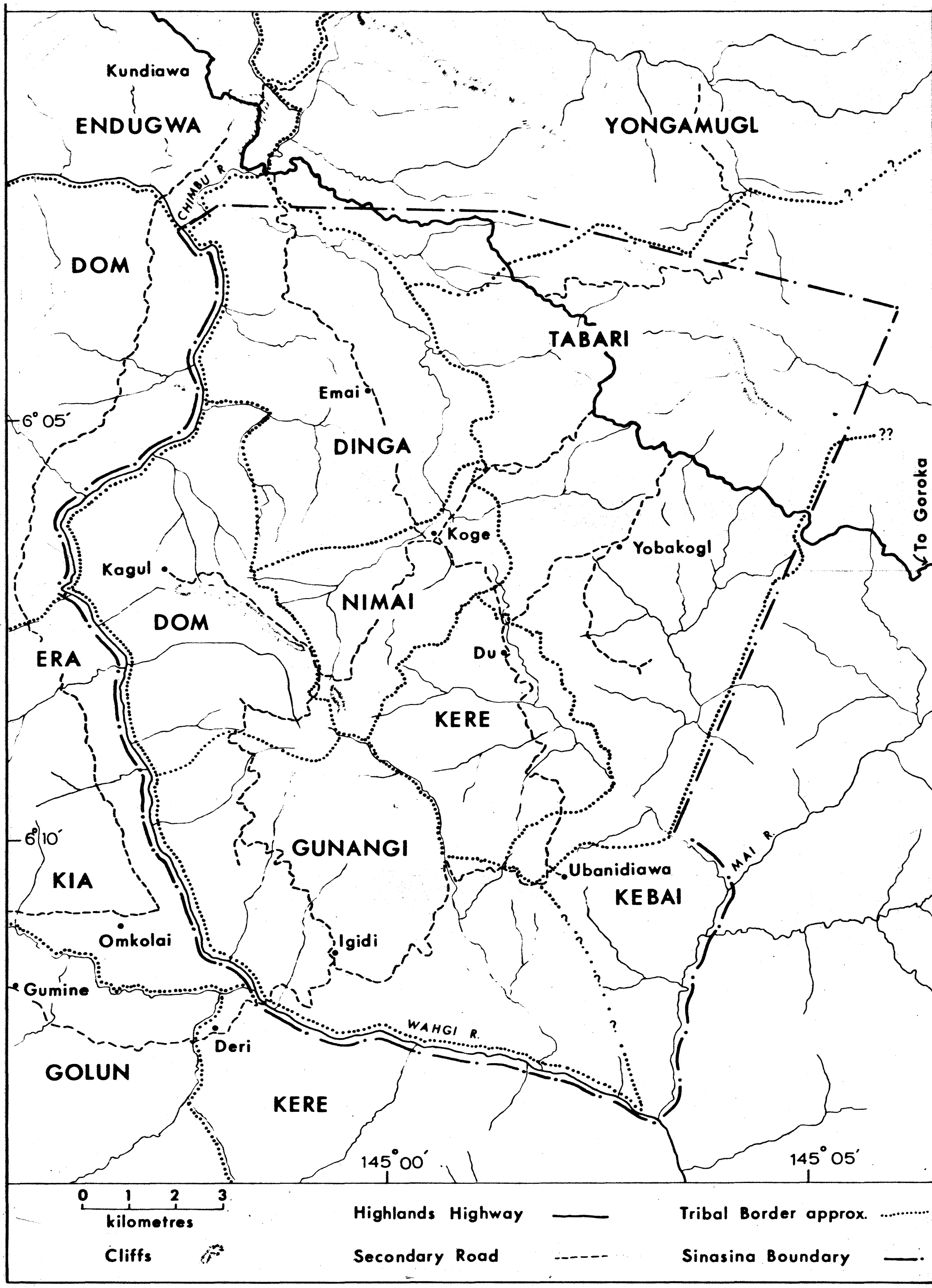
[2] i.e. the _de jure_ population registered by the censuses taken by the then Department of District Administration (DDA hereafter). This 1971 figure thus includes 'absentees', a large and poorly defined category (Chapter 3).

[3] In 1973 the council area of Sinasina was divided into two census divisions, the northern half retaining the name Sinasina, while the southern half was christened Gunangi, presumably for good political reasons (see p.49).



Map 2.2 Tribes of Sinasina and surrounding areas

Linguistic and cultural affinities

Unlike the neighbouring central Chimbu area where the majority of some 66,000 Kuman-speakers are "...closely united linguistically showing only small dialect differences" (Deibler and Trefry 1964:4), Sinasina is considerably more linguistically diversified (as also are the Gumine and Chuave regions to the south and east, ibid., 3). Linguists recognise four (ibid., end map; see also Wurm 1975 for more recent nomenclature), or three (Irwin 1974:10), languages and several dialects within Sinasina, all of which Wurm classifies as members of the Chimbu Sub-Family of the Central Family of the East New Guinea Highlands Stock (1975:462, 468-9).

The most widely spoken is Sinasina[4], speakers of which certainly include the four northern groups of Tabari, Dinga, Nimai and Kere numbering, in 1971, just over 18,000 people, and, following Irwin (1974:1; pers. comm. 29 May 1980), also the Gunangi in the south. Several dialects are distinguished, with the most marked difference (though variation is generally continuous), according to Deibler and Trefry (1964:4), being that between the Tabari in the east and the rest of the language. Sinasina spoken by the Nimai and Dinga is very closely related. The boundary between Kuman to the west and the Sinasina language, even that spoken by Dinga who border Kuman speakers, is

[4]There is a grammar of the Tabari dialect of this language (McVinney and Luzbetak 1954). C.V. Turner of the New Tribes Mission at Mani has also done linguistic work with this dialect, but the others, to my knowledge, have not been studied.

relatively sharp[5]. Sharper, according to Deibler and Trefry, than that with Dom speakers to the west of the Wahgi, and that between Sinasina spoken by Nimai and Marigl spoken by the Kia south of the Wahgi in the Gumine region (Map 2.2). There is therefore a southern trend in linguistic relationships.

The linguistic situation of the three southern Sinasina groups of Dom, Gunangi and Kebai is, by comparison with their northern neighbours, rather more fragmented. Both the Dom and Kebai speak different languages relating them closely to populations living outside the Sinasina borders, Dom to the west and southwest in the former case, Chuave to the east and southeast in the latter. Irrespective of whether 'Gunangi' is classified as belonging to the Sinasina language or not, it is very closely related with that spoken by the Kere (or Keri) living to the south of the Wahgi (B. Irwin, pers. comm. 29 May 1980).

Since the degree of mutual intelligibility is high, particularly in neighbouring areas, the effects of such linguistic differences on social interaction should not be overstressed. Further, since the marriage of the members of any one group, including low-level ones with populations of 100 or so, are customarily dispersed, most groups include adult speakers of several dialects and languages. It is unlikely that this is a recent phenomenon resulting from the extension, during the colonial period, of the distance range within which marriages occur since the latter is offset by an increasing proportion of local marriages

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[5] Sinasina sometimes mark the difference by reference to the terms konda (Kuman) and kora (Sinasina): in both languages meaning "no!" and "left" hand (cf. Nilles 1969:131).

brought about by an extensive redefinition of exogamic boundaries at lower levels in the hierarchy of groups[6]. Nevertheless, it is significant that the most pronounced linguistic division within the Sinasina region approximately coincides with the geographical division between an agriculturally more favourable north and a less well-endowed south, with the former occupied at a higher density (p.34).

Traditions of origin broadly reflect the pattern of linguistic differentiation. The Nimai and the Dinga share an account (linking them with another group, the Danga, who are said to have later moved westward to their present location near Nondugl, see Chimbu tribal map in Brookfield and Brown 1963), which describes them moving down the Chimbu valley from Womkama (cf. Brown 1960:25) to Diga-degen, a location in the northwest of current Dinga territory. After the exit of the Danga, the Nimai and Dinga are said to have divided, following a fight in which the Nimai were defeated, dispersed, and driven into temporary exile to the south of the Wahgi, before occupying their approximate present territories. Accounts from the Tabari and Kere describe movements southward across the Porols (Hughes 1966), whereas Dom and Gunangi traditions (also recognising Womkama as their original place of origin), refer first to movements down the Chimbu and Wahgi rivers to locations to the west and south of the latter river, with subsequent moves east and northeast across the river and into Sinasina[7]. No account was

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[6]Both the social geography of marriage relations and the redefinition of exogamic boundaries are discussed in detail in Chapter 4.

[7]Taped accounts from Aulakua Wemin of Dom Kumgau Barikane (23 April 1972, C/RH/72.4 A), and from Abakure of Gunangi (12 September 1972, T/RH/72.1 B)

obtained from the Kebai.

One feature shared by all such accounts is a general emphasis on the relative recency of the events described, usually reinforced by reference to shallow genealogies which rarely include more than three or four generations. Although no direct archaeological evidence is available for dating human occupation of the Sinasina area itself, sites from the vicinity of Chuave in the east indicate a time depth for human history of at least 10,000 years (S. Bulmer 1975:35-6). Recent pollen analysis from Mt. Wilhelm at the head of the Chimbu valley shows a steady increase of Casuarina and plants of disturbed vegetation such as Trema from 1000 years BP, with a sudden rise in Casuarina over the last 100-300 years, which Hope interprets to suggest an initial expansion up the valley some ten centuries ago, followed by considerable recent expansion, perhaps after the introduction of sweet potato (1976:651,656). Such evidence of environmental change, presumably in the face of increasing human impact, makes hypotheses of longterm equilibrium between people and resources in the recent past unlikely[8].

The amount of contemporary cultural variation within Sinasina appears to be slight. Documented information on the situation in the

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[8] cf. Hughes (1966), and Dwyer (1978a, 1978b). Suggestive of pressure on higher altitude zones in Sinasina are reports from Nimai of the disappearance with the last 40 years of a forest wallaby (in Nimai, bera, presumably Dorcopsulus sp., cf. Bulmer and Menzies 1972:493), and a bird (in Nimai, dinge panabe, perhaps a ground dove, cf. Majnep and Bulmer 1977:80), which used to feed on the fruit or seeds of the climbing bamboos found in the forest fringe.

early 1930s is fragmentary. The earliest records show that outsiders recognised changes in styles of self-decoration between the people to the east of the Mai river (i.e. Chuave), the inhabitants of Sinasina, and the Kuman or central Chimbu to the west (Hughes 1977:54), and also broad differences in settlement patterns (Chapter 5), but internal variation was not remarked. Bergmann, who established the Lutheran mission at Ega (Kundiawa) in 1934 also notes that groups to the east of the Chimbu river were distinguished from the Kamanuku and other central Chimbu by differences in settlement and ritual (1971, Vol. 2, p. 2; Vol. 4, pp.128, 178-80).

In the early 1970s, the Nimai, from their central location in Sinasina, recognised differences between themselves and groups beyond Sinasina to the west and northwest, i.e. Yongamugl, Kamanuku and Endugwa, all classified by them as 'Kuman'. On occasion these were specifically 'marked', as, for instance, at a rare marriage between Nimai Waula and Yongamugl in early 1973 when members of Nimai Waula deliberately performed certain parts of the marriage ceremonies in accordance with 'Kuman' custom. Groups to the east of Sinasina, referred to generally as 'Kobile' (also 'Elimbari', or 'Suave') were also recognised as different in some respects (marked particularly, in my observation, by the decorative styles of eastern dance groups visiting their Sinasina hosts during pig festivals in 1972). To the south, an area referred to generically as 'Bomai', distinctions seemed to be less clearly stated. Indeed, in the context of the Yongamugl-Waula marriage just referred to, one Nimai woman (originally from the Sinasina Kere before marriage) stressing the lack of prior relationships between Yongamugl and Nimai ("We have friends as far as Boganil, i.e. on the border between Tabari and Yongamugl, but beyond that we don't know anyone"), spoke of the problems she would face when visiting the bride in the future: "we are part of Bomai, we don't know their (i.e. Yongamugl) language, and we'll be (frightened) like a possum tied to a stick by its tail" (CH/T/29 A).

In all such cases, however, cultural similarities and differences are interwoven with those of language and ecology, and precise statements of difference or similarity are usually relative and contextual. In speeches made at a large prestation (komina bire) of pandanus from Kere to Dinga in March 1973, for instance, the unity of the Sinasina region was claimed on the grounds of geography, name, and common physical features[9]: "We who live between Gera (in the northwest), Kumul (in the northeast), and the Wahgi river (in the west and south), we are all called Sinasina. We all share the same kind of 'nose'" (T/RH/72.13 A). Differences between the two major participating groups were expressed in terms of relative location and ecology, with the Kere addressing the Dinga as "you from Kuman" (i.e. in implicit contrast to us from 'Kobile'), and describing themselves (frequently by reference to insults or derogatory nicknames said to have been levied at them by

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[9] Indirectly, unity in terms of common custom was expressed by the Sinasina MHA on the same occasion in a speech countering rumours and fears that impending self-government and independence would mean the withdrawal of all money by departing Europeans, and the beginning of a new era in which "food prestations, pig festivals, and singing in womens' houses (i.e. courting), all these old customs which our ancestors taught us and we have continued" would be forbidden. Such customs, however, are shared by Sinasina with most Chimbu.

Dinga), as inhabitants of the zone known as dimina (higher altitude, less fertile), in contrast to the lower, warmer, more fertile, same zone.

Physical environment

Sinasina covers an area of approximately 213 km^2,[10] lying between the provincial centre of Kundiawa in the west, and the small township of Chuave in the east. The terrain is dominated in the north by the sharp limestone escarpment of the Porol range, and, separated by a 10 km-wide corridor of less rugged topography, toward the south by the 2600 m high Suai-Wone ridge which drops relatively steeply to the floor of the Wahgi gorge in the far south. Both the escarpment and the ridge,

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[10] See Howlett et al. (1976:73) where north Sinasina, known since 1972/73 as Sinasina Census Division, is given an area of 126 km^2 and south Sinasina, the Gunangi Census Division, 87 km^2. However, there are several other measurements in the literature. Using a different base map, Howlett et al. (1976:75, fn. 2) gave the north 138 km^2, the south 88 km^2 (ibid., 77). Shand and Straatmans (1974:35), citing a 1962 map by Alder, gave the north 165.9 km^2 (Tabari 94.3, Dinga 35.2, Nimai 19.4, and Kere 17.0), while the 1962-64 Intensive Agricultural Survey (TPNG 1967: Table 1) measured the north at 196.7 km^2, giving Tabari (their community 8) 105.6 km^2, and Nimai, Dinga, and Kere (their community 9) a combined total of 91 km^2 (all measurements originally in acres). The official Village Directory (PNG 1973) gives the north 120.7 km^2, the south 105.4 km^2 (originally in $miles^2$), making a Sinasina total of 226.1 km^2. The considerable difference between the highest figure of 196.7 km^2 for the north (TPNG 1967), and the 126 km^2 given by the most recent study (Howlett et al. 1976:73) is presumably due to different boundary definition. The former, for instance, includes two extra, but small, census units (see notes to Table 3.1), and internal evidence (i.e. the high proportion of Tabari land over 2286 m, see Table 2.2 below), indicates that it also included a considerable area of land to the north of the Porol range not included in later measurements. However, I have not been able to locate this survey's original maps showing community boundaries. For the purposes of this study, the Howlett et al. figures of 126 km^2 for the north, and 87 for the south, will be followed.

the latter an eastern extension of the Kubors, follow the main northwest-southeast trend of the geological structure of the central highlands cordillera. Two deeply incised river valleys, of the Wahgi in the west and south and the Mai (or Maritifuga) to the southeast, into which all Sinasina rivers drain, bound much of the region. The Suai-Wone ridge effectively cuts Sinasina into two parts. The northern area contrasts with the south in that it is larger, considerably less rugged, and has little land below 1600 m (Table 2.1). The ridge, although of relatively little consequence for foot traffic, also draws a boundary between the territories of the three southern groups of Dom, Gunangi, and Kebai, which, falling sharply into the valleys and gorges of the Wahgi and Mai, face southwards, and those of the four northern groups which either face north and northeast (Dinga, Nimai and Kere), or, in the case of the Tabari, lie athwart the broken hills of the corridor and the Porol scarp.

Following Haantgens et al's classification (1970), six land systems can be distinguished, all roughly following the main northwest-southeast trend. Proceeding from north to south, that of 'Pira' covers the mountain ridges to the north of the Porol scarp, 'Elimbari' the scarp itself including its' less sharply-angled, north-facing, dip slope, and 'Womei' the low, dissected and slumped hills at the southern foot of the scarp. All three are narrow bands. The less rugged corridor 'floor', extending roughly from the highlands highway (Maps 2.2, 2.3) to the secondary road running from Emai through Koge to Du, classed as the 'Kumun' system of low hill ridges, comprises the second largest area within Sinasina. The largest is that of 'Koge', the

TABLE 2.1 Distribution of altitudinal zones and terrain types in north and south Sinasina [1]

	North Sinasina	South Sinasina
Altitudinal zones (m)	n=126 km^2 Per cent	n=87 km^2 Per cent
< 1200	-	2
1200 - 1600	8	23
1600 - 2000	65	41
2000 - 2400	24	28
> 2400	3	6
Total	100	100
Terrain types [2]	n=138 km^2 Per cent	n=88 km^2 Per cent
Plain-lands	0.7	-
Undulating	25.4	14.8
Hilly	43.3	15.2
Barrier	30.6	70.0
Total	100.0	100.0

[1] Source : Howlett *et al*.(1976:73,77). Total area calculations for the two variables differ due to the use of different base maps (ibid.,75,fn.2). For alternative calculations for the north see footnote 10 above. .

[2] For definition, see Howlett *et al*.(p.74-5,fn.1).Approximate slopes ; plain-lands less than 3½ degrees, undulating up to 15 degrees, hilly 21-25, and barrier over 26.

rugged, relatively low mountainous area on greywacke and shale which extends from the Emai-Du road to the far south where, in the southwest, there is a narrow band of the 'Bismarck' system, and, in the south, a further small strip of 'Kumun'.

A closer look at terrain and soil variation in north Sinasina is allowed by information from the Intensive Agricultural Survey (TPNG 1967). Table 2.2 shows that Tabari territory contains more higher altitude land than the remainder of the north (but see fn. 10 above), though it is less steeply sloping. The same two soil units predominate in both these northern areas, though Tabari has more of the shallow soils and less of the deep, well-drained ones. This difference is important as the survey suggested that long-term average sweet potato yields on the latter soils (which can be cultivated more frequently) were two to three times higher than those of the shallow ones (ibid., Table 5, p.10). Average annual yields (on all productive soil units) ranged from 15 to 26.5 tonnes/ha, dependent upon altitude and slope: the highest yield was reported for land between 1905 and 2286 m, with a slope of less than 10 degrees (ibid., Table 4, p. 10). Only on land over 2286 m did yields fall below an average 22 tonnes/ha[11].

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[11] Comparative knowledge of the soils and general ecological conditions affecting cultivation in Sinasina and neighbouring areas is, as would be expected, extensive. Comments made by two women to a young Nimai Waula bride on the eve of her marriage to a man from Yongamugl (whose territory descends to 1400 m) are revealing:

> "The women at Yongamugl eat only one kind of sweet potato (nilgi). When they plant it, only the leaves grow large, and they can't harvest quickly....."
>
> "Here (in Nimai) when we plant sweet potato, it produces tubers not only from the main slips in the mound but also from the vines wherever there's room for them to reach the ground. But over

Continued at next page

TABLE 2.2 Altitude zones, slope classes, and major soil units in two areas of north Sinasina [(1)]

Altitude zones (m)	Tabari (n = 105.6 km^2) Per cent	Nimai, Dinga, Kere (n = 91 km^2) Per cent	Total (n = 196.7 km^2) Per cent
<1,905	24	53	38
1,905-2,286	56	43	50
>2,286	20	4	12
Totals	100	100	100
Slope classes (degrees)	Per cent	Per cent	Per cent
0-10	5	3	4
10-25	79	56	68
25-40	16	41	27
Totals	100	100	100
Major soil units (2)	Per cent	Per cent	Per cent
Shallow, developed on finely divided shale and mudstone (D)	62	48	55
Deep, well drained (A)	26	45	35
Other	12	7	10
Totals	100	100	100

(1) Source : adapted from TPNG (1967:Table 1). Areas originally in acres, altitudes in feet; the Tabari were community 8, the Nimai, Dinga and Kere community 9 (ibid.,17-19).

(2) Nine were distinguished in the survey, of which seven were present in North Sinasina. Only units D and A (symbols from original survey, TPNG 1967:4) were of significant occurrence. 'Other' includes unit B (somewhat poorly drained mottled soils, 9 per cent in Tabari, 2 per cent in the other community), E (shallow soils developed over massive shale or shale rocks with no cultivation observed on them), H (rock out-crops and steep cliffs), F (shallow soils over sandstone), and Dx (an eroded and skeletal type of D). Of these only H (and possibly E) was considered uncultivable (ibid.,7). H was restricted to Tabari (1.5 per cent) and E to the other community (4.9 per cent).

Everywhere the Sinasina vegetation (Robbins 1970) reveals clearly the heavy demands placed on both cultivable land and non-domesticated plant communities by high human and domestic pig populations. Small areas of mixed-beech forest remain only on part of the Porol range, and the peak of the Suai-Wone ridge. At slightly lower altitudes there are small localised remnants of oak forest, and woody streambank vegetation along the watercourses of some rivers. Secondary vegetation communities dominate at all altitudes below approximately 2500 m, the most extensive of these being foodcrop gardens and the varied stages of fallow regrowth, the latter including short grasses and herbaceous regrowth (mainly at lower altitudes), stands of distinctive Casuarina trees and tall Miscanthus sword grass, and on the forest fringe, shrub and mixed tree regrowth. More stable managed communities include groves of karuka (nut) pandanus, especially on the southern foothills of the Porol range and the 2300 - 2500 m forest fringe on the Suai-Wone ridge, small coffee plantings, mainly between 1600 and 2000 m, and the distinctive tree and shrub associations at settlement sites. Small scale mapping of land use intensity using 1955-56 air-photos (McAlpine 1970) showed much of northern Sinasina, especially land falling in the 'Kumun' and 'Womei' systems, to be used "intensively" (i.e. more than 75 per cent under anthropogenous vegetation, of which more than 20 per cent was cultivated). In contrast,

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Continued from previous page

there (at Yongamugl) only the mounds produce tubers, when they're finished there's nothing more. The trailing vines don't produce anything.....only leaves"(CH/T/28 B, and T/29 A).

most of southern Sinasina, or land classed as belonging to the 'Koge' system, was under "moderate" use (i.e. more than 50 per cent under anthropogenous vegetation, of which 5-20 per cent was cultivated). This conforms with calculations of crude population density (using 1971 de jure population figures, Howlett et al. 1976:93) which gave the north 138 persons per km^2 compared to 92 in the south[12].

Although no longterm climatic records are available for Sinasina[13] a comparison between rainfall data from Koge, the major Nimai settlement and my research location, recorded between November 1971 and April 1973 at 1820 m, and from Kundiawa (at 1495 m and c.11 km to the north west), where data both for the same period[14] and averages based on 13 years of records are available, suggests that the same general pattern obtains (Fig. 2.1). In summary, there is a broad division between a wet, and a dry, season, the former concentrated mainly in the period December to April, and the average annual rainfall is probably in the 2000 - 2400 mm range (Howlett et al. 1976:81). During the research period there was little variation around the mean monthly temperature of 18.7 degrees C, and the mean monthly minimum and maximum temperatures at Koge were

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[12]The former was the highest for all 22 Chimbu census divisions, the latter the fifth highest (ibid.). If, however, density is calculated only on land below 2400 m, north Sinasina fell to the third highest, and the south to ninth.

[13]The only records, as of 1971, were a few months of rainfall figures for 1960 from the Catholic Mission at Koge, and some fragmentary rainfall data from Muaina Primary School for early 1971.

[14]During the 18 months covered, Koge recorded a total 4169 mm compared to 3769 at Kundiawa.

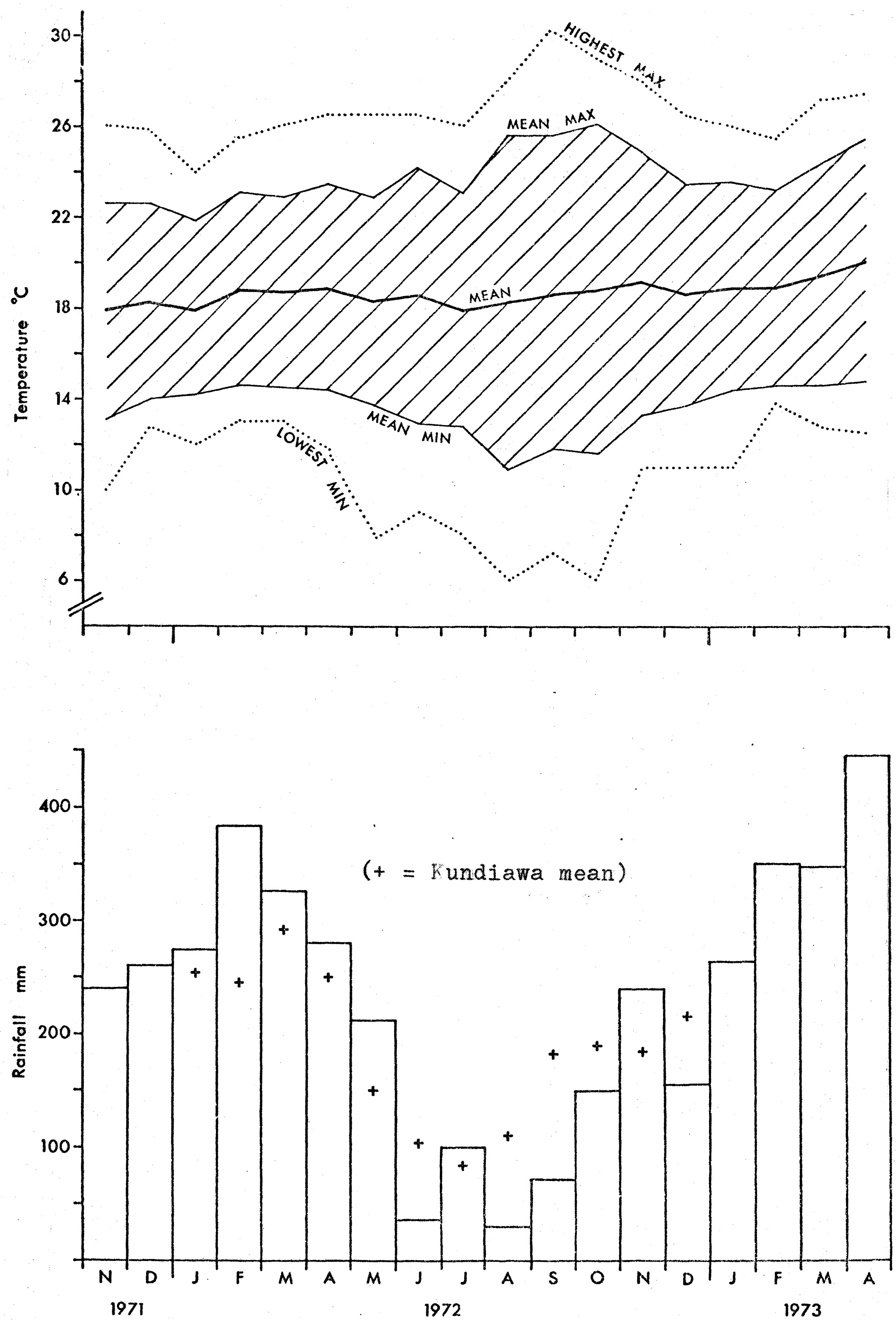

Fig.2.1 18 months rainfall and temperature records at Koge

respectively 13.5 and 23.8 degrees C (Fig. 2.1). These may be compared with the Kundiawa 13 year averages of, respectively, 20.4, 14.6, and 26.1 degrees C (McAlpine et al. 1975:127), which are one to two degrees higher due to the decrease in altitude of 325 m (cf. McAlpine 1970: 73). Extreme minimum and maximum temperatures were recorded at Koge during the exceptionally dry season, with lows of 6 degrees C in both August and October, and a high of 30.2 degrees C in September[15].

The severity of the 1972 dry season was not a local occurrence. In the high altitude areas of the Western Highlands, for instance, drought conditions were combined with sharp frosts and subsistence viability was threatened (Brown and Powell 1974; Waddell 1975; see also Shannon 1973 for the Goroka area). To contextualise later material on both crop and animal production in the light of Brookfield and Hart's advice that "(v)ariability, intensity, and the incidence of spells of weather, especially of dry weather, are as important to an understanding of the distribution of tropical agronomy and ecology as are an understanding of the distribution of total rainfall, and of season regimes" (1966:23), the conditions obtaining during 1972 require closer examination.

Climatic conditions in north Sinasina during research

During the three months of June to August (in 1972), Kundiawa

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[15]A comparison of temperatures taken inside and outside three different styles of house at Koge for 6-7 days during August and September 1972 showed that all three substantially reduced the range of diurnal variation (cf. Sinnett 1977:68). The outside averages ranged from 13.7 to 14.3 degrees C, those inside from 5.6 to 8.5.

received a total of 141 mm of rainfall (at Koge 167 mm). The 13 year average for this period is 298 mm, with a minimum of 132 mm recorded during 1965, a year which also saw drought widespread throughout the highlands. (Brookfield and Hart 1966:22)[16]. Although the 1972 figure was the second lowest on record, it was preceded by a wet May during which an above average 235 mm fell. This contrasts sharply with the situation in 1956, when Kundiawa's third lowest June to August rainfall of 153 mm followed a May rainfall of only 33 mm (cf. McAlpine, 1970:77, Table 9, which shows that depletion of soil moisture storage at Goroka and Henganofi in the Eastern Highlands was exceptionally severe in 1956). These, admittedly short, records therefore suggest that, although the 1972 drought was probably the second or third most severe on record, such extreme conditions occur relatively frequently (at Kundiawa). Further, McAlpine's comparative analysis of soil moisture storage at four highlands locations indicates that while Kundiawa is more subject to depletion that Hagen to the west, it is considerably less so than either Goroka or Henganofi in the Eastern Highlands (1970:76). Tentatively extending this brief analysis to the Koge area of Sinasina, I therefore assume that 1972 was an unusual, but not

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[16] Yongamugl, at least, appears to have suffered a food shortage in 1965 since four tons of rice was advanced to them on credit by the government (Letter, 12 November 1065, ADC to DDC, Kundiawa, attached to Akins, CPR 18, 1964/65).

exceptionally extreme, year[17].

Some selected characteristics of rainfall at Koge during the period of research are given in Tables 2.3 and 2.4. Data on the occurrence and duration of dry spells show how extended the latter were in the period June to September (Table 2.3). Besides affecting cultivation and plant growth, drought conditions also increase the risk of fire damage. In one eight day period at the beginning of September 1972, most of the Nimai Bomai hamlet at Kolai (Map 5.1) was razed to the ground (when some young girls heating stones for an earth oven left the fire untended), and a high altitude garden burn-off by some Nimai Waula got out of control and swept through the tinder-dry tops of several groves of karuka pandanus. Days on which more than 50 mm of rain fell were uncommon (Table 2.4). This is probably significant since a considerable amount of cultivation is done on steep slopes. Erosion is recognised as a hazard, and use is made of soil retention devices. Nevertheless, heavy falls occurring soon after planting were observed to washout several new sweet potato mounds on a

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[17]Local evidence generally supports this assessment. None of the Nimai Waula households with which I was most closely associated complained of straightened circumstances resulting from the drought, though I believe some planting was delayed and some damaged. Elsewhere in Sinasina, especially to the south among the Dom and Gunangi, complaints were heard, and some Government assistance with maize seed in early 1973 reported. The Dom situation, however, was complicated by the conjunction of the drought with their pig festival, an event which is frequently reported to be followed by evidence of food shortage (Bailey 1963a:399; Barrie 1956:48; Criper 1967:248: Montgomery 1960:3; I have discussed the question elsewhere, Hide 1980b, in relation to Lambert's food intake study, 1975, 1976). It is of interest, nevertheless, that drought-associated shortage or famine is probably the most frequently mentioned hazard in Sinasina folk tales.

TABLE 2.3 Dry spells at Koge (1971-73) : number of dry spells by duration and month[1]

Months	Dry spell duration classes (days)				
	2 - 3	4 - 5	6 - 8	11 - 12	20
November	3	1	-	-	-
December	3	1	-	-	-
January	3	-	-	-	-
February	-	-	-	-	-
March	2	-	-	-	-
April	-	1	-	-	-
May	2	1	1	-	-
June	2	1	-	1	-
July	2	1	1	-	-
August	1	1	-	-	1
September	-	1	-	-	1
October	-	-	1	1	-
November	3	1	-	-	-
December	1	1	-	-	-
January	2	-	-	-	-
February	-	-	-	-	-
March	1	-	-	-	-
April	-	1	-	-	-
Total spells[2]	25	11	3	2	2

(1) Source : field data. A dry spell is two or more consecutive days on which less than 1 mm of rain was recorded (cf.McAlpine et al. 1976:4).

(2) Continued on following page.

TABLE 2.3 Dry spells at Koge (1971-73) : number of dry spells by duration and month

Footnotes continued

(2) These totals are the sums of the monthly figures. However, since 7 spells between May and November (1972) overran consecutive months, they are not actual totals for the period as a whole. The latter were :

Duration of spell (days)	No. of spells	Total days
22-28	2	50
16-18	2	34
8-9	2	17
4-5	9	41
2-3	22	48
Totals	37	139

TABLE 2.4 Rainfall intensity at Koge (1971-1973) : number of days with rainfall within specified classes [1]

Months	Rainfall classes (mm)					Total rain
	<1	1 - 4	5 - 24	25 - 49	50 - 99	
November	14	6	6	3	1	240.8
December	12	6	9	4	-	258.5
January	8	7	12	4	-	273.8
February	1	8	15	5	-	385.0
March	4	10	14	2	1	326.6
April	9	10	9	1	1	280.8
May	17	6	4	4	-	213.0
June	23	5	2	-	-	37.2
July	18	6	7	-	-	98.8
August	26	3	2	-	-	31.2
September	24	-	6	-	-	72.4
October	18	6	6	-	1	151.4
November	13	6	8	2	1	238.6
December	12	8	10	-	-	155.5
January	8	6	15	2	-	262.7
February	6	7	10	3	2	349.5
March	3	6	18	2	1	347.8
April	6	7	9	7	1	445.8
Totals	222	113	162	39	9	4,169.3
Proportion of total rainfall						
mm	35.3	293.4	1,971.3	1,349.4	519.9	4,169.3
per cent	0.8	7.0	47.3	32.4	12.5	100.0

[1] Source : field data. Rainfall classes after McAlpine *et al*. (1975: Table 7,p.99).

number of occasions. It is also possible that rainfall characteristics, in association with the heavy human and pig populations, affect the level of faecal coliforms present in drinking water supplies (cf. Feachem 1974), though a recent study of 15 Chimbu streams did not detect any present (Kidd 1977:39, citing Kidd and Guthrie 1975). Some aspects of monthly variation in the daily occurrence of sunshine, cloudiness and rain, as recorded three times daily at Koge, are shown in Fig. 2.2. Seasonal trends[18] are apparent in the aggregated patterns (D), with sunshine averaging 70 per cent of observations in the period June to October, but falling to 46 per cent from November to April: conversely, while cloud cover averaged 47 per cent in the former period, it rose to 76 per cent in the latter. Daytime rain was generally uncommon throughout the 11 months surveyed, but it increased from 5 per cent of observations between June and October to just over 9 per cent during November to April.

Other climatic features posing potential threats to crops, animals, or humans are of relatively rare occurrence. One major hail storm struck in December 1972, causing, according to reports which I was unable to verify, damage to coffee trees in other parts of Sinasina. No serious damage was apparent at Koge. Deaths from lightning during electrical storms are rare, but have been known (in one remembered case at Koge, a double death was said to have been punishment for theft). Strong winds are more frequent. Blowing

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[18] Perhaps partly due to the unusual climatic pattern of 1972? McAlpine presents data from stations in central basin positions (Goroka, Mt. Hagen) which show relatively little variation for cloudiness (1970:75-76; see also McAlpine et al. 1975:158), and for sunshine (ibid., 154).

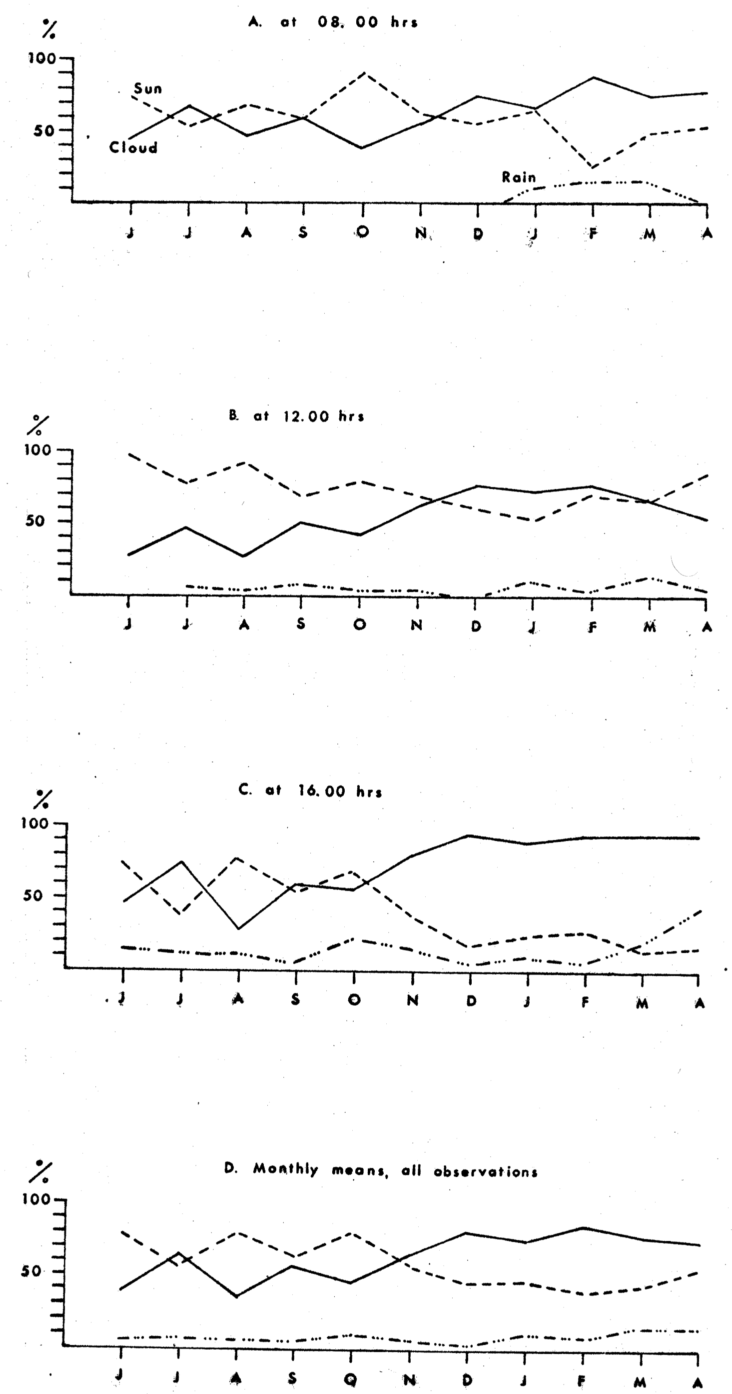

Fig.2.2 Monthly averages of cloudiness (% cloud cover), sunshine (% observations), and daytime occurrence of rain (% observations) at Koge (June 1972 - April 1973)

usually from the south or southeast, these were noted at Koge in November of 1971, in June, October and December during 1972, and in April of 1973. They were sufficiently strong to break branches, blow down large, old Casuarina trees on settlement sites, and flatten maize in exposed gardens.

Colonial history : a summary

In the following chronological summary, I outline events of the forty year period during which the region of Sinasina was increasingly incorporated into the colonial order of Papua New Guinea.

Initial penetration 1933-42[19]

1933	Taylor-Leahy expedition passed through northern Sinasina. Taylor attacked on return by eastern Tabari.
1933-34	Major mission stations established in central Chimbu by Catholics and Lutherans. Lutherans post teacher/catechists to at least four locations among the Tabari, and probably one or more among the Dinga. Catholics select possible station site among the Nimai after a survey through whole Sinasina area. Leahy brothers make a quick sortie through south Sinasina and across the Wahgi. South Sinasina probably not visited again until the 1940s.
1934-35	Two Catholic missionaries killed in Chimbu valley. Closure of region to further 'uncontrolled' movement. Direct mission activity within Sinasina apparently ended. Government station (Chimbu-Wahgi Post) established at site of Kundiawa : staffed by two European officers and a small force of New Guinean police. Satellite police posts established at Chuave in the east, Awagl in the west, and Goglme in the Chimbu valley.

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[19] Sources : general : Simpson (1954); missions: Anon.(1971); Frerichs and Frerichs (1969); government: Taylor (Mt.Hagen Patrol 1933); M.J.Leahy, (Diaries 1930-34); reports and correspondence by Bates, Downs, Kyle, and Warner Shand; Kundiawa Station Diary (1936-40); Vial (1941). Oral accounts from Nimai and Dom.

1935-36 Road-making, 'pacification', and early appointments of government-recognised headmen (village officials). Northern Sinasina, especially Tabari and Dinga, increasingly drawn into relationships with individuals and institutions of the emergent colonial order.

1937-38 Frequent inter-group fighting in north Sinasina; attacks on travellers and government forces. In May 1937, of a total of 88 deaths reported in fighting in the northern Chimbu region over the "last few weeks", 48 occurred in north Sinasina (Kyle, MR May 1937). By mid 1938, groups from Dinga, Dom, and Nimai were formally visiting the government station at Kundiawa.

1939-41 Patrols visiting the Nimai, and first courts held. First census of Dinga, Nimai, Tabari and Kere taken in April 1940: "...an area under complete control" (Downs, PR 28 March-9 April, 1940, p.2), though the Kere were to cause trouble a few months later (see Chapter 4). Government rest-houses built among northern groups, and official 'headmen' bolstered and groomed ("Numai - Diga - China Sina and Masul Headmen in conference", Kundiawa Station Diary, 14 June 1940). Pig 'farm', or pound, established at Koge in Nimai territory.

ANGAU inter-regnum 1942-46[20]

1943-44 Many northern Sinasina recruited by Allied forces for work in the Eastern Highlands. Dysentery epidemic struck Sinasina in 1944. At some point during ANGAU regime, Kundiawa no longer staffed and Chimbu administered from a post at Minj in the west, reporting to a headquarters at Mt.Hagen : conditions said to have deteriorated.

1945 Officer and five police stationed at Chuave. Censuses again taken, including south Sinasina for the first time.

Post-war 1947-1973[21]

1946-47 Fighting amongst Dom at Kagul (and amongst Kia and Kere south of the Wahgi) : short-term garrisons of police stationed amongst combatants. Lutheran and Catholic missions

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[20] Sources : government reports by Costelloe, Dennis, Jones, and Williams (see bibliography A) ; military history, Dexter (1961).

[21] Sources : general, Hatanaka (1972); Howlett et al.(1976); missions, Julius nd.; Knight (1971) politics and elections, Criper (1965) ; Hatanaka (1972); Kuabal (1976); coffee, Hughes (1966); Shand (1966); Shand and Straatmans (1974) government, see reports for relevant years in bibliography A.

re-enter Sinasina : the former with evangelists amongst all major northern groups, the latter with a head station under a European priest at Koge.

1950-51 First Sinasina indentured labour recruited under the Highlands Labour scheme. Branch road from Dumun (on future highway in Tabari territory) to Koge open for vehicles. Marriage 'taboos' reported to be breaking down. For administrative purposes, Sinasina population divided amongst four census divisions : the Dinga, Nimai, Tabari and Kere constituted the Sinasina division; the Dom were included with their fellow Dom speakers across the Wahgi in the Dom division; the Gunangi with groups to the south of the Wahgi in the Salt division, and the Kebai attached to Chuave in the east. Catholic store at Koge reported to have takings of £30-50 per month.

1952-53 Mission-government conflict over Lutheran 'villages' and allegiance of officials. Rudimentary schooling begun by missions. Initial promotion of coffee as a cash crop (See Table 2.5 for expansion of plantings). Road to Goroka opened for vehicular traffic.

1954-55 Road from Koge linking north Sinasina to south (Dom and Gunangi) surveyed and cut.

1956-57 Catholic store at Koge taking £195 per month, fourfold increase since 1951. Patrol post established south of the Wahgi at Gumine. Upgrading of mission primary education.

1958-59 First sales of Sinasina coffee. Appearance of first Sinasina owned stores.

1959-61 Local Government Councils established in Waiye (Kundiawa, including Dom), Yongamugl, and Chuave regions. Head tax instituted in Sinasina. Road from Koge eastwards through Kere to Ubanidiawa cut.

1962-63 Sinasina consider their region suffering official neglect : in the south, some Gunangi build their own 'Government station' at Igidi; in the north, village officials call for the establishment of a patrol post. 50 per cent of northern Sinasina men had established coffee holdings. Expatriate-owned store opened at Mauro on highway : seven Sinasina owned stores reported.

1964-65 First National elction held, with Sinasina divided among 3 electorates. Kundiawa Coffee Society (KCS) a grower's co-operative formed, and purchased factory near Kundiawa : considerable membership from north Sinasina. Society enjoys purchasing monopoly until 1966. Sinasina council formed, despite attempts by some Dom and Kebai to join neighbouring

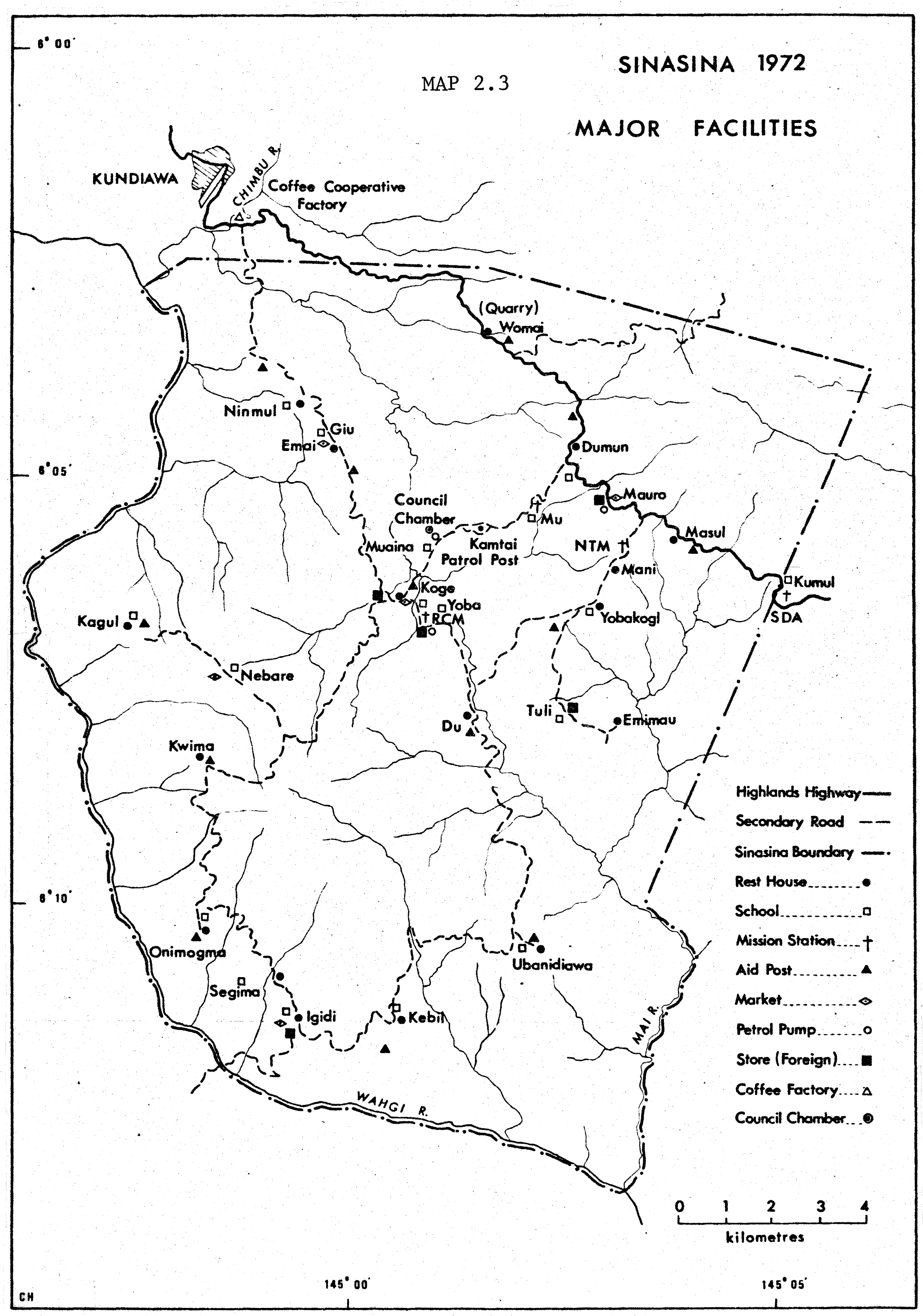
TABLE 2.5 Distribution of coffee trees and growers by major Sinasina groups in 1962 and 1972[1]

Groups	Number of trees		Number of growers		Trees per grower		Trees per capita[2]	
	1962	1972	1962	1972	1962	1972	1962	1972
North Sinasina								
Tabari	149 329	582 135	1 203	1 519	124	383	18	60
Nimai	23 573	103 782	320	450	74	230	13	51
Dinga	87 613	155 660	744	623	118	250	24	38
Kere	13 774	53 164	292	250	47	215	7	23
subtotal	274 289	894 741	2 559	2 842	107	315	17	49
South Sinasina								
Dom	26 894	76 399	366	397	74	192	10	28
Gunangi	16 264	187 394	187	859	87	218	4	47
Kebai	N A	42 334	N A	237	N A	180	N A	55
subtotal	43 158	306 127	553	1 493	78	205	7	41
Total	317 447	1 200 868	3 112	4 355	102	277	14	47

(1) Sources : 1962 for North Sinasina, Hardie (CPR 1, 1964/65, p.13, citing DASF 1962); for South Sinasina, Parker (CPR 5, 1964/65,p.9, citing DASF counts of 1961-63).
1972 DASF "Coffee census-Sinasina", Kundiawa File No.4-1-A.

(2) For population figures, see Table 3.1. South Sinasina figures for 1962 were not available, and 1967 ones were used instead. It is unlikely that use of these depress the South Sinasina trees per capita figures by more than one.

MAP 2.3


SINASINA 1972
MAJOR FACILITIES
6° 00′
6° 05′
6° 10′
145° 00′
145° 05′
KUNDIAWA
CHIMBU R.
Coffee Cooperative Factory
(Quarry)
Womai
Ninmul
Giu
Emai
Dumun
Mauro
Council Chamber
Mu
Muaina
Kamtai Patrol Post
NTM
Masul
Mani
Kumul
SDA
Koge
Yoba
RCM
Yobakogl
Kagul
Nebare
Tuli
Emimau
Du
Kwima
Onimogma
Segima
Igidi
Kebil
Ubanidiawa
MAI R.
WAHGI R.
Highlands Highway
Secondary Road
Sinasina Boundary
Rest House
School
Mission Station
Aid Post
Market
Petrol Pump
Store (Foreign)
Coffee Factory
Council Chamber
0 1 2 3 4
kilometres
CH

ones. Two expatriate trading companies operating five stores in region. Administration post established first at Koge, later moved to Kam tai (Map 2.3). Small market established at Koge. Expansion of primary education facilities.

1966-67 Chimbu achieved District status (previously a subdistrict of the Eastern Highlands, administered from Goroka). Considerable public works initiated by new Sinasina council. Following financial problems of KCS, private buyers established in Sinasina. 'Take-off' in locally owned retail stores : 150 by 1967 (9 in Koge alone); 344 by 1970/71.

1968 Second national election : 'Sinasina' electorate included northern neighbours, the Yongamugl. One of two candidates from the latter group outvoted the 14 Sinasina contestants.

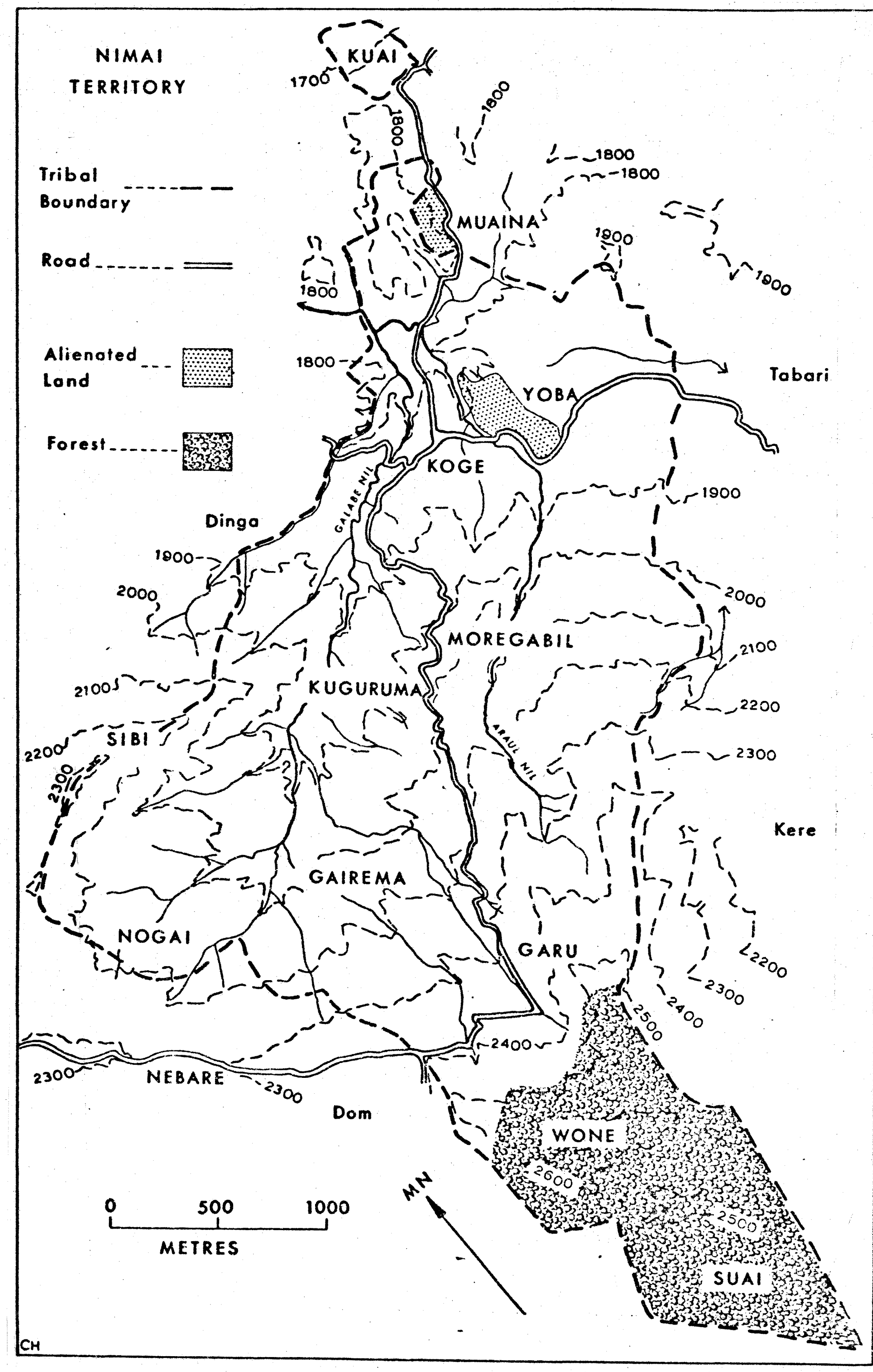
1969-71 Cracks in council unity : rumour that southern Gunangi wished to secede to join the newly formed Salt-Nomane council. Administrative inputs to south boosted. In 1971, idea of a united Dom council again floated. Fourth Sinasina council elections held in late 1971.

1972 Third national election : Somare's National Coalition took power. Demonstrations in Chimbu, and much discussion in Sinasina, opposing self-government and independence. Chimbu Area Authority formed, with each council represented by two delegates. Sinasina High School planned. Unsuccessful primary school leavers 'riot' at end of year.

As sketched in this summary, the economic and political incorporation of Sinasina, although beginning in the 1930s only gathered momentum after 1950. Nevertheless, events and processes set in train before 1950 - 'conquest', awareness of a world beyond the narrow precolonial limits, and the realisation of the wealth and power of the outsiders - fundamentally affected the ways in which Sinasina responded to the opportunities and constraints of the following twenty years. During the latter period change was increasingly rapid: for many bewilderingly so as the 1960s drew to a close and the final rush to national self-government and independence began. Despite the rapidity of change, and the obvious overlay of a developmental infrastructure on the Sinasina landscape (Map 2.3), fundamental re-structuring of the regions's rural economy and society had not taken place by the early 1970s. Cash cropping and labour migration were the two most significant means by which the lives of the majority were articulated with areas and markets outside the region, but the former was partially integrated into previous patterns of land and labour allocation, and the latter remained primarily circular. Within Sinasina, group structure, inter-group relations, land tenure and the underlying pattern of land use, continued to operate in ways owing much to the past, although all were subject to new sets of constraints.

Social groups and inter-group relations

I have described the Sinasina population as divided among seven large, named, territorial groups, which, to follow earlier usage, I call tribes (Map 2.2). Each of these is composed of a hierarchy of sub-divisions, of which the most significant are clans (named, territorial, exogamous units), subclans (named, partly territorial units), and men's house groupings (usually locationally named units). In most essentials, this segmentary form of Sinasina social organization agrees closely with that described for the neighbouring central Chimbu area (Bergmann 1971; Brown 1960, 1962, 1964, 1967b, 1969, 1970s; Brown and Brookfield 1963; Criper 1967; Nilles 1943/44, 1950). That is to say, the pre-dominant ideology of group structure is patrilineal, members are primarily recruited to groups through patrilineal links, most land is inherited patrilineally, and marriage is usually followed by the wife moving to live with her husband in the latter's clan territory. No


NIMAI
TERRITORY
Tribal Boundary
Road
Alienated Land
Forest
KUAI
MUAINA
YOBA
KOGE
Tabari
Dinga
MOREGABIL
KUGURUMA
SIBI
GAIREMA
NOGAI
GARU
Kere
NEBARE
Dom
WONE
SUAI
GALABE NII
ARAUL NII
0
500
1000
METRES
MN
CH
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600

MAP 2.4

major emphasis is placed on genealogical reckoning, and, in situations of dispute, claims based on the quality of relationships as expressed in care and gifts may outweigh those based on genealogy alone. Relationships created by marriage, established, maintained, and monitored by extensive flows of gifts and assistance, are of great significance. Given the size of exogamous units (c.300-700, but previously larger), and the wide dispersal of members' affinal links, the social field of most individuals' relationships extends throughout the Sinasina region and beyond.

Following the suppression of warfare in the 1930s and 1940s (inter-group fighting on a large scale did not break out again until late 1973), Sinasina inter-group relations were predominantly focused on exchange occasions. As in central Chimbu, these include pig festivals (bona gene), the largest of Sinasina ceremonial events which, in recent years, have been held every 7-10 years by groups at usually the tribal level, 'food-pile' prestations (komina bire) between groups of varying size, and, at lower levels, exchanges between affines at marriages, and between matrikin, and compensation payments made in the event of some deaths. Of central concern in the latter part of this study are pig festivals (for central Chimbu descriptions, see Bergmann 1971; Brown 1972; Criper 1967; Gande 1974; Knuttson 1978). In recent years these have been co-ordinated in Sinasina at the level of groups with populations of several thousand. Between 1968 and 1974, for instance, the sequence of festivals was Gunangi and Kebai (1968), Nimai and

Dinga 2[22] (1969), Tabari 1 (1972), Dom (1972), Dinga 1 (?1973), Tabari 2 and Kere (1974). Although co-ordinated at these higher levels, most of the activity associated with a festival is decentralized at the major settlement sites of the constituent lower-level groups, usually parts of clans with their own ritual centres (*ere more*). Unlike central Chimbu, Sinasina do not have separate ceremonial grounds, where, at the time of a festival, long lines of temporary housing are constructed (Brookfield 1968). Instead, settlement housing is refurbished or rebuilt, and guests are accomodated in their host's own houses during the final few days of the festival. In other respects, Sinasina festivals generally resemble those reported for central Chimbu. That is to say. they involve co-ordinated planning culminating in a festival period of 6-12 months during which guest dancing groups visit the hosts, and a final climax at which considerable numbers of large pigs are slaughtered and pork is presented to relatives and friends. Elsewhere I will describe the form and sociology of these exchanges : in this study my major concern is with their influence on production.

Political and economic conditions in 1972-73

The period of research coincided not only with the 1972 drought but also with a period of unsettled economic and political conditions. On the economic front a downturn in international coffee prices had important ramifications throughout the monetary economy of the highlands, while politically the move towards self-government following the 1972 national elections had significant effects at all levels of Sinasina and Chimbu society.

The price of coffee fell in 1971 (Fig.2.3) as a result of Papua New Guinea'a limited access to the world market. In January 1972 the Pacific Islands Monthly described New Guinean coffee growers as suffering a "slump" (Vol.43, No.1, p.106). Reporting later that only two-thirds of the total production for the year ending March 1972 had been sold, the same journal noted that New Guinean growers were "angry", and commented on the "politically sensitive" nature of the problem (Vol.43, No.6, p.115). By early 1972 a rumour ran through Sinasina that coffee was "finished", and people were reported to be saying that they would cut out their coffee trees. Throughout most of 1972 coffee prices were a major subject of discussion in Sinasina council meetings, and, less formally, in men's houses. It is probable that all money use was affected (Fig.2.4). For the year ending 30 June 1972, the largest foreign-owned company with major trading interests in Sinasina (Collins and Leahy Holdings Ltd.), reported a fall in trading profits from $335,257 to $75,081, and an 18.9 per cent decrease in turnover : according to the company's annual report, the "lower coffee prices which prevailed throughout the year reduced the monies available for spending in the group's retail outlets by the 60,000 indigenous coffee farmers in the company's trading areas. Sales from this source normally comprise 60 per cent of turnover" (Collins and Leahy 1972:3). In similar vein, the newly elected Sinasina MHA reported, in an address at Koge market in May 1972, that he had told the national Assembly in his maiden speech, that "in 1971-72, the price of coffee fell and all the small locally-owned tradestores suffered, and the few men owning business trucks collapsed...".

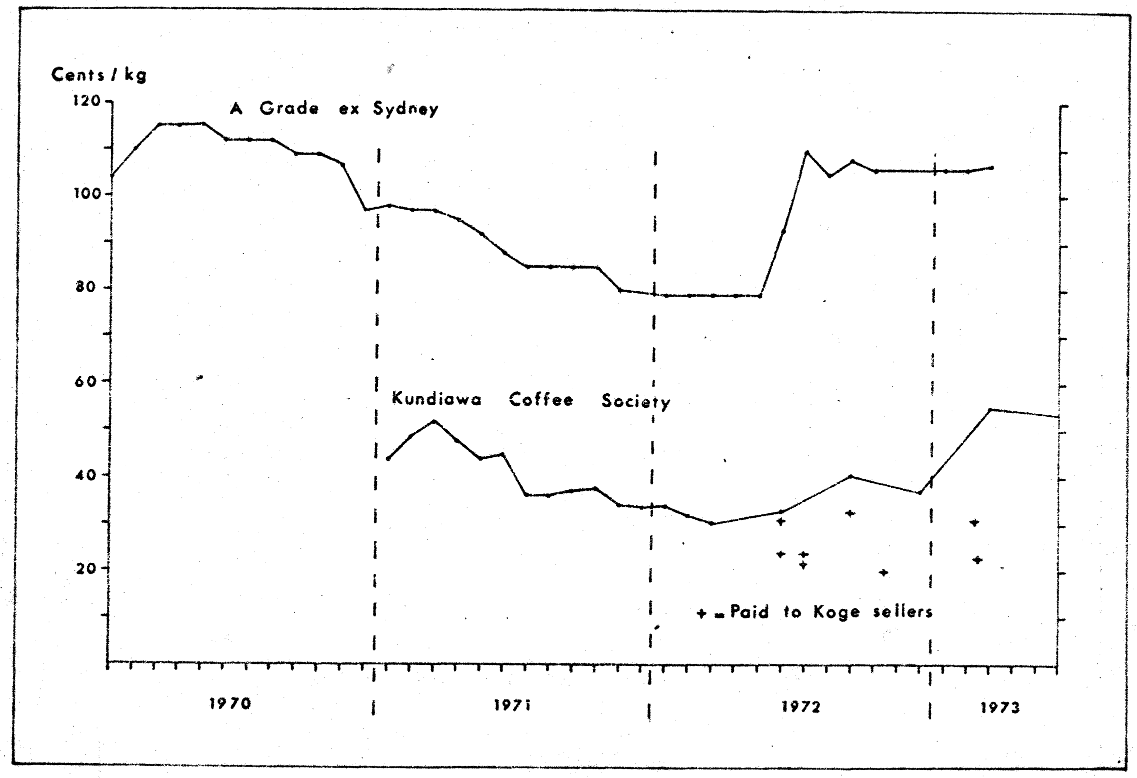


Fig.2.3 International, regional, and local coffee prices 1970-73

(Sources : the international prices, for green bean, are taken from produce price quotations appearing in each issue of Pacific Islands Monthly; the regional prices are the average prices paid for parchment coffee purchased by the Kundiawa Coffee Society: monthly averages for the period January 1971 to March 1972 were calculated from approximate weekly figures kindly supplied by the KCS, while the subsequent figures are taken from Howlett et al.1976: 227; the local prices are occasional observations of prices paid to Nimai Waula sellers of parchment at Koge).

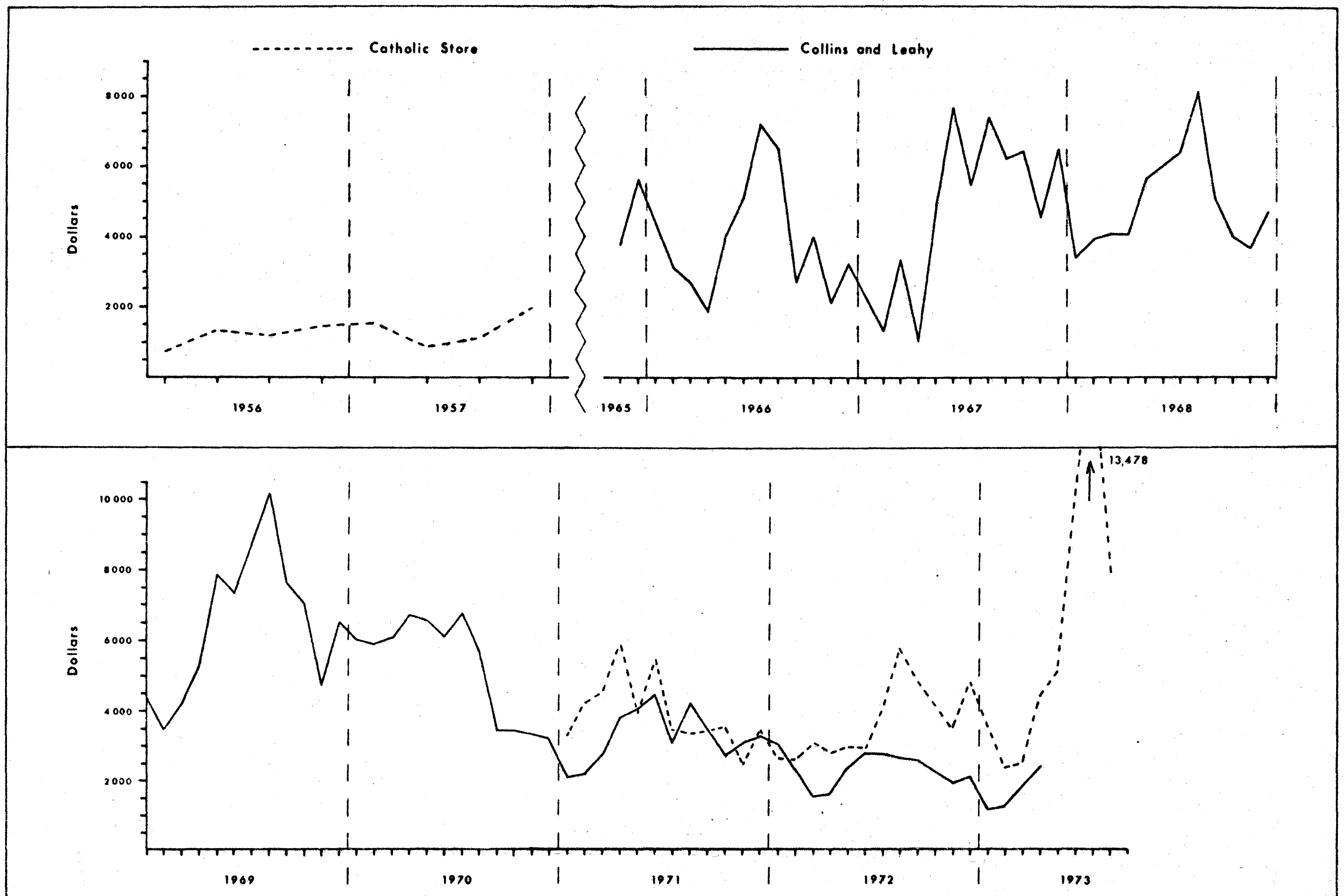


Fig.2.4 <u>Trading figures from two expatriate-owned stores at Koge</u>

What made this coffee price depression particularly sensitive politically was its conjunction with the rapid political changes occurring in the early 1970s. Many saw this conjunction of economic and political insecurity only as a threat. On April 6 1972, for instance, some 300 central Chimbu from the Wandi area marched into Kundiawa and demanded that the new Papua New Guinea flag be lowered from the District Office, on the grounds that coffee prices had declined ever since the flag had been raised. Others, and they were a definite minority in Sinasina in early 1972, interpreted the situation as an opportunity for beginning a much-needed process of decolonization. Throughout the period of research politics at the levels of both the Sinasina council and the wider Chimbu arena (formalized in late 1972 with the creation of the Area Authority), centred on such issues. Though outside the scope of this study it is necessary to stress that the climate of uncertainty in which this debate flourished, and which it in turn fueled, permeated Sinasina at the time. Although large-scale inter-group fighting had not resumed in Sinasina, after a 20-30 year period of 'pacification', as it had further to the west, it did very shortly afterwards. The inter-group exchanges reported in this study need to be seen within this wider context.

CHAPTER 3

Demography

Introduction

Some general characteristics of the Sinasina population - the high crude density and the broad pattern of distribution - were described in the preceding chapter. In this chapter I examine, at various levels, selected aspects of the demographic history of the region during the colonial period. After a preliminary overview of the sources, my starting point is with the finding of previous studies that, despite improving access to new medical services, the rate of population growth since the early 1950s has been relatively low. Following Bowers (1971), it is suggested that this may be due, in part at least, to the movement through the population of a set of cohorts diminished by epidemics in the early part of the colonial period, one of the consequences of which could have been a low birth rate. Recent population dynamics are examined in more detail at the micro-level of the single clan of Nimai Waula. Finally, after a brief examination of the high, but variable, masculinity ratios, the major migration trends are outlined.

Sources of demographic data

There are three sources of information on Sinasina population. At the most general, and indirect, level, there are the two national censuses (in 1966 and 1971, see Bureau of Statistics 1969,1974), which aggregate figures at the level of the whole Chimbu province. Since the Sinasina population is only 13 per cent of the provincial total these are of limited use, though their findings on growth and vital rates, and aspects of migration, will be cited where relevant. Of considerably more use for Sinasina, and the subdivisions within it, are the quasi-annual censuses conducted by the Department of District Administration (DDA). These counts are based on census units which, since they generally coincide with sub-clans or similar groupings, can be aggregated to give figures for the named social units (clans, tribes) which relate closely to on the ground groupings (cf.Brookfield and Brown 1963:72-3; Bowers 1971:14). Finally there are field materials, based on house to house censuses, interviews, and the recording of demographic events, which were collected during 1972-73 among the members of the one small Nimai clan of Waula.

The first DDA census of some Sinasina populations was carried out in 1940 (Downs,PR,28 March-9 April,1940), but does not appear to have survived the war. Further counts which did survive, were made in 1941 and 1945. After a break between 1945 and 1950, quasi-annual censuses were taken. Table 3.1 gives some figures for the Nimai (with its component clans), and for other Sinasina tribes, with subtotals for the 'North Sinasina' grouping of the Tabari, Dinga, Nimai and Kere, and a 'South Sinasina' consisting of the Gunangi, Dom and Kebai. After 1972 the census format was changed, and, in 1975, the system was replaced by a ten per cent sample survey (see Howlett _et al_. 1976:66-67, and Harris 1977, Appendix A, for details).

Examination of the census material between 1941 and 1971 suggests that both the earliest and the latest counts are inaccurate. The 1941

TABLE 3.1 Some DDA population figures for various Sinasina groupings[1]

Census dates (month/year)	North Sinasina								North Sinasina total	South Sinasina			South Sinasina total	Sinasina total
	Nimai clans				Nimai total									
	Dugul	Bomai	Waule	Ogole		Dinga	Tabari	Kere		Dom	Cunangi	Kebai		
9-10.1941	486	528	183	-	1 197	2 200	4 913	1 486	9 796	-	-	-	-	-
2,7-8.1945	-	-	-	-	964	2 522	-	-	-	1 900	2 841	538	5 279	-
3-5.1950	-	-	-	-	1 522	3 009	6 447	1 669	12 647	2 164	3 145	630	5 939	18 586
9.1951	620	586	235	125	1 566	3 044	7 649	1 731	13 987	-	-	-	-	-
8.1952	628	582	231	132	1 573	-	-	-	14 224	-	-	-	-	-
1.1954	-	-	-	-	-	-	-	-	14 605	-	-	-	-	-
9.1954	661	611	246	134	1 652	3 296	7 961	1 814	14 723	-	-	-	-	-
8.1961	-	-	-	-	1 828	3 601	8 258	2 040	15 727	-	-	-	-	-
12.1962 - 3.1963	747	699	260	158	1 864	3 668	8 441	2 083	16 056	-	-	-	-	-
8-9.1964	754	730	270	161	1 915	-	-	-	16 444	-	-	-	-	-
10-11.1965	783	737	272	162	1 954	-	-	-	-	-	-	-	-	23 954
10-11.1967	786	773	277	164	2 000	4 043	9 286	2 256	17 585	2 618	3 886	753	7 257	24 842
1-5.1969	802	799	284	161	2 046	-	-	-	-	-	-	-	-	25 357
4-6.1970	795	774	278	158	2 005	-	-	-	-	-	-	-	-	25 194
4-7.1971	800	769	285	162	2 016	4 097	9 764	2 296	18 173	2 763	3 974	769	7 506	25 679

[1] Notes on sources on following page

[1]Sources for Table 3.1

1941 Warner Shand (PR M.10,1941/42).

1945 For Nimai, Dennis (CPR 6,1944/45,p.3, though his CPR 11,1944/45, which was viewed but not copied, may be more accurate). For other groups, Dennis (CPR 2,1945/46) : I have adjusted his Kebai and Gunangi figures by transferring one Gunangi subgroup (Maimagu, with a population of 175) from the former to the latter, and also by excluding one Kebai group (Aula, with a population of 203), which was noted as located east of the Mai river and which does not appear in later censuses. It may also be noted that in February 1945 Jones (CPR 9,1944/45) also censused part of Dinga, and Dom, but his figures were considerably lower than those of Dennis.

1950 Burfoot (CPR 1,1950/51,Appendix B). His definition of Tabari cannot have been as inclusive as that of Kelaart in the following year (see below).

1951 Kelaart (CPR 2,1951/52,Appendix A). To conform with later censuses, I have adjusted his Nimai and Dinga figures by transferring Nimai-kirine (with 155 persons) from the latter to the former, and have changed his North Sinasina total (of 14,063) to the corrected one given by Hayes in the following year. The abnormal increase shown by his Tabari figure, relative to the 1950 figure, was presumably due to his inclusion of Tabari living at Ogonimo, north of the Porol range, not previously included (ibid.,9). Kelaart's Tabari figure, like those for 1952 and 1954, also include two census units (Boiku and Maneku) of the Ewaneku (or Ewanigu) clan, which were later (between 1954 and 1961) transferred to the Chuave Census Division. I do not have population figures for these units in 1951, but in 1954, they had a combined total of 506 persons (Colman,CPR 4,1954/55). For the purpose of estimating Tabari, and North Sinasina, population increase over the period 1951-71, the 1951 Tabari population is estimated at 7,163 (i.e. minus an estimated Ewaneku population of 486 - calculated by assuming Ewaneku grew at the same rate as the total Tabari population between 1951 and 1954), and the North Sinasina total at 13,504.

1952 Hayes (CPR 5,1952/53,Census and pp.19-20).

1954 For January, Harris (CPR 8,1953/54), and for September, Colman (CPR 4,1954/55). For the purpose of estimating Tabari and North Sinasina population increase (see Table 3.2 below), I exclude the two Ewaneku clan census units (Boiku and Maneku) with a combined population of 506, to give revised totals of 7,455 and 14,217 for this year.

1961 For census date, Lambden (CPR 1,1961/62). For figures, Shand and Straatmans (1974:35).

[1]Sources for Table 3.1 (Continued from previous page)

1963 Lewis (CPR 5,1962/63,p.21).

1964 Humfrey (CPR 3,1964/65).

1965 Nimai figures from Sinasina LGC tax records for 1967/68; Sinasina total from Clayton (CPR 9,1966/67).

1967 From census records held at Sinasina LGC office.

1969 Calculated from Sinasina population register (1958-69) held at Sinasina LGC office.

1970 Stott (CPR 14,1969/70). Noting the decrease from the previous year's figures, Stott states that the previous base registers had been lost and that new ones had had to be made. However, Hatanaka (1972:Table 1.2,p.11) gives a different total for Sinasina of 26,357, the origin of which is unclear.

1971 From census records held at Sinasina LGC office.

and 1945 censuses appear to be definitely incomplete.[1] In the 8½ years between 1941 and 1950, for instance, the Nimai increased by a total of 27 per cent, the Tabari by 31, the Dinga by 37, and the Kere by a more reasonable 12 per cent. Irrespective of natural growth, these increases must include some residents who avoided or missed the earlier count, as well as refugees from earlier fighting returning to their previous homelands. The large drop shown by the Nimai between 1941 and 1945, 19 per cent in 3½ years, though tallying with accounts of wartime epidemics, was presumably due to the hasty nature of the latter census (see fn.1 above), since an impossible 58 per cent increase in the following five years would have been required to reach the 1950 figure. Confirmation of the latter by subsequent censuses strengthens the case against the earlier counts (for a similar appraisal of the 1940s censuses in central Chimbu, see Brookfield and Brown 1963:73).

From 1951 until 1969 the total numbers given by the censuses appear to be reasonably reliable, though the size of some annual increases between 1951 and 1954 (Table 3.2;cf. Brookfield and Brown

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[1] As was realised by officers at the time. Downs, for instance, commented on the first (1940) census that "(c)ensus checks in Naregu (i.e. central Chimbu,RH) showed that original census compared with first check was 85 per cent complete. It is hard to say whether or not as many new names will be obtainable in the areas just covered the first time they are checked. The census was carried out in a methodical manner and the natives had a week's notice" (Downs, PR, 28 March-9 April, 1940,p.4). The census of the Nimai in February 1945 was described by the officer as only a "line count" (Dennis, PR 6,1944/45, p.2).

1963:73), suggest the inclusion of some previously unrecorded persons. A few difficulties result from boundary changes, or from different aggregations of the basic census units. Several are described in detail in the notes to Table 3.1 (see especially 1945, 1950, 1951). One which should be noted here is the inclusion of two census units (Boiku, Maneku) belonging to the Ewaneku (also Ewanigu) clan in the Tabari, and hence North Sinasina, totals between 1951 and some time between 1954 and 1961 when they were transferred to the Chuave census division. This change affects calculations of Sinasina growth rates in the 1950s.[2]

After 1969 there are again problems of reliability. According to Stott (CPR 14, 1969/70, Appendix A) the basic population registers were lost before the 1970 census, which presumably explains at least some of the decrease between 1969 and 1970 in both the Nimai and Sinasina totals (Table 3.1). Some of the Nimai decline was also due to the permanent out-migration (at least 8 families between 1969 and 1972; see Table 3.6 below), to the oil palm resettlement blocks at Cape Hoskins in West New Britain. More generally, however, G.T.Harris (1977, Appendix A) has described a decline in the accuracy of Chimbu, and other censuses since 1969, and especially since the 1972 change in census format. He concludes that deterioration "has reached the point where little reliance can be placed on them" (ibid.).

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[2]It may be partly responsible for the very low annual growth rate of 0.3 per cent per annum given by Hatanaka (1972:11) for the whole of Sinasina between 1955/56 and 1965/66. On North Sinasina evidence, this is too low (see Table 3.2, and pp. 65-8).

Thus DDA census material for Sinasina is incomplete for the period 1941-51, relatively good for the period 1951-67, and is suspect after 1969. This evaluation refers only to total population numbers, not to age estimates or the recording of vital events. The accuracy of the latter data in DDA censuses in general have been the subject of a number of critical reviews (McArthur 1966; Brown and Winefield 1964).

Population growth 1951-71

A number of studies have estimated that the total Chimbu population (including absentees) has grown slowly by comparison with many other parts of Papua New Guinea. Between the 1966 and 1971 national censuses, for instance, Chimbu was one of four provinces sharing the lowest annual growth rate of 1.6 per cent, in contrast to the national average of 2.5 (Howlett et. al.1976:39, see also pp.30-40 for a review of studies to 1975). According to DDA censuses, North Sinasina population growth between 1951 and 1971 has been similarly low with an annual increase of 1.5 per cent, and similar rates for each of the two decades (Table 3.2).

The latter decade, however, includes the suspect post-1967 figures. Between 1967 and 1971 the North Sinasina annual growth rate apparently dropped to 0.9 per cent, while the rates of three of the four northern tribes were less than 0.5 per cent (Table 3.2). These rates partly disagree with those calculated by Smith in his re-analyses (1971,1975) of rates projected for 12 Chimbu communities by an interdepartmental study of land scarcity in the early 1960s (TPNG 1967). Two of the communities defined by that study covered the whole of North Sinasina : community 8, which included all of Tabari

TABLE 3.2 <u>Annual rates of population growth in 4 North Sinasina groups for various periods between 1951 and 1971</u> [1,2]

Inter-censal periods		Tabari	Dinga	Kere	Nimai	North Sinasina Total
Dates	Years					
1951-54	3.00	1.33	2.65	1.56	1.78	1.72
1954-61	6.92	1.48	1.28	1.70	1.46	1.46
1951-61	9.92	1.43	1.69	1.66	1.56	1.54
1961-67	6.17	1.90	1.88	1.63	1.46	1.81
1967-71	3.58	1.40	0.37	0.49	0.22	0.92
1961-71	9.75	1.72	1.32	1.21	1.00	1.48
1951-71	19.67	1.58	1.51	1.44	1.28	1.51

(1) Source : Table 3.1 for data base (but see notes to 1951 and 1954 adjustments).

(2) $\text{Rate} = \frac{\log_e (P_2 / P_1}{n} \times 100$ where n is the number of years between censuses.

(plus the two Ewanigu census units later transferred to Chuave, see p. 64 above), and community 9, which included the Dinga, Kere and Nimai (ibid.,17-19). For community 8, Smith calculated annual growth rates of 2.15 per cent between 1962/63 and 1969, and 1.6 per cent between 1962/63 and 1971/74 (1971:2, 1975:Table 1),[3] which are reasonably close to my figures of 1.9 for 1961-67, and 1.7 for 1961-71, for the slightly smaller unit of Tabari without Ewanigu (Table 3.2). Smith's figures for community 9, on the other hand, contrast markedly with those calculated here. For the period 1962/63 to 1969, he reports a massive annual rate of 3.13 per cent (1971:2), falling off to 2.0 per cent (1975:Table 1; 2.21 per cent in G.T.Harris, 1978:287), when calculated for the period 1962/63 to 1971/74. In contrast, my figures, recalculated for the three tribes (Dinga, Kere, and Nimai) as an aggregated unit, are 1.71 per cent for the former period, and 1.22 per cent for the latter. The discrepancy between these two sets of rates results from our use of different population figures for community 9 at the later dates : Smith using totals of 9043 in 1969, and 9280 in 1971/74, compared to my figures of 8299 in 1967, and 8409 in 1971 (Table 3.1). Since we both record the same total of 7615 for 1962/63, one of us has presumably made an error in aggregating the 60 census units composing community 9 at the later census

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[3]Due to the indeterminacy of his dating of the latter census, the post-1969 growth rate unfortunately cannot be calculated from his data.

dates.[4] Without the original census data at hand to check, the community 9 discrepancy can only be noted at this time, though I am inclined to doubt the possibility of an increase as large as 3.13 per cent.

G.T.Harris, using Smith's (1975) data on all 12 Chimbu communities (i.e. a total population of 87, 632 in 1962/63), describes a drop in the annual growth rate from 1.52 per cent between 1962/63 and 1969, to 1.26 per cent between 1969 and 1971/74, which he suggests could have been the result of a decline in the birth rate (1978:292). Although he is sceptical, in a later paper (1977,Appendix A), of the accuracy of recent censuses, especially those after 1972, he notes that the low rates of increase they show have been found "in a number of communities, censused from different sub-district headquarters and by different personnel"(ibid.), implying the possibility of a real decline. In the Sinasina case, however, the known loss of the census registers in 1969/70 make firm conclusions about the growth rate, and hence also the birth rate, impossible.

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[4] Which is never difficult given the differences between the listing of census units in the census registers or forms, and the aggregations of such units needed for other purposes. A further problem is the occasional presence of two census units of the same name within the same census division. For instance, Hatanaka's table (1972:12) of Sinasina tribal populations in 1968-69 gives community 9 a population of only 7951, i.e. more than a thousand less than Smith's figure. This is probably due to her misplacing census unit Siba (No.2) amongst the Gunangi, and census unit Siba (No.1) amongst the Dinga. Since the latter unit had a population (in 1971) of only 118, in contrast to the 547 of the larger Siba (No.2), the result is a considerable error (ibid.18, Table 2.1, which shows an unmarked Siba unit with a population of 557 in Gunangi).

DDA data on vital rates (crude birth and death rates) are also not very helpful. Some scattered information for North Sinasina and Nimai (Table 3.3) shows low rates, but these are calculated on the total population figures including absentees. Most observers assume that birth and death figures recorded by DDA are subject to considerable underreporting, especially of children dying young, and rates estimated for the whole of Chimbu from the 1966 and 1971 national census data are considerably higher (i.e. a birth rate of 44, and a death rate of 17, in 1971, Howlett *et al*.1976:35-6).[5]

The effect of epidemics

Although age estimates in the absence of record keeping are notoriously difficult, and thus no great confidence should be placed on the accuracy of the five year periods shown in Figs. 3.1 and 3.2,

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[5] A closer look at the Nimai population in 1969 shows how different assumptions about the proportion of children dying before the age of 5 years (the majority presumably dying in the first year of life), and the size of the population used as a basis for calculation, affect estimates of the birth rate. In 1969 there were 272 children aged 0-4 years, and the total population had risen from 1954 to 2046 between 1965 and 1969, giving an inter-period figure of 2000. Absentees ranged from 6.8 per cent in 1963 to 15 per cent in 1970, thus a rough estimate of 10 per cent for the period should not be far wrong. The following table shows four estimates of the average Nimai birth rate over the period 1965-69.

TABLE 3.4 Four estimates of the Nimai birth rate 1965-69

Percentage of children surviving 0-4 years	Average births per year	Estimated birth rate for	
		Total population (2000)	Resident population (1800)
80	68	34	38
70	78	39	43

TABLE 3.3 Some vital rates for North Sinasina and Nimai at various dates between 1951 and 1971[1,2]

Dates	North Sinasina				Nimai			
	Birth rate	Death rate	Natural increase rate	Growth rate	Birth rate	Death rate	Natural increase rate	Growth rate
1951-52	37.8	19.7	18.1	18.5	26.4	19.5	6.9	4.9
1952-54	29.9	13.2	16.7	18.9	-	-	-	-
1954	31.3	21.6	9.7	14.5	40.4	19.4	21.0	14.6
1961-62/63	24.0	9.4	14.6	13.9	20.0	6.8	13.2	13.1
1962/63-64	33.3	12.8	20.5	16.0	33.9	12.2	21.7	19.2
1969-70	-	-	-	-	31.1	1.8	29.3	-16.2
1970-71	26.9	9.1	17.8	17.7	22.8	8.9	13.9	5.5
Means	30.5	14.3	16.2	16.6	29.1	13.4	15.7	11.5

(1) Sources : DDA censuses (see sources for Table 3.1).

(2) All rates calculated per 1000 population per annum. In most cases inter-censal periods were not exactly 12 months and rates have been recalculated.

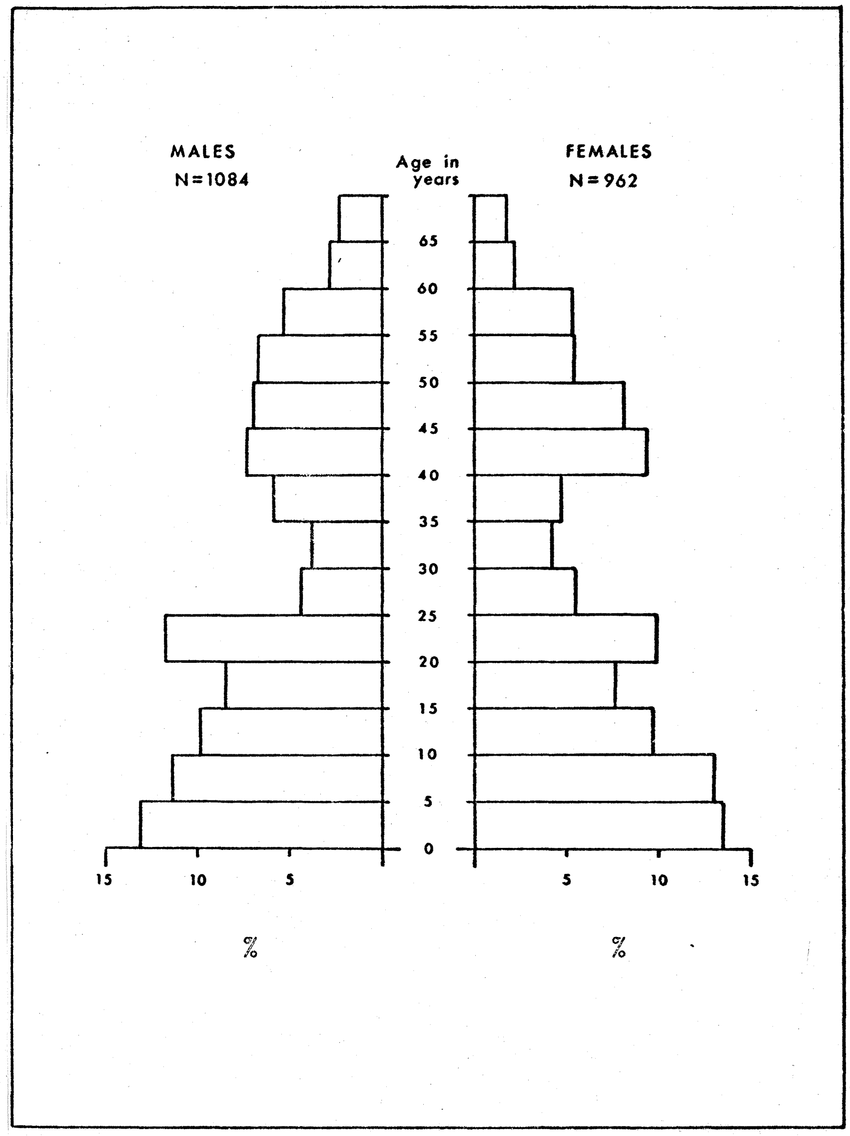
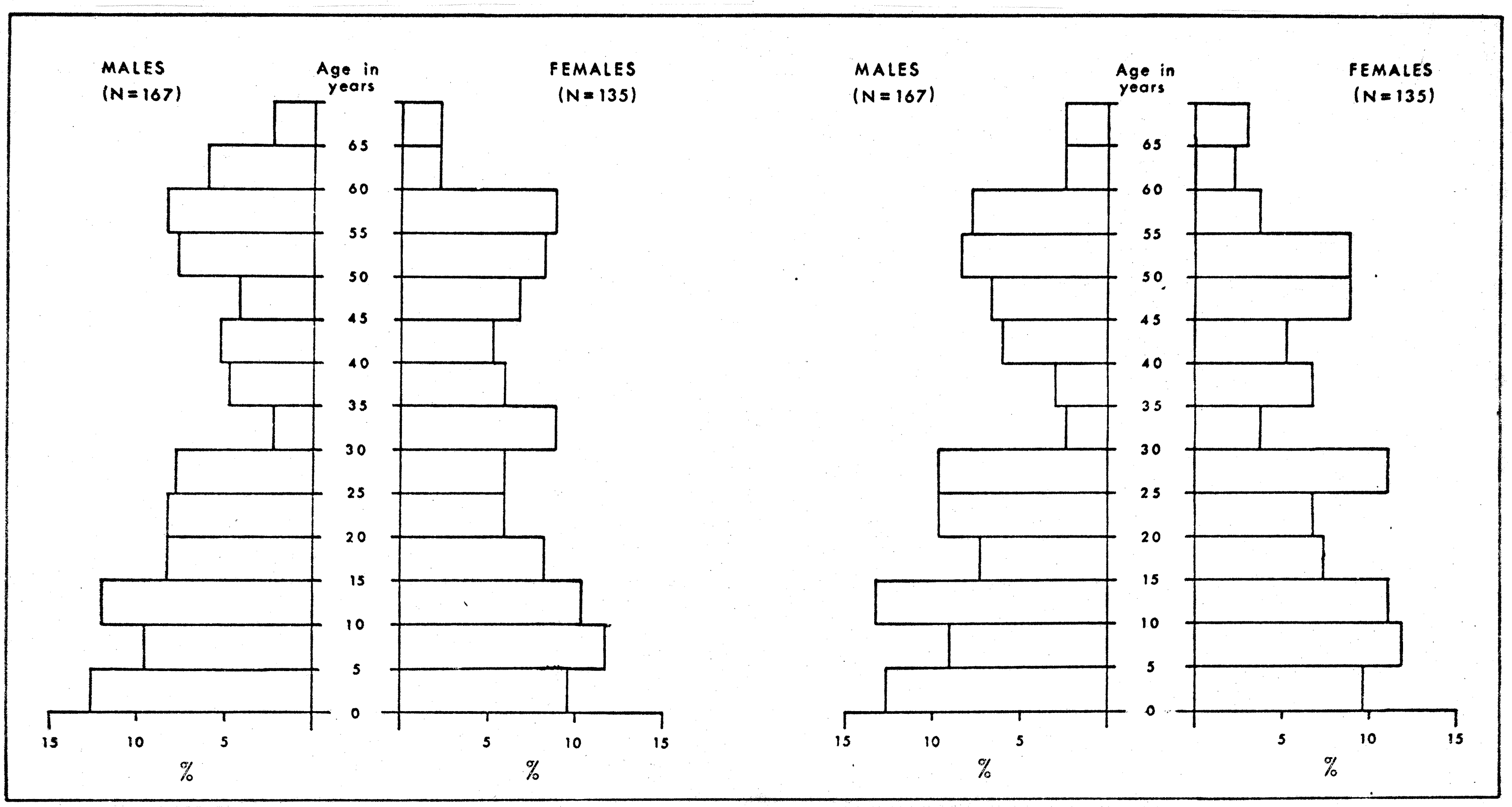


Fig. 3.1 <u>Nimai population 1969</u>

(Source : Appendix 2)



A. Field age estimates

B. DDA age estimates

Fig. 3.2 <u>Waula population 1972</u>

(Source : Appendix 2)

at least before 1950,[6] the reduced numbers of persons aged either between 30 and 49 years according to field estimates of the Waula population (Fig.3.2A), or between 30 and 44 years according to DDA estimates of Waula and Nimai (Figs. 3.2B, 3.1), i.e. those born between c.1922/27 and 1942, are striking. If, as seems likely, the DDA age estimates were first recorded in 1950-51, the disproportionately large number of persons born between 1943 and 1949 (i.e. those aged 20-24 years in 1969, Fig. 3.1), may have been due to consistent under-estimation of the ages of children aged over five years at the time. However, even if allowance is made for such bunching, reductions would still exist in the preceding three cohorts, and it is possible that they may be due to heavy losses sustained during epidemics in the early colonial period.

It is well-known that some of the smaller populations of the fringe areas of the New Guinea highlands suffered appallingly heavy mortality during the initial contact period. For instance, estimates of up to 60 per cent depopulation have been reported in the Southern Highlands (Bulmer 1972:120-1). Although there is no reason to believe

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[6]After 1950 the fairly regular censuses, and, in the case of Catholics, mission records of births, marriages and baptisms (utilised in Fig. 3.2A), make for considerably greater confidence. By 1971, members of Nimai Waula were keen to record exactly the birthdates of their children. Such enthusiasm should not be taken to mean, however, that the various records (DDA censuses, Council tax registers, mission and school records), necessarily match in all details. For instance, persons listed as the "parents" of a child in school records often differ from those in the census records, and both may be at variance with the facts of parenthood. Some of this variation results from adoption, and some from the fact that the "parents" of school children are responsible for a half-day of school maintenance work each week. Future historians seeking to make use of such records will face a heavy task.

that losses of this magnitude occurred in the Central Highlands, Scragg reports that while the overall picture of highlands medical demography is "confused by a variety of patterns" (1972:745), most pyramids show at least some depletions in the cohorts born between 1941 and 1946 (ibid.,742). In Sinasina, and elsewhere, losses may well have been more extensive. Bowers, after reviewing a number of earlier studies from various parts of the highlands concludes that "...there are several indications that real depletions exist in cohorts born between 1930 and 1945, especially in the Chimbu and Bismark regions but possibly also farther east and sotheast" (1971:13).

The evidence for early epidemics in Chimbu can be reviewed briefly. Bergmann, who visited the Eastern Highlands in 1929-30 before settling in Chimbu in 1934, records that in 1930 "a very severe 'flu epidemic...went through the whole highlands" (1971, Vol.1, p.68). Single villages in the east, he notes, often lost more than 20 people. Although there is no documented evidence of this epidemic in what was then pre-contact Chimbu, extensive references were made, during the collection of genealogies at Koge, to an epidemic ("big sick") occuring at approximately this time. Although difficult to date exactly (and unfortunately I did not at the time see the possible significance of the information), such accounts could refer to this influenza epidemic.[7] Whatever the effects of possible

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[7]Nelson also reports an epidemic in the Nebilyer valley(Western Highlands Province) occurring perhaps 30 to 40 years before 1969, though he argues that accounts of the symptoms suggest malaria (1971: 206-8). To my knowledge (c.f.Ward 1958:202), the highlands' literature makes no mention of a possible earlier outbreak of the post-World War 1 "Spanish" influenza epidemic which killed (continued over page)

pre-, and early, contact epidemics, the occurrence, if not the effects, of at least two epidemics in the early 1940s are well documented.[8]

"Pleurisy, pneumonia and influenza raging though the subdivision," recorded the Kundiawa Station Diary on 9 April, 1940. Hearing that "dysentery had broken out at Ega mission and influenza was also spreading", Downs, then on patrol in Sinasina, returned immediately to Kundiawa (Downs,PR, 28 March-9 April 1940, Patrol Diary). The sick on both the government and mission stations were at once isolated, and "drugs, blankets, biscuits and marmite" were issued (ibid.). Two weeks later the epidemic was "dropping off" (Kundiawa Station Diary, 23 April 1940). This is probably the outbreak noted by Bergmann as a "very severe" epidemic of amoebic dysentery [9] which he dates to the

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[7](Continued from previous page) large numbers world wide, and is estimated to have killed 22 per cent of Western Samoa's population (Crosby 1976:235-6). According to official reports, all ships departing Australian ports for the Territory of New Guinea (and Papua?) during 1918 and 1919 were quarantined on the Australian coast and inspected on arrival in New Guinea. Such measures are claimed to have effectively prevented transmission (Mackenzie 1934:217-8).

[8]According to Gitlow (1947:13) there was also a serious outbreak of dysentery in the Mt.Hagen area a little earlier, in 1938. Was this the same as that recalled by the Hagen big-man Ongka as "a very bad epidemic of sickness...(when) people died in large numbers. Some died out in the field and lay there to rot, others died in their houses and pigs came to eat the corpses, for there was no-one to bury them" (Strathern 1979:19) ? Ongka's description of the symptoms partly suggest dysentery ("bad running sores on our legs and blood in our excrement"), but his implicit dating of the epidemic to his (?) early childhood suggests it occurred before 1933. Be that as it may, the Raiapu Enga to the west of Hagen suffered heavily from dysentery, which they associate with the arrival of Europeans, and which Feachem (1977: 165) dates to 1941 or 1942. He estimates losses by one clan of 7 per cent (ibid., 166).

[9]However, according to Ivinskis et.al., there have been "no recorded cases of amoebiasis or amoebic dysentery in the Chimbu region", only "sporadic outbreaks of bacillary and unclassified dysentery" (1956:147).

beginning of World War 11. Although "several hundred people died", he thought that rapid government action limited its spread to a comparatively small area (Bergmann 1971 Vol.1, pp.63-4). Dysentery again struck in 1944, definitely affecting Sinasina. In January 1945, Dennis noted that a Lutheran Medical assistant had been stationed at Koge in the past year due to dysentery (CPR 6, 1944/45,p.2). This, I assume, was the epidemic of "bacillary" dysentary mentioned by Nilles, which struck "(d)uring the last war, after all missionaries had been evacuated....(It was) most probably brought in by the army " (1953:26). It caused, according to Nilles, "a number of deaths" among the Kuman. Ivinskis et.al. are more specific. This

> "very serious outbreak of bacillary dysentery swept through the whole of the highland region. It was traced to Bena Bena, to an American airman who had been in contact with Japanese at Buna where dysentery was occurring. The Chimbu area was severely affected and it has been estimated that from two to three thousand deaths occurred among the natives at the time of the epidemic" (1956:147-8).

This was presumably the same epidemic which ran through the Siane in the east of Chimbu in 1944-5 (Salisbury 1962:114), resulting in some villages losing "up to 20 per cent of their adult male populations" (ibid., 123). Salisbury's statement points to an important question. Did these epidemics affect both sexes in all age categories equally, or was mortality age and sex specific? Contrary to Salisbury's rather ambiguous statement, the Waula and Nimai population pyramids suggest that the young in particular suffered.

A further source of indirect evidence on the early effects of disease in the region is provided by an analysis of the size and survival ratios, of sibling sets (Table 3.5). This information was

TABLE 3.5 Sibling set size and survival[1]

Decade of completion	No. of sets	Size of sets			Survived to adulthood			Survived to 1972		
		Total members	Mean	SD	Total	Mean	SD	Total	Mean	SD
-1920	37	110	2.97	1.38	98	2.65	1.32	53	1.43	0.73
1921-1930	44	143	3.27	1.37	114	2.59	1.39	92	2.09	1.12
1931-1940	31	81	2.61	1.36	46	1.48	1.26	40	1.29	1.16
1941-1950	20	81	4.05	1.32	68	3.40	1.19	66	3.30	1.08
1951-1960	25	121	4.84	1.71				83	3.32	1.34
1961-1970	15	71	4.73	1.87				47	3.20	1.57

[1] Source : Nimai Waula genealogies.

obtained from Waula men, and their spouses, in the form of genealogies, and the dating is necessarily very approximate. Table 3.5 divides the sibling sets according to the approximate decade in which they were completed (either by birth of last sibling, or early death of mother), and for each decade gives the average size of the set, and the average number of siblings per set surviving both to adulthood (defined as marriage, or, in the case of a few males, participation in warfare), and to the beginning of 1972. The results generally confirm the picture of losses in the first ten years of the colonial period. The sets completed in the decade 1931-40 are slightly smaller than those in the preceding and succeeding decades, suggesting some losses of women before the completion of their reproductive years. More significantly, considerably fewer siblings survived to adulthood from sets completed in this decade than from either older or younger sets.

If the first years of the colonial period were accompanied by considerable losses among the young as suggested here, then the generally low rates of population increase during the 1950s and 1960s are not surprising. Assuming that women reach fertility at age 18, then, from about 1940 (Fig. 3.2A), or 1945-7 (Figs. 3.1, 3.2B), the populations of Waula and Nimai experienced reductions in the number of women of reproductive age. As a consequence, reduced numbers of children could be expected, as Bowers (1971:12,16,26) has pointed out in relation to Brown and Winefield's Chimbu sample, and to her own Kepaka data from the Western Highlands. However, the reductions in the number of women of reproductive age are likely to have coincided with, or been closely followed by, a decline in mortality, resulting from the post-war provision of medical services, which could explain why growth rates, although low, did not fall below replacement levels as they commonly did in some other parts of Melanesia in the early contact period. How long would the effects of reduced numbers of women of reproductive age have been felt? Following the DDA age estimates for the Nimai (Fig. 3.1), it is evident that in 1969 the Nimai were at a point where the reduced cohorts coincided with the peak of a woman's reproductive period (25-35 years of age). This suggests that the very low annual rate of population increase (0.22 per cent) reported by the Nimai for the period 1967-71 (Tables 3.2, 3.6), was not entirely due to either the post-1969 loss of the census registers, or resettlement (see p. 64 above). Although the last of the supposedly reduced cohorts will not complete fertility until approximately 1980-84 (assuming reproduction to occur mainly between the ages of 18 and 40), the larger cohorts born after 1945 have been entering fertility in increasing numbers since approximately 1963.[10] If the age estimates are correct (and, from the mid 1950s at least, they should not be seriously wrong), and if independence is not followed by a decline in health services leading to a rise in mortality, the potential for Nimai population growth may be expected to rise significantly over the next 15 years (c.f. Bowers 1971:26).

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[10]As noted above (p.73) the disproportionately large number of 20-24 year olds on 1969 may be due to consistent under-estimation of the ages of children who were in reality more than 5 years of age when their ages were first estimated. If this is the case, the number of women entering fertility began to increase five years earlier, i.e. in 1958. Table 3.2 shows that the annual rate of growth of the North Sinasina population rose from 1.46 per cent in 1954-61, to 1.81 in 1961-67, but decreasing mortality could also have played a part in this increase.

The possible effects of age-specific mortality due to early epidemics are not restricted of course to changes in fertility. Chapter 5 explores further ramifications of changes in the age-distribution of the Nimai (and North Sinasina?)population(s), in particular changes in marriage rates after c.1948, and possible consequences of changing adult-child ratios on levels of production.

A micro-analysis of one clan

The previous sections have drawn primarily on DDA census material at the level of tribes, or aggregations of several tribes, with populations of several thousand, focusing especially on changes in overall numbers. This section looks solely at the single clan of Waula, exploring in greater depth some of the factors underlying the rate of increase.

How representative are the Waula? Table 3.6 compares Waula growth rates with those of the three other Nimai clans.[11] Between 1951 and 1963 the Waula population grew at a slower rate than the others, especially during the period 1954 to 1963. Though it increased slightly faster than the total Nimai population between 1963 and 1971, its earlier, slower, rate of growth reduced its overall rate between 1951 and 1971 to the lowest rate recorded by the four clans. If the suspect post-1969 data are excluded the Waula growth rate between 1951 and 1969 increases marginally, but drops a little further behind the

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[11] The periods in this table are slightly different from those in Table 3.2, due to the lack of data on Nimai clans for 1961. In addition, 1969 data are included.

TABLE 3.6 Annual rates of population growth in Nimai clans for various periods between 1951 and 1971[1]

Dates	Years	Ogole	Waula	Bomai	Dugul	Nimai total	North Sinasina total
1951-54	3.00	2.32	1.52	1.39	2.13	1.78	1.72
1954-63	8.33	1.98	0.66	1.62	1.47	1.45	1.46
1951-63	11.33	2.07	0.89	1.56	1.64	1.54	1.53
1963-67	4.67	0.80	1.36	2.16	1.09	1.51	1.95
1967-69	1.42	-1.30	1.76	2.33	1.42	1.60	n.a.
1969-71	2.17	0.28	0.16	-1.76	-0.12	-0.68	n.a.
1967-71	3.58	-0.34	0.80	-0.14	0.49	0.22	0.92
1963-71	8.25	0.30	1.11	1.16	0.83	0.95	1.50
1951-71	19.67	1.32	0.98	1.38	1.30	1.28	1.51
1951-69	17.42	1.45	1.09	1.78	1.48	1.54	n.a.

[1] Calculated from DDA census figures (Table 3.1). For definition of rate, see Table 3.2,note 1.

the other three clans. Nevertheless, while low, the overall Waula rates of 1.0 or 1.1 per cent per annum are not exceptionally different. Further, comparison of rough adult-child ratios, and adult masculinity ratios, in the 1950s and 1960s (see notes to Tables 3.11, and 3.14 below), reveal no major differences between Waula and the rest of Nimai.

A number of measures confirm the low growth rate indicated by the DDA census data. In 1972 only 33.1 per cent of the Waula population was aged under 15 years, a figure closely similar to that found by Brown and Winefield for a larger sample in central Chimbu nine years before (1964:184-5, 188; 32 per cent aged under 16 years in 1963, 36 per cent in 1960). During the calendar year of 1972, Waula women reported only three births, giving a crude birth rate of only 12 per cent for the resident population of approximately 250. Information from 70 married, or previously married, women living in Waula territory provides some useful indicators of fertility (Tables 3.7, 3.8). Women aged 45 years or more reported an average of 4.06 live births per woman, in contrast to figures of 3.5 (for women of reproductive age) found by Venkatachalam (1962:2-4) for a general Chimbu sample, 2.7 for a Siane sample of women aged 45 or more (Nag 1962:170; using Salisbury's unpublished data), and 2.3 (for children surviving one year or more to women aged 46 years or more) for Mintima in central Chimbu (Brown and Winefield 1964:185). In 1971, the national census gave 4.41 births per woman for Chimbu women aged 45-9 years (calculated from Howlett _et al_. 1976:34). This Waula figure of 4.06, the average number of live births per woman of completed fertility,

TABLE 3.7 Distribution of number of live births per woman, and summary of all issue, for women in 4 age-groups[1]

Number of live births	Number of married women aged: 55 years + No.	%	45-54 years No.	%	30-44 years No.	%	20-29 years No.	%
0	3	23.1	2	10	3	12.5	7	53.8
1	0	0	2	10	2	8.3	1	7.7
2	1	7.7	0	0	0	0	3	23.1
3	2	15.4	1	5	3	12.5	2	15.4
4	3	23.1	3	15	5	20.8	0	0
5	2	15.4	5	25	3	12.5	0	0
6	0	0	4	20	6	25.0	0	0
7	0	0	2	10	2	8.3	0	0
8	2	15.4	1	5	0	0	0	0
Number of women	13	100.0	20	100.0	24	100.0	13	100.0
Number of live births	46	-	88	-	96	-	13	-
Mean live birth/woman	3.54	-	4.40	-	4.00	-	1.00	-
Number of miscarriages	2	-	3	-	1	-	0	-
Miscarriages/woman	0.15	-	0.15	-	0.04	-	0	-
No. of deaths under 5 yrs.	21	-	31	-	18	-	1	-
Deaths per 1000 live births	456	-	352	-	188	-	77	-
Mean surviving issue/woman	1.92	-	2.85	-	3.25	-	0.92	-

(1) Source : interviews, C.Hide.

TABLE 3.8 <u>Distribution of children surviving c.5 years or more, by women in 4 age-groups</u> [(1)]

Number of children	Number of married women aged							
	55 years +		45 - 54 years		30 - 44 years		20 - 29 years	
	No	%	No	%	No	%	No	%
0	4	30.8	3	15.0	3	12.5	7	53.8
1	1	7.7	2	10.0	2	8.3	2	15.4
2	2	15.4	3	15.0	0	0	2	15.4
3	4	30.8	4	20.0	6	25.0	2	15.4
4	2	15.4	5	25.0	8	33.3	0	0
5	0	0	1	5.0	4	16.7	0	0
6	0	0	2	10.0	1	4.2	0	0
Number of women	13	100.0	20	100.0	24	100.0	13	100.0
Number of children	25	-	57	-	78	-	12	-
Mean issue	1.92	-	2.85	-	3.25	-	0.92	-

[(1)] Source : interviews, C.Hide.

or the total maternity ratio, would be classed by Nag (1962:175, Table 6) as "low" (on a three stage scale of "very low", "low", and "high"). The Waula maternity ratio, or the average number of live births per ever married woman, of 3.47, however, is "high" in terms of Nag's classification (ibid.), but this is probably due to the disproportionate number of older women in the sample. As an indicator of the gross reproduction rate, the number of live females born to women of completed fertility is useful. The Waula figure of 1.70 is rather higher (though still "low" according to Nag's scale), than the 1.2 given for Mintima by Brown and Winefield (1964:185), but their figure did not include children dying under one year of age. If female children dying before the age of 5 years (data on exact age at death were not collected) are excluded from the Waula calculation, the average drops to 1.12. The Waula child-woman ratio (ratio of the number of living children aged less than 5 years to the number of women aged 16-45 years), of 0.518 is also very similar to Mintima's 0.520 (Brown and Winefield 1964:187). Both are "low" according to Nag's scale (ibid.).

It is of interest that both the Waula child-woman ratio, and the proportion of the population aged below 15 years, were, in 1972, very similar to Brown and Winefield's figures obtained from central Chimbu 9 to 11 years previously. The 'stability' of these two indices seems paradoxical in that both might be expected to have increased as the result of a decline in infant and child mortality following the introduction of health services.[12] That such mortality has significantly decreased is indicated by Tables 3.7 and 3.9 : women aged more than 55 years lost 45.6 per cent of their children born alive, while those aged 45-54 years lost 35.2 per cent, e.g. a decrease of 22.8 per cent. This is not, of course, an absolute contrast, since a number, though it is not large, of the children of

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[12]An exact date for ready access by most people to health services (and for their use of them) is difficult to establish. As early as 1940 medical orderlies occasionally accompanied patrols. For example, the first Sinasina census patrol gave 40 Novarsenobillon injections against venereal disease (Downs, PR, 10 April 1940, pp.1-2), a major outbreak of which had been reported in and around Kundiawa in 1936-7 (Kyle, MR November 1936,p.8 ; Letter, Kyle to D.O., Salamaua, 19 May 1937). To combat the 1944 dysentery epidemic, a Lutheran medical assistant was stationed temporarily at Koge (Dennis, CPR 6, 1944/45, p.2). It was not until after 1947, however, that more regular provision was made. By October 1951, Native Medical Assistants were stationed permanently at Du, Koge, and Dumun in North Sinasina, though a patrolling officer considered the one at Koge to be of "very doubtful use to anyone" (Kelaart, CPR 2, 1951/52,p.7). Although the Catholic Mission at Koge lacked proper medical facilities in the early 1950s (Hayes, CPR 5, 1952/53, p.8), it was reported to be treating c.50 minor cases a week by July 1952 (Keogh, CPR 1, 1952/53, p.9).

In brief, rudimentary services were available in the early 1950s (within 1-2 kms for most Nimai), and more serious cases could be taken to Kundiawa hospital. I would assume a mid-1950s date for frequent use by most people of such services. However, it may be noted that Waula women (in 1972) frequently accounted for the deaths of their children (when describing them in interviews), by reference to instances of adultery by their husbands or to witchcraft practiced by other women of the clan (often explained in terms of jealousy or anger felt by the latter in response to the mother's failure to distribute meat properly). Sickness and accident were also mentioned as causes of death, though not necessarily to the exclusion of these 'social' factors. To what extent these etiological beliefs inhibited parents from seeking medical aid in the 1950s and early 1960s I do not know. By the time of research, many Waula parents , while still explaining serious sickness in social terms, usually showed no hesitation in taking or sending their children to clinics or hospital with considerable haste.

TABLE 3.9 Mortality of children, by age of women [1]

Age of women	Period of fertility [2]	Sample of 70 Waula women: No. of women	Number of children: Born live		Died under 5 yrs [3]		Chimbu women at 1971 census	
			Total	Per woman	Total	Per 1000 live births	Births per woman	Deaths per 1000 births
55 +	1928-56	13	46	3.54	21	456	-	-
50-54	1935-61	12	55	4.58	19	345	-	-
45-49	1940-66	8	33	4.12	12	364	4.41	238
40-44	1945-71	7	32	4.57	7	219	4.12	236
35-39	1950-76	8	32	4.00	6	188	3.82	246
30-34	1955-81	9	32	3.55	5	156	3.15	211
25-29	1960-86	7	9	1.29	0	0	2.29	217
20-24	1965-91	6	4	0.67	1	250	1.14	190

(1) Source : Waula women, interviews, C.Hide; Chimbu women, 1971 National census, figures from Howlett *et al*. (1976:37: mortality for age-group 40-44 corrected).

(2) Approximate, assuming fertility from 18-40 years.

(3) Also total issue dead. Lambert (1975:33) gives an estimate of 222 per 1000 live births for child (under 5 yrs) mortality in Chimbu rural areas in 1974-75, and a figure of 148 per 1000 (0-5yrs) for 36 "families" from the Sinasina village of Jobakogl (ibid.,34).

the latter group are still aged below 5 years and hence still at risk. This decrease approximately coincides with the increased availability of health services in the post-war period. Table 3.9 suggests an initial decline in the mortality of children born to women between 1935 and 1966 (women aged 45-54 in 1972), followed by another decline amongst those born to women whose fertility spanned the period 1945 to 1971 (those aged 40-44 years in 1972). It may be noted, however, that data from the 1971 national census (columns 8 and 9, Table 3.9), from a much larger sample of Chimbu women, indicate a lower level of mortality among the issue of this latter age group (unfortunately data for older women are not available to me at present). Given the suggested magnitude, and timing, of this decrease in mortality among the young, why were the proportion of Waula children (0-15 years), and the child-woman ratio still low in 1972?

The maintenance of a low child-woman ratio implies that the customary long birth intervals (of c.4 years between surviving children), have been retained.[13] The proportion of children in the

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[13]A 50 per cent reduction in the mortality of children (0-4 years), from, for example, 400 to 200 deaths per 1000 births, would only raise the number of children surviving to age 4 years by about 14 per cent, if birth intervals remained stable. A reduction in the average birth interval to 2 years, on the other hand, without a change in mortality, could cause a 40 per cent increase in the number of children born during, and surviving, a 4 year period.

I calculate these as follows : assuming average birth intervals of 4 years between surviving children, and two years following an early death, the number of children surviving to 4 years (per 1000 births), under a mortality regime of 400 deaths per 1000 births, would be 600 survivors of the original 1000 births, plus 240 survivors of 400 'replacement' births, = 840. With mortality at 200 deaths per 1000 births there would be 800 original survivors, plus 160 'replacement' survivors = 960. In contrast, with no change in mortality, but a reduction in the average birth interval to 2 years, there would be 600 survivors of the first 1000 births, (Continued over page)

population, while related to the child-woman ratio, and hence birth spacing, is however more sensitively affected by changes in infant and child mortality, because it includes the events of a longer time span and thus takes greater account of cumulative change. This would be particularly true during the first and second decades following a reduction in such mortality when the effects of the reduction would still be concentrated in the younger cohorts. Thus, in the Waula case, the indicated decrease in mortality should have led, other things being equal, to an increase in the proportion of children in the population. The absence of such an increase implies a simultaneous change in other variables, with a decline in the birth rate, due to a decline in the number of women of child-bearing age, as a strong candidate.

It is nevertheless important to see this suggested fluctuation of the birth rate in relation to the longer term experience of Sinasina inhabitants. They were undoubtedly aware, long before 1933, of the scarcity of their agrarian resources relative to overall population numbers. Assuming reliable recall, the data described above on the number of children born to older women indicate that the numbers of births, and conceptions, were regulated independently of mortality losses. Such regulation continues. A commonly expressed view holds that a woman should cease reproducing before her children begin raising a family. If followed, this practice would effectively

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[13](Continued from previous page) plus 600 survivors of the second, = 1200. These, of course, are very crude calculations which assume that all mortality among 0-4 year old children takes place before the age of 2 years.

limit a woman's reproductive period to some 16-20 years following the birth of her first surviving child. Given birth intervals of approximately four years between surviving children, this implies a completed family size of 4 to 5 children. Information on mortality suggests a rough correlation between the number of births per woman and the incidence of mortality among the first few births (Table 3.10). The relationship is not firmly grounded, however, because we did not record whether all such deaths preceded subsequent conceptions or births. If it is assumed that the majority of these early deaths occurred in the first two years of life (which is not unreasonable), these data indicate that Waula women reporting higher numbers of births were'making up' for earlier losses, and it may be inferred that others not suffering such losses deliberately restricted conceptions, or births, after successfully raising a certain number of children.[14]

For some women, childlessness is a problem. At Mintima, Brown and Winefield (1964:185) found 12 per cent of women aged 46 years or over without surviving children, and 16 per cent of women aged 31 to 45 years. The Waula figures are similar : 5 of 33 women (15 per cent) aged 45 years and over reported no live births (four had not conceived,

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[14] Modern contraceptive techniques were not widely used in 1972 (at least to my knowledge). During 1968 a Public Health Department doctor from Kundiawa visited most Chimbu councils, including Sinasina, to give information on contraception,re-visiting some, also including Sinasina, on later occasions to fit small numbers of women with loops. Follow up, however, was poor and this programme soon lapsed. At least two Waula women, both with five surviving children at the time, began to use the loop then, but after complications, discontinued doing so. Both conceived again. Until the end of 1972, when a once-weekly Family Planning Clinic was started at Kundiawa, no official programme made contraceptive technology and information available within the region.

TABLE 3.10 <u>Number of births per woman and mortality among first four births</u>[1,2]

No. of births	Women aged 45 + years				Women aged 30-44 years			
	No. of women	Deaths among first 4 births			No. of women	Deaths among first 4 births		
		Total	Percent	Per woman		Total	Percent	Per woman
8	3	11	91.7	3.7	-	-	-	-
7	2	4	50.0	2.0	2	4	50.0	2.0
6	4	6	37.5	1.5	6	9	37.5	1.5
5	7	11	39.3	1.6	3	2	16.7	0.7
4	6	6	25.0	1.0	5	1	5.0	0.2
1-3	6	6	46.2	1.0	5	0	0	0

(1) Source : Interviews, C.Hide. The exact age at which children died was impossible to determine. It ranged from a short time after birth to approximately five years. Unfortunately we failed, in the case of children aged c.2-5 years, to inquire whether their death preceded a subsequent birth or conception. It may be noted that of the six women aged between 20-29 years who had born children (not included in this table), one had one child, three had two, and two had three. The only child which had died was that of one of the mothers of two children.

(2) Does not include miscarriages. Of the five miscarriages reported by women aged 45 and more years, two were reported by one woman who had had no live births (no cause for the terminations given); two by the two women with one live birth each (one offered no cause, while the other resulted, according to the woman, from her sorrow at her mother's death : she "jumped up and down" and lost the foetus); and one by a woman with six live births. In the latter case, it was her fourth pregnancy, and resulted, she said, from the fact that she ate <u>Aleurites</u> sp. nuts in the morning. The one miscarriage reported by a woman in the 30-44 year age group was by a woman with four live births. It was her first pregnancy, and resulted, in her opinion, from eating cold, one day-old sweet potato one morning.

one had had two miscarriages), and 3 of 24 women (12 per cent) aged 30 to 44 years had had no live births, and had not conceived (Table 3.7). The figures for no surviving children, rather than no live births, are slightly higher for the older age group (i.e. 7 women or 21 per cent), but the same for the younger women (Table 3.8). Such imbalances result in a considerable amount of 'adoption' which will be described elsewhere.

High masculinity ratios

Masculinity ratios (males per 100 females ; MR hereafter), tend to be high in Sinasina, as they are elsewhere in Papua New Guinea (Lea and Lewis 1975). For instance, the 243 live births recorded by 70 Waula women had an MR of 143. Such figures invite consideration of Divale and Harris' suggestion of an association between warfare and selective female infanticide as forms of population regulation in the absence of effective or less costly alternatives (1976). In their cross-cultural analysis of a large sample of MR's (ibid., 527-531), they found that juvenile (0-14 years) MR's recorded at censuses taken while warfare was still practiced were constantly higher than adult ratios. They argued that the high juvenile ratio at the time of warfare was "due to female infanticide" (ibid.,527), while the more even adult ratio was "due to male mortality in warfare" (ibid.). They also found that as the length of time between the cessation of warfare and censuses increased, juvenile ratios decreased.

Sinasina data are available for three levels ; clan, tribe, and region (Table 3.11).[15] Though the earliest available records (1941, 1945) are included in Table 3.11 it has been argued earlier that these are not reliable. This is further confirmed by the major, and unlikely, change between the 1945 and 1952 figures. No records relate then to conditions during warfare (1940 would be a reasonable date for 'pacification'), and the Sinasina data therefore fall into the two 'post-war' categories of Divale and Harris, that is to say, 5-25 years after warfare (the 1952-64 censuses), and more than 26 years after (the 1970-72 data).

The few North Sinasina records at the regional level show two characteristic features between 1954 and 1971. First, an increase in the total MR from 109 to 116, and secondly, that the adult MR was higher than the juvenile ratio at all dates. With some exceptions, these are also found at the tribal level of the Nimai population. The much higher ratios of the 1940s are, as suggested, unreliable ; there is a slight decline in the total MRs at the 1954, 1963, and 1964 censuses : and the juvenile ratio appears to fluctuate considerably between 1952 and 1964, though always remaining well below the adult ratio. At the lowest level of Waula clan, the increase in the total ratio is far more marked, from 101 in 1952 to 124 in 1972, though the increase is not continuous. Further, in all years but one the adult

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[15]Unfortunately, due to the high and skewed proportions of migrants, the total figures for the whole of Chimbu Province from the 1966 and 1971 national censuses cannot be used in this discussion. However, since children under the age of 16 are not likely to be similarly affected their figures may be usefully noted. In 1966, the Chimbu juvenile MR was 106.8 (N=68, 022), in 1971, it was 109.4 (N=71, 435), figures that are broadly similar to those recorded for the Sinasina region (Table 3.11).

TABLE 3.11 Masculinity ratios for Waula, Nimai, and North Sinasina[1]

Date	Waula			Nimai			North Sinasina[3]		
	Child[2]	Adult	Total	Child[2]	Adult	Total	Child[2]	Adult	Total
1941	-	-	-	150	121	130	-	-	-
1945	-	-	-	130	140	137	-	-	-
1952	90	107	101	100	117	111	-	-	-
1954	104	105	105	90	116	106	106	111	109
1963[2]	-	-	120	-	-	109	-	-	110
1964	106	116	113	103	114	110	-	-	-
1970	127	137	134	110	120	116	(107	120	116)
1971	125	130	128	110	118	115	113	117	116
1972	126	122	124	-	-	-	-	-	-

(1) Calculated from DDA census data (see Table 3.1), except for Waula in 1972 where the data base is field records (Fig.3.2A). N.B. The 1941 and 1945 censuses were almost certainly incomplete, see discussion on pp. 59-65 above. Masculinity ratio = $\frac{\text{males}}{\text{females}} \times 100$

(2) "Children" were not defined by age in the 1941 and 1945 records. In the 1952, 1954, and 1963 census form summaries they were also undefined by age, and, as Brown and Winefield (1964:180) note, any of three definitions may have been used. In 1964, 1970, and 1971, after a change of the summary form in 1964 (which allows calculation of the adult/child division for the total population), children were defined as those aged less than 16 years. I use the same definition for the 1972 field data on Waula.

(Continued next page)

TABLE 3.11 (Notes continued from previous page)

(2) (Continued) A marked change in the proportion of children in the populations is clearly indicated in the 1963 census, suggesting the use of an "odd" definition during that year (cf. Hughes,1966: Appendix 4, who notes the same change in relation to the proportion of the 16-45 year age-group absent). The following figures indicate the abrupt difference.

Year	Waula			Nimai		
	Children		Adults	Children		Adults
	No.	%	No.	No.	%	No.
1952	78	33.8	153	529	33.6	1044
1954	90	36.6	156	601	36.4	1051
1963	115	44.2	145	850	44.2	1014
1964	95	35.2	175	688	35.9	1227
1970	93	33.4	185	769	38.4	1236
1971	99	34.7	186	777	38.5	1239

Source : DDA censuses. Total children figures calculated for 1952, 1954 and 1963 (when the total adult and child figures in the census summaries excluded absentees), by assigning those recorded as "students" to the child category, and those absent "at work" to the adult category (cf. Brown and Winefield 1964:180-2). N.B. The North Sinasina child percentages were generally similar to the Nimai ones (i.e.37.9, 45.4, 36.8, and 39.3 for, respectively, 1954, 1963, 1970 - when North Sinasina refers to the whole of Sinasina- and 1971).

(3) With the exception of 1970, when the figures refer to the whole of Sinasina. It is likely these are close to the North Sinasina figures since, in 1971, the ratios for the whole of Sinasina were, respectively, 111, 120, and 116 (compare with North Sinasina figures in Table).

ratio exceeded the juvenile one. This exception, 1972, was the one farthest removed from warfare. Thus these Sinasina data show features which run against the trends suggested by Divale and Harris : first, the earliest reliable records, dating approximately from 10-20 years after warfare, show no indications of juvenile ratios exceeding adult ones, and secondly, instead of decreasing with time after war, juvenile ratios, and total ones, have all increased.

Changes at the clan level can be partially explored through consideration of birth details recorded from the sample of 70 Waula women (Table 3.12). Their total 243 live births, which began in approximately 1928, showed an MR (at birth) of 143. There was no difference by sex in the patterns of child mortality : 42 male (29.4 per cent) and 29 female (29 per cent) children were reported to have died before the approximate age of 5 years. If, however, the women are divided into two groups, those aged 45 years and over, whose reproductive years spanned the rough period 1928-66, and those aged 20-44 years, who began reproducing in 1945, an interesting difference emerges. The 134 live births of the older women had an MR of 139, but mortality was heavier among boys (42 per cent) than girls (34 per cent), leaving a MR of 122 amongst the surviving children. In contrast, the 109 live births of the younger women were even more skewed in favour of males, with a MR of 148. But mortality was higher among girls (23 per cent), than among boys (14 per cent), resulting in a MR for the survivors of 165.

Examined closely these data do not appear to suffer from either a general failure by all women, or a specific failure by older women,

TABLE 3.12 Births and survivor sex ratios, by age of women [1]

Age of women	No. of women	Live births			Deaths 0-5 years				Survivors Sex ratio
					Males		Females		
		M	F	Sex ratio	No.	%	No.	%	
55 +	13	28	18	155.6	14	50.0	7	38.9	127.3
50-54	12	35	20	175.0	13	37.1	6	30.0	157.1
45-49	8	15	18	83.0	6	40.0	6	33.3	75.0
Subtotal 45 +	33	78	56	139.3	33	42.3	19	33.9	121.6
40-44	7	20	12	166.7	4	21.0	3	25.0	177.8
35-39	8	16	16	100.0	1	6.2	5	31.2	136.4
30-34	9	21	11	190.9	3	14.3	2	18.2	200.0
25-29	7	5	4	125.0	-	-	-	-	125.0
20-24	6	3	1	300.0	1	33.3	-	-	200.0
Subtotal 20-44	37	65	44	147.7	9	13.8	10	22.7	164.7
Total	70	143	100	143.0	42	29.4	29	29.0	142.2

[1] Source : interviews, C.Hide.

to recall the births of female children who died young, which are both commonly suggested as possible sources of inaccuracy (Howlett *et al.* 1976 : 33, 35-6). If the latter obtained, for instance, one might expect the reported births of the older women to show a higher MR than those of the younger women, rather than the opposite as was the case. While it is true that women aged 55 years or more reported an average of 3.54 births in comparison with the 4.58 of women aged 50-54 years (Table 3.9 above), the MR for the former births was still lower than that for the latter (Table 3.12). It may also be noted that the smaller average number of births recorded for the older women need not necessarily indicate a general recall lapse, if, as has been suggested (Bailey 1963:397), women of high parity have a lower life expectancy than their age-mates bearing fewer or no children. A 'general' failure to recall the births of young females who died young would also seem unlikely given the marked variation in the MRs of births to women of different ages. Assuming that mothers who report more than the average number of children are less likely to have failed to mention births of female children dying in infancy, and conversely that the majority of any 'forgotten' female children were born to mothers with less than the average number of births, it can be argued that a disproportionately high masculinity ratio for births of the latter women could indicate the existence of at least selective 'forgetfulness'. However, as Table 3.13 shows, this was not the case for Waula women of completed fertility (45+ years) : the MR for the live births of those with four births or less was 131, slightly though not significantly, lower than the MR of 142 for the births of women with five or more children. Among the younger women aged 30-44 years, the

TABLE 3.13 Birth and survivor sex ratios, by age of women and number of births[1]

Age of women	No. of births	No. of women	Live births			Deaths 0-5 years				Survivors Sex ratio
						Males		Females		
			M	F	Sex ratio	No.	%	No.	%	
30-44	1-4	10[2]	22	9	244.4	1	4.5	0	0	233.3
	5-7	11	35	30	116.7	7	20.0	10	33.3	140.0
	total	21	57	39	146.2	8	14.0	10	25.6	169.0
45 +	1-4	12	21	16	131.2	7	33.3	5	31.2	127.3
	5-8	16	57	40	142.5	26	45.6	14	35.0	119.2
	total	28	78	56	139.3	33	42.3	19	33.9	121.6

[1] Source : interviews, C.Hide.

[2] 7 of these women were less than 35 years of age.

suggestion cannot be tested since the majority of women with less than 5 births were still under 35 years of age. The data on the younger women nevertheless indicate the amount of variation possible among small populations in the short term.

These reproductive histories therefore suggest that the increasing MRs, both juvenile and total, of the Waula population between 1952 and 1972, are the result of variation at birth. Since analysis of demographic data was not completed during field research, no direct inquiry was made concerning the trend. However on at least one public occasion a Waula elder was heard to contrast current numbers of young males with conditions in the past, implying that the trend had not escaped notice. While infanticide was practiced in the past, at least in the wider Chimbu region (see Bergmann 1971, Vol.1, p.180, Vol.4, p.66 ; though he does not mention the killing of females in particular), it is, I consider, unlikely to be a common enough practice under present (and recent) conditions to seriously affect the sex ratio.

Explanations derived from the one clan cannot of course be extrapolated to the more inclusive levels of tribe and region. The Nimai and North Sinasina data pose, therefore, two interesting questions : why does the total MR appear to have increased, and why do the adult MRs exceed the juvenile ones ? Divale and Harris suggest that an increase in the adult sex ratio in the period 5-25 years after the cessation of war may be due to the survival of men who previously would have been killed in warfare (1976:527, note to Table V). This is clearly one possibility. Another, which will be considered in

Chapter 4, relates to factors affecting the number of adult women.

Migration

Although the total North Sinasina, Nimai, and Waula populations increased respectively by 36, 29, and 23 per cent between 1951 and 1971 (Table 3.1), these figures are not necessarily indicative of similar increases in the numbers of persons primarily dependent on local resources since, in the same period, out-migration also increased significantly.[16] From the start of the colonial period, but particularly since the early 1950s, large numbers of Sinasina, like Chimbu generally, have travelled and worked elsewhere in Papua New Guinea. Though such movements have characteristically changed over time, most Sinasina migration was still 'circular' in 1972, implying that out-migration, however influential in the short-term on local human-resource ratios, had not substantially affected long-term problems consequent upon population increase. The following description of Sinasina migration is based on DDA census data on persons absent at the time of census,[17] on some other documentary sources, and on employment histories collected from Waula men (Table 3.15).

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[16]There is a rapidly growing literature on migration in Papua New Guinea. The most recent study is that of Young (1977), which integrates national, provincial, and local levels of movement, and includes data from one Sinasina location (the Dinga at Emai). See also Seifert (1975) for description of migration from the neighbouring Dinga at Ninmul.

[17]An awkward category (Brown and Winefield 1964:180-182, Young 1977:23), including short and long-term migrants, as well as persons briefly away from home for a number of purposes.

TABLE 3.14 Three measures of Nimai and North Sinasina absenteeism at 5 dates between 1952 and 1971[1,2,3]

Year	Total absenteeism[4]				Adult male absenteeism[5]				Adult female absenteeism[6]			
	Nimai		N.Sinasina		Nimai		N.Sinasina		Nimai		N.Sinasina	
	in prov.	out prov.	in prov.	out prov.	in prov.	out prov.	in prov.	out prov.	in prov.	out prov.	in prov.	out prov.
1952	0.6	3.4	1.5	3.6	1.8	9.4	4.6	11.1	-	-	-	-
1954	0.7	6.4	2.5	3.5	1.6	18.6	6.9	10.6	0.4	-	0.8	0.1
1963	3.0	3.8	3.2	4.0	7.8	12.9	9.3	13.7	2.7	0.4	2.2	0.5
1970	3.0	12.0	4.1	13.0	6.2	24.0	4.6	25.4	1.1	5.4	5.7	6.9
1971	6.6	12.2	6.2	14.9	8.1	17.9	7.3	25.0	5.8	8.2	5.0	8.3

(1) Source : calculated from DDA censuses (see notes to Table 3.1).

(2) North Sinasina : for 1970 and 1971 the figures refer to the whole of Sinasina, due to my failure to disaggregate the 1970 data on a tribal basis when copying census data. However, going by the 1971 figures, it is unlikely that the true North Sinasina figures would vary by more than one or two percentage points from those given here (i.e. for 1971, the true North Sinasina figures were, for total absenteeism, 7.6 (in province), 15.5 (out province); for adult male absenteeism, 9.1 and 24.6; and for adult female absenteeism, 6.4 and 9.5

(3) In province/out province : until 1966 Chimbu was part of the Eastern Highlands District, thus this in/out distinction changes its reference between the 1963 and 1970 dates.

TABLE 3.14 (Notes continued from previous page)

(4) All persons absent as a percentage of total population. The definition of persons absent in the summary census forms changed over time : in most censuses they were recorded as at work and at school, male and female, child and adult, inside and outside district (= province here). I have not included "persons at school" in the category all persons absent.

(5) Adult males absent as a percentage of total adult males. Adult males at work only are included. unfortunately, the definition of "adult" could have varied between censuses (see discussion in Table 3.11, note 2 above). As explained there, it is likely that 1963 is the only year in which the basic definition seriously altered. This is shown by the following figures.

Year	Total adult males			
	Nimai		N.Sinasina	
	No.	% of total population	No.	% of total population
1952	564	35.9	4640	32.6
1954	565	34.2	4821	33.0
1963	536	28.8	4575	28.5
1964	655	34.2	-	-
1970	675	33.7	-	-
1971	676	33.5	5858	32.2

(6) Adult females absent as a percentage of total adult females. Definition as for adult males (and subject to same problems).

TABLE 3.15 Summary employment experience of 78 Waula men[1]

Age classes (years)	No. of men interviewed	1934 - c.1952			Agreement work 1950-70							Non-agreement work 1952-72				Never employed	No. of jobs	
		No. of men employed during			No. of men by no. of terms served							No. of men employed by					Total	Mean per man
		1934-42	1942-45	1946-52	0	1	2	3	4	5	6	No-one	Govt.	Mission	Other	1934-72		
> 60	17	5	12	6	17	-	-	-	-	-	-	17	-	-	-	1	26	1.5
50-59	25	6	25	12	12	7	3	2	1	-	-	12	2	3	9	0	90	3.6
40-49	14	-	8	6	2	3	4	1	1	2	1	5	1	2	6	0	64	4.6
30-39	9	-	-	-	3	-	-	4	2	-	-	1	1	4	7	0	41	4.6
25-29	13	-	-	-	5	8	-	-	-	-	-	0	2	5	11	0	39	3.0
Totals	78	11	45	24	39	18	7	7	4	2	1	35	6	14	33	1	260	3.3

(1) Source: interviews.

Between 1933 and 1942, employment opportunities in North Sinasina were largely restricted to the occasional patrol (i.e. short-term carrying work) with government officers, missionaries or gold prospectors, and they were available only to a minority of men. For the very few, there was the chance of more regular, and long-term, employment as interpreters, policemen, or labourers. Within North Sinasina, opportunities probably varied with access to the track running from the Eastern Highlands through Chimbu, and to mission and government stations. As early as 1937, for instance, Kyle described Masul, one of four outlying mission stations which the Lutherans had established in the 'China Sina' area and had run for over two years before withdrawing, as lying "...on the main road about 5 hours from here (Kundiawa) and 2 from Chuave....Most of the young men have worked, some in Salamaua, either for Leahy, ourselves or the Mission. Their women are married to Leahy's labourers and 1 to a constable.... (They) are constant visitors to Tema Mission station and ourselves. Most of the young men and girls talk some 'pidgin', many fluently" (Letter,19 May 1937,p.2,A.F.Kyle to D.O.,Salamaua. Parentheses added).

During World War 11 opportunities expanded. Conveniently located in the east of Chimbu near the main foot road to the Eastern Highlands, North Sinasina provided large numbers of labourers for the Allied Forces centred in the Goroka valley (Dexter 1961:234,240; Finney et al., 1974:344). Many Sinasina men and some youths did at least one stint of short-term cargo carrying, and road and airfield construction work between 1943 and 1944. Of 51 Waula clansmen aged 16 and over in 1943, and still alive in 1972, only 7 had not journeyed to Goroka for such work. From 1950 there was a surge of medium-term (12-18 months), indentured or agreement, labour migration, still exclusively male, under the aegis of the Highland Labour Scheme.

Hatanaka's account of Sinasina participation in the scheme (1972:32-5) is reasonable though it overplays, in my opinion, an image of hapless rural innocents at the mercy of rapacious capitalist exploiters. Without underestimating the low pay, the boredom of plantation production, or the real lack of alternatives for unskilled rural people, I would point to the evidence, mainly provided by the employers themselves that Chimbu, and Sinasina, labourers were not slow to contrive means of evading the "hard work" and "long hours" dwelt on by Hatanaka (ibid.,35). Within the first year of recruitment a special correspondent to the Pacific Islands Monthly reported, under the heading "Highland labour not always the right answer", growing dissatisfaction with the Chimbus (here referring indiscriminately to to highlanders) among Rabaul employers. One, Coconut Products, had even sent back 150, and "...most Chimbus (and I speak from experience) are very slow in movement and if they possibly can will sit down to work" (Anon.1950:108, parentheses in original). Three years later an editorial note in the same magazine commented that highland labour was "on the whole not popular", and that employers say they are 'dumb' (hard to teach) or lazy" (Anon.1953:92). Problems of climatic adjustment aside, this seems <u>prima facie</u> evidence of creative (within limits) industrial 'action' by a not-yet-proletarianised labour force. Also relevant is the comment by the Acting District Commissioner at Goroka on a report concerning the low rate of payment (1-2 pearl shells, i.e. approximately $5.00, for 5-6 months) made by Chimbu living near Kundiawa to employees from more remote areas (McBride,CPR 4,1951/

52 p.4-5). "If", he wrote, "the performance of Sina-Sina natives at Goroka may be taken as an indication of their general effectiveness as labour units, then the rate of payment for native employed native labourers becomes more reasonable" (Letter,3 January 1952,to Director, Department of District Services and Native Affairs, attached to McBride,ibid.). Further evidence for the ability of labourers to manipulate the system is given below (p.152 fn.35). Far from constituting an apology for the system of indentured labour, such instances suggest, and direct evidence from ex-labourers would, I believe, support them, that the system did not constrain highlanders to the extent implied by Hatanaka.

Further, in citing an unreferenced figure of less than 5 per cent for contract renewals (ibid.,35), she implies that once was enough for most Sinasina workers. A more relevant figure, given circular migration, would be the proportion who returned for second or more terms after spells at home. Of 31 Waula men aged 30 to 59 years in 1972, 7 had served two terms, and 14 three or more. Only 10, or just under a third, signed a single contract (Table 3.15). Similar evidence is provided by a very early 1954 survey among the Sinasina Dom which showed that of 124 men away on contract, 19.4 per cent had engaged for a second term, and 0.8 per cent for a third (Hibberd, CPR 2,1954/55,Appendix B). The proportions for a larger total of 393 men from the entire Dom area (i.e. including Dom west of the Wahgi) were higher : 27.2 per cent on their second term, and 1.5 on their third (ibid.,p.3).

In March 1950, however, 135 Nimai men, or 32.4 per cent of males aged 16-45 years, offered themselves to the first recruiting patrol, a slightly higher proportion than amongst the neighbouring Dinga (29.4 per cent) and Tabari (24 per cent) (Burfoot CPR 1,1950/51, p.18 Appendix B.). By 1952 approximately one in every ten Sinasina men aged over 16 years was away on such work (Table 3.14), most of them on coastal plantations though, as early as November 1954, Colman noted that an increasing number of northern Sinasina were finding work in the Goroka area of the Eastern Highlands, accompanied in some cases by their wives and children (CPR 4,1954/55,p.9; 334 absentees within the District, compared to 173 the previous year). Six years later a village official among the Dinga complained to a patrolling officer that many of his people were travelling to Goroka in search of work, though it may not be a coincidence that the same patrol was engaged in collecting a newly announced tax of one pound (per adult male), which represented a 100 per cent increase over the previous rate of ten shillings (Greaney CPR 14,1959/60,p.3).

From 1954 into the mid 1960s the proportion of male absentees (absent adult males as a percentage of all men over c.16 years of age), was around 20 per cent (Table 3.14), though there appears to have been considerable year by year fluctuation in any one locality. In January 1954, for instance, 57 Nimai men were recorded as absent (F.N.Harris, CPR 8,1953/54), but in October of the same year there were 105 Nimai men out of the District, and a further 9 absent elsewhere within it (Colman,CPR 4,1954/55;cf.Young 1977:232-3). Total absenteeism (absent men, women and children as a percentage of total population), was apparently steady at about 7 per cent during the same period. The number of women away rose only gradually (Table 3.14). In 1954 only two Nimai women were away, both within the District. By 1963, 15 were absent.

Total absenteeism doubled between 1963 and 1970 and continued to increase between 1970 and 1971 (Table 3.14).[18] By 1971, approximately one in five of all Sinasina (and Nimai), were reported absent at the time of census, with 15 per cent of the Sinasina population outside the province, and 5 per cent absent elsewhere within the province. Although these are high figures, amongst the highest for all areas in Chimbu (see Howlett _et al_.1976:47-8 for a comparison of all Chimbu census divisions using a different ratio), indicating a major increase in out-migration during the late 1960s, they agree with the picture given by the 1966 and 1971 national censuses for Chimbu as a whole. According to these sources, 8.7 per cent of Chimbu were located outside the province in 1966. Five years later the figure was 12.6 per cent, giving an annual increase in the rate of out-migration of over 11 per cent (Howlett _et al_.1976:31,42). Total absenteeism (outside the province) of most Sinasina tribes was close to the overall Sinasina figure of 14.9 (i.e. Dinga 10.7, Nimai 12.1, Gunangi 13.5, Dom 13.6, Kebai 14.7, Tabari 16.7), with the exception of Kere,

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[18] The early 1970s increase in outmigration, suggested by the 1970-71 rise, seems to be confirmed by Young's study of 5 Chimbu locations (including one among the Dinga), which showed, for late 1974-early 1975, 'absentee' percentages ranging from 30 to 49, with Dinga (Emai) recording the latter figure (Young 1977:234). It should be noted (a) that Young's 'absentees' are defined on a different base than that used by DDA (ibid.,51-2,495), and (b) that the use of other migration ratios (i.e. years away from village/total adult years) ranks Emai below the other Chimbu locations (ibid.,234).

TABLE 3.16 Absentees, Nimai Waula January 1972 and April 1973 : age, sex, and location[1]

Location	January 1972				April 1973			
	Adults		Children	Total	Adults		Children	Total
	M	F			M	F		
1. Coastal provinces								
Central	3	–	–	3	5	–	–	5
New Britain	1	–	–	1	1	–	–	1
Bougainville	2	–	–	2	2	–	–	2
Sub total	6	–	–	6	8	–	–	8
2. Other Highlands provinces								
Western	13	3	–	16	12	7	1	20
Eastern	2	3	–	5	6	3	1	10
Sub total	15	6	–	21	18	10	2	30
3. Other Sinasina groups								
Nimai Bomai clan	2	3	7	12	–	1	4	5
Dinga	4	4	3	11	3	4	3	10
Sub total	6	7	10	23	3	5	7	15
4. Jail/Unknown	4	–	–	4	–	1	–	1
Total	31	13	10	54	29	16	9	54

[1] Source : interviews.

TABLE 3.17 Locations of migrants from Nimai clans and North Sinasina in 1964 (1)

Locations	Nimai clans				Total	
	Ogole n=8	Waula n=20	Bomai n=68	Dugul n=69	Nimai n=165	North Sinasina n=1514
Eastern Highlands	62.5	45.0	66.2	53.6	58.2	55.0
Western Highlands	12.5	10.0	2.9	1.4	3.6	4.7
Southern Highlands	-	-	2.9	-	1.2	1.4
Highlands subtotal	75.0	55.0	72.1	55.1	63.0	61.2
Central	-	10.0	8.8	26.1	15.8	11.6
Madang	25.0	-	1.5	1.4	2.4	8.1
New Britain	-	30.0	4.4	1.4	6.1	5.3
Morobe	-	-	-	-	-	3.5
Bougainville	-	-	13.2	8.7	9.1	2.9
New Ireland	-	5.0	-	2.9	1.8	2.0
Sepik	-	-	-	1.4	0.6	1.4
Manus	-	-	-	-	-	0.1
Western	-	-	-	-	-	0.1
Unknown	-	-	-	2.9	1.2	3.8
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

(1) Source : calculated from data in Hardie, CPR 1, 1964/65, Appendix C.

which recorded an exceptionally high 21.5 per cent. As indicated in Table 3.14, the 1960s rise in out-migration, included a substantial increase in the movement of women,[19] though adult men still dominated.

A comparison of the locations at which persons absent from Waula were said to be resident in 1972-3 (Table 3.16), with the locations at which male migrants were recorded as working in 1964 (Table 3.17), suggests changes in the direction of some movements. At the earlier date the Eastern Highlands and New Britain accounted for 15 of 20 Waula migrants. By the early 1970s, the Central Province had replaced New Britain as the major coastal target area, and, within the highlands, the flow had turned partly away from the eastern Goroka area to the Wahgi valley in the west.

Summary

Though reliable data on the Sinasina population are not available for the first two decades of the colonial period, there are indications that losses, primarily, perhaps, restricted to the young, resulted from early epidemics. Such losses would help explain one of the two main demographic trends of the following twenty years, the relatively modest rate of population growth which saw the *de jure* populations of the north Sinasina region and the Nimai tribe increase by, respectively, a third and a quarter. Such increases, however, were counterbalanced by migration, the other main trend. Over the same twenty year period, a rising number of Sinasina, reaching approximately 20 per

[19]And children : in 1971 10 per cent of Nimai children were recorded as absent outside the province, 6 per cent within it.

cent by 1971, moved away, if only temporarily, from their usual place of residence. Thus the actual numbers of people present (at the time of census) in north Sinasina, and dependent on its resources for their daily livelihood, increased by 15 per cent between 1951 and 1971. The comparable figure for the Nimai was only 3 per cent.

CHAPTER 4

Inflation and devaluation

Introduction

If the demographic consequences of colonial incorporation were not so profound in Sinasina as in other less fortunate areas of Melanesia, the same cannot be said of the effects of changes in the quantities, kinds, and sources of valued goods used in major prestations and transferred in trade. Understanding of production in contemporary Sinasina, and particularly of the social production of pigs, requires consideration of these changes. My account in this chapter is based on an approximately dated series of recollected bride payments, supported where possible by documentary evidence. Following an overview of the major patterns revealed by the former source, I examine, in turn, the fluctuating histories of each of the major items, or classes of items. I conclude by discussing some of the possible effects of such changes on marriage strategies.

My use of bride payments for information on the vicissitudes of valued goods during the colonial period reflects their advantages for constructing a rough time-series. That is, they occur frequently, they can usually be dated with some accuracy, and they include the majority of the most valued items. Other prestations, in contrast, occur either at considerable intervals or less regularly, and, in some cases, involve only the transfer of a restricted set of items. The bride payments used here, a total of 142, were recollected by members of Nimai Waula. A fuller description of the payments, and discussion of problems concerning their accuracy and interpretation, can be found in Appendix 3.

Sinasina bride payments c.1925-73 : an overview

The overall pattern of change in Sinasina bride payments (Figs. 4.1A,B) is familiar : the numbers of particular items have increased, and, as Brown has noted for Chimbu, there has been "a series of substitutions and variations in proportions as between feathers, shells, stone axes, steel axes, knives and money" (1972:85). The changes in the main categories of items can be summarized in terms of three rough periods.

In the 1930s and 1940s, payments were based on three major items, pigs, which were mainly slaughtered, shell items, and stone axes (with steel increasingly common by the mid 1940s). During this period, shell increased most rapidly : it appeared in more payments, and the average number of shell items per payment rose six-fold.[1] The number of pigs per payment doubled. Stone axes declined, but were joined by imported steel tools. Salt, apparently a minor item, disappeared.

In the post-war period of the 1950s, composition became more complex, with plumes and money joining, as major items, the established triad of pigs, shell, and axes. Although stone axes disappeared, steel ones continued to occur in most payments. The number of shell items again increased, but at a slower rate. Pigs doubled again. Plumes

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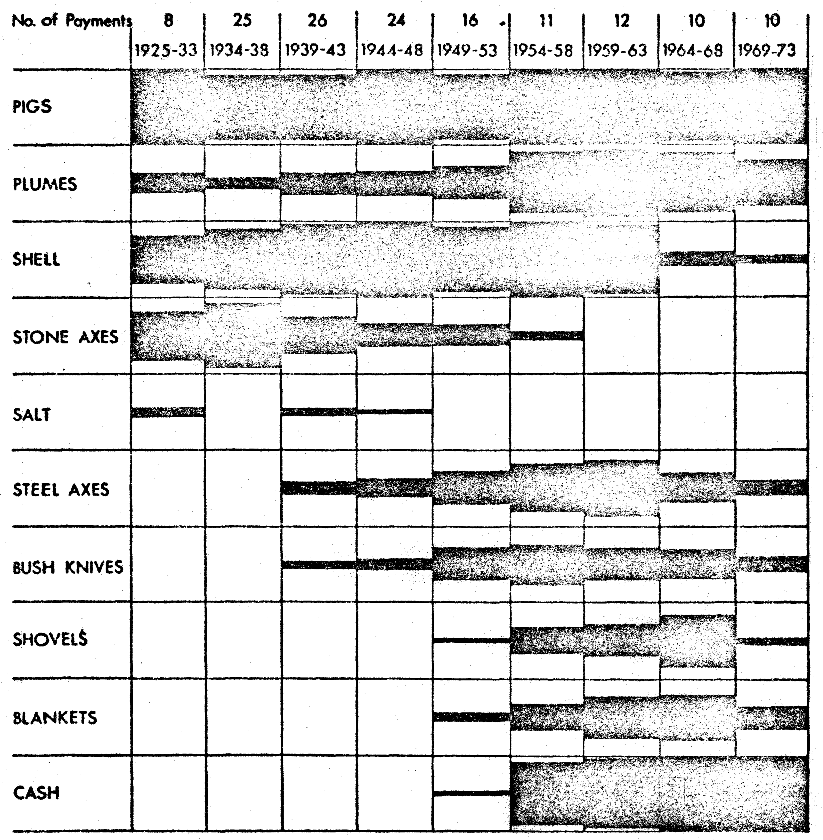
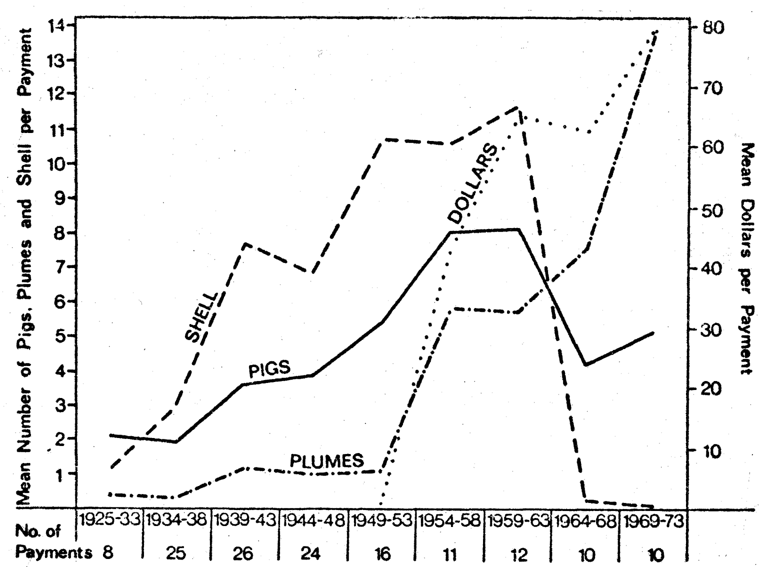
[1] Compare Salisbury's estimate, using a pearl shell index, of a a five-fold increase in the capitalization of Siane gima activities between 1933 and 1950 (1962:153).



A. Percentage of payments in which items appeared



B. Mean numbers of major items per payment

Fig.4.1 CHANGES IN THE COMPOSITION OF SOME SINASINA BRIDE PAYMENTS jumped into prominence in the mid 1950s, appearing in 8 out of 10 payments rather than their initial 2 or 3, and their average numbers increased five-fold. The rise of money was similarly meteoric.

In the final period of the 1960s and early 1970s, shell collapsed and axes declined to leave pigs, cash, and plumes as the major components. Although the average number of pigs fell, and the rate of increase (after an initial slight decline) in amounts of money slowed, both appeared in almost all payments. Plumes, on the other hand, appeared (though the number of cases is small) less frequently, although their average numbers continued to rise.

Before looking more closely at individual categories, two general points, the extent of regional variation in the composition of payments in Chimbu, and attempts at regulation, need to be considered.

Bride payment differences within Chimbu

Although direct comparison is not intended here, it is relevant to ask whether Sinasina bride payments differ substantially from those in neighbouring parts of Chimbu. The primary difficulty here is one of evidence, for the documentary record is uneven, both for time and place, and not extensive. All the material I have been able to locate is shown in Table 4.1.[2] We know that some differences in

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[2]These are, it must be stressed, very rough 'case' materials, including 'typical' payments (Nos. 1,2,11,12), payments made by wage-earning, and prestigious, policemen (3,9), and odd payments that European observers happen to have been present at (4,5,6, and perhaps 7,8, and 9). Further, some are incomplete. Also, by aggregating certain items into single categories, such as plumes, they may hide differences. Where differentiation of a category was made in the original source, details appear in the notes.

TABLE 4.1 Approximate* composition of some bride payments in various parts of Chimbu (1933-65).(1)

	1 c.1933	2 c.1933	3 1937	4 c.1940	5 1949	6 1952	7 1953	8 1953	9 1953	(10) (1953)	11 1954	12 1958-65
Pigs	2-3	-	-	-	4	-	14	23	8	3	-	6
Pearl shells	2-3	-	3	4	22	12	25	13	6	7	10	20
Dog whelk	2-3	2-3	-	3	4	6	10	8	3	4	10	15
Cowrie		-	-	12	-	-	5	14	-	-	-	-
Baler	-	-	-	-	-	6	-	-	-	-	-	3
Green snail	-	-	-	-	( )	-	4	1	-	2	-	-
Plumes	2-4	1	-	8	10	-	10	8	5	3	10	29
Stone axes	30-40	1	-	30	57	-	18	45	-	1	-	-
Fur	2-3	1	-	2	-	-	-	-	-	-	10	-
Steel axes	-	-	2	-	3	2	10	6	5	3	4	20
Bushknives	-	-	2	-	7	6	8	2	10	4	-	2
Cash	-	-	-	-	£1.15	-	-	-	£100	£3.0	-	£15-200

* Approximate in that some sources record actual observations (i.e.6), while others indicate that they are describing "typical" payments (i.e. 1, 7), and for some the evidence is incomplete (i.e. 4, 6). Some absences, such as pigs in 2, 3, 4, 6, and 11, are therefore probably due to the nature of the record. ( ) indicates an item was mentioned but no quantity given.

(1) Sources : over page

Sources for TABLE 4.1

1. Kamanugu (Waiye Census Division); Bergmann 1971, Vol.1,174). The dog whelks and cowries are specifically forehead ornaments, though he also mentions 2-3 "shells lined up on strings".

2 and 11. Salt (Gumine District); F.N.Harris (CPR 9, 1954:13). In 11 he included "several" strings of beads, a mirror, a laplap, and 3 handkerchiefs. These figures appear to be the (unacknowledged) source of Hatanaka's "the average bride price before contact (compared) with that of the early 1950s" (1972:30). She adds however an unlikely 2-3 pearl shells in the 1930 column, and a figure of 4-7 for the strings of beads in the 1954 column, and notes that the Gunangi, who are situated immediately to the north of Salt across the Wahgi, usually included salt in their bride payments.

3. Either vicinity of Kundiawa, or one of the Police Posts? (Part of?) a bride payment made by Police Constable Apia in 1937 (Letter, A.F. Kyle to the Senior Inspector of Police, Salamaua, 14 March 1937; carbon in Chimbu-Wahgi Post, Monthly Reports and Correspondence). The order also included 2 "mary's blouses", 2 lavalavas, and one cardboard of ordinary small shirt buttons. The price of the pearl shell was specified as 2-3 shillings each.

4. Vicinity of Mingende? From two photographs in the possession of Fr. Joseph Kuppers. Four of the pearl shells were large, one small. The cowries were either prepared as ornaments (3 "eyeshade" type visors - cf. Hughes' description of the common middle Wahgi head decorations as recorded by 1933 photographs, "rows of ring or money cowries stitched to bark cloth worn over the top of the fore head and over the temples, framing the face, in Taylor's Dickensian description, like Dolly Varden bonnets" (1977:55) - and 1 broad forehead band), or sewn on a "rope of ?bark cloth (4 approximately one metre long, 4 two metres). The dog whelks were all in ornament form (2 visors, 1 thin forehead band). Four of the bird of paradise plumes were *Paradisaea raggiana*, four *Paradisaea minor*.

5. Kerowagi area? Daika (1949:56). The source is an article in the *Pacific Islands Monthly*, titled "Brides join the price spiral", which included a photograph showing a bridal pair. Payment included a large quantity of beads and an unspecified amount of native salt.

6. Tabari payment to Dinga, Sinasina; Julius (n.d.,9). Julius, the then Government Anthropologist on a two week visit to Sinasina, notes that he was told that "...this was a good deal more than such a presentation would have involved in pre-european days and that it was part only of the transaction".

7, 8, 9, 10. Respectively Yongamugl, Kewandegu, Kamanugu and lastly a proposed "recommended" payment; Hayes (CPR 12, 1953:13). Hayes considered that 7, 8 and 9 were typical payments, though the cash

7, 8, 9, 10 continued from previous page.
in 9 was "unusual, being incurred in the case of a member of the police once stational at Kundiawa". The dog whelks are described as headdresses, the cowries as ropes.

11. see 2.

12. Central Chimbu; Brown (1972:91, Table 2). Brown's 29 plumes consisted of 15 *Paradisaea apoda* (i.e. *raggiana*?), 3 *Paradisaea minor*, 10 *Astrapia stephaniae*, and 1 *Lophorina superba*. she also notes 12 *Psittrichas fulgidus* headdresses and a further 10 other headdresses. The cowrie headbands were no longer given after "about 1960".

ornaments, and in preferences for items sought in exchange, were apparent in 1933 (Hughes 1977:54-55). Regions also differed considerably in their access both to the sources of salt, stone and other items, and to the trade routes which carried other exotic goods from more distant places. Further, broad ecological differences in altitude and soil presumably meant productivity differences with the potential for some exchange advantage. By 1940, for instance, the Minj area to the west was described as the

> "...natural cultural and trading centre of the Wagi valley.... (with its) great volume of livestock wealth unequalled in the length and breadth of the subdivision....There was a great deal of steel and valuable shell and they seemed to be more wealthy than the average Chimbu tribe simply by trading" (Downs,PR 1-9 July, 1940,pp.6-7).

Given such differences (even if not necessarily so pronounced as the latter account implies), different evaluations of particular items, and hence variation in the composition of payments, even over relatively short distances, seem possible.

It is against such a background that the contrast between, for example, the relatively small average numbers of stone axes in Sinasina payments (Fig. 4.1B) and the large numbers regularly reported in parts of central Chimbu (Table 4.1 ; columns 1,4,5,7,8),[3] should perhaps be viewed. While the difference may be nothing more than memory lapse (although nine was the highest number recalled in 49 Sinasina cases in which stone axes were included), it is of a magnitude to be suggestive. It is perhaps supported by the figure of only 1 from the Salt area to the south of Sinasina (Table 4.1 ; Column 2). Some minor disagreements

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[3]Cf. Vial (1939:21, 1940:162), who reports as many as 60 in a single payment (p.129 below).

concerning the timing of changes are also apparent. Bergmann, presumably referring to the Kamanuku, elsewhere dates the beginning of the use of steel tools in payments to about 1957 (1971,Vol.1,p.175), which is much later than indicated by the Sinasina evidence (Fig. 4.1A). It is also contradicted by Nilles (1950:35). The continued use of large numbers of stone axes in Yongamugl and Kewandegu in 1953 (Table 4.1 ; columns 7,8) seems, conversely, late by Sinasina standards, but is confirmed by Nilles (1953:2). Though I have deliberately excluded details from the Siane area to the east as being 'non-Chimbu', Salisbury's description is worth citing in terms of the timing and extent of change. Pre-1933 Siane payments consisted of two or three broken pieces of pearl shell, one cowrie headband, some plumes, and at least one pig (Salisbury 1962:100,116). By about 1940 they had doubled, even in western Siane which Salisbury describes as more isolated from the new sources of wealth in the Goroka to the north east (ibid.,116), though I suspect this downplays the importance of Chuave as a source. By 1953, "the period of rapidly increasing prices (in trade) seemed to have passed, and rates were high and stable..." (ibid.,parenthesis added). At this date, bride payments varied according to location, but not markedly (ibid.,132), and Salisbury gives figures of about 6 pigs,[4] 9-14 pearl shells, 0-2 cowrie head bands, 0-5 green snail shells, 0-4 headdresses, 0-5 plumes, 1-2 cloth laplaps, 0-1 pieces of fur, and 0-£2 in notes (ibid.,98,132).

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[4]Elsewhere he gives an average of 5 pigs, from 3 'weddings', (ibid.,80). The latter figure seems to have been based on two bride payments of about 6 pigs each, and one return from the bride's clan of about 4 (ibid.,98).

It is of interest that Salisbury makes no mention of the use of stone axes in pre-1933 bride payments, and records that steel axes were rarely used in ceremonial preentations by 1953 (ibid.,118).

In summary then, there is evidence to indicate a certain amount of regional variation prior to the general exposure of most of north and central Chimbu to shell and steel imports and access to new sources of plumes.

Attempts to regulate bride payments

The fluctuating movements of the average numbers of items shown in Fig. 4.1B are not only apparent when graphed over a forty year period : contemporary observers were well aware of devaluation in trading rates from the first few months of the colonial period (Hughes 1977 :57,1978), and, by 1949, the inflation of bride payments had even made the pages of the Pacific Islands Monthly (Daika 1949:56). Such perception led to attempts at regulating both trading prices and the sizes of bride payments. In the case of trading and other payments between foreigners and Chimbu, attempts were made to protect the value of the media of exchange (see p.133 below; also Finney et al.1974:344). In the early 1950s inflated bride payments in Chimbu were seen by some government officers as a problem, recommended levels were discussed and even drawn up (Table 4.1 ; column 10), but apparently no official action was taken at the time. Langness, writing of the Eastern Highlands, suggests that the stimulus for regulation came primarily from Europeans (1963:), but this was not the case in the Hagen region to the west where M.Strathern describes a 1956 attempt to limit bride payments as originating from the people : council rules, however, were not finally implemented until about 1970 (1972: 146,fn.1). From the middle Wahgi area (Kuma), Reay reports government regulation but does not date it (1966:167). Explicit attempts to establish limits in central Chimbu are not reported until the establishment of councils (Brown 1972:116).

In Sinasina the first council (1965-66) ruled that the money component should not exceed $50, but within four years this was raised by the third council (1968-71) to $100, partly, according to Hatanaka (1972:77), to bring Sinasina payments into line with those of surrounding areas. Such council regulations, however partial their enforcement (cf.Brown 1972:116), appear, on the evidence of the Sinasina case material, to have had some effect (Fig. 4.1B).[5] A proposal by delegates from the third Sinasina council at a District Councils Conference for the complete abolition of bride payments apparently met with no success (Hatanaka 1972:63).

Members of the fourth Sinasina council (elected late 1971) continued to police at some infractions of the 1969 cash limit.[6] Some councillors felt, however, that limits should be extended to other items. A Dinga councillor attacked the lavish expenditure

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[5] Hatanaka draws a causal arrow from the regulation to increased demand for family consumption and, thus, "...the number of tradestores increased from 20 in 1965-66 to 268 in 1968, 283 in 1969, and 300 in 1970" (1972:90). This exaggerates, in my opinion, the effect of the limit, and underplays rising incomes from coffee production, and remittances from the growing number of migrant workers.

[6] Sinasina LGC Minutes, Agenda Item 9, 16 November 1971; Agenda Item 3, 21 March 1972. Also Field Notes for meeting of 15 February 1972.

on alcohol and store foods incurred at marriage exchanges, and informed the council that his people were going to do away with such waste (Sinasina LGC Minutes, 18 January 1972). The same theme received heavy stress a few weeks later from the newly elected councillor of Nimai Waula and Ogole in a long speech to his ward members. Noting that the cash prices of everything were rising fast and that accumulation for tax and other purposes was therfore difficult, he said.

> "When you marry off a young woman I don't want to see a single bottle of beer come into Nimai Waula houses. This must stop now. Yesterday (on the occasion of a Dugul-Ogole marriage), Kuguruma (a Dugul settlement) wanted to send some beer to Koge (i.e. to Ogole), but I said its forbidden and I stopped them. They only cooked rice, they didn't buy beer. I told them to get only one 'parcel' (?bag) of rice and cook it for everyone, and they did only cook you one 'parcel'. Yes, that's enough. If they had got more, how many friends do they have who would have wanted to contribute, and the quantity would have shot up. I forbad this strongly....When you want to marry off a girl, use pigs only.... If you buy that meat they've got in the freezers in the stores, what happens ? You cook it and its eaten, and your money has gone to the Companies....You've eaten this meat and where's it gone ? Its gone down the toilet, its nothing but shit, and you can't get it back. So, if you go to the stores and find the prices have gone up, forget them, there's sweet potato, there are all our vegetables, these are our food....give up the store foods. They'll stay in the stores, rusting on the shelves, and later the prices will go down and you can buy them, or they'll go bad and will be thrown away. But you'll still have money on your skins to pay for transport and whatever else you want" (C/RH/72.1A).

Four months later, another Dinga councillor proposed that plumes be dropped from bride payments, arguing that the latter should consist only of pigs and money. He pressed that this suggestion should be raised at the Combined Councils Conference scheduled for the following week. It was, though in amended form. The Sinasina proposal sought to restrict the number of pigs to two, to limit money to $100 (as before), and to completely exclude all other items (Chimbu District Combined Councils Conference, 24-26 May 1972; Agenda Item in Law and Order

Section). I do not know the direct outcome of the conference's deliberations on the topic, but the Sinasina Council took no further action in formal meetings before May 1973. Outside the council, however, matters took a different course. Information on the proposed restrictions was communicated within two days of the conference to members of Waula clan. The occasion was the arrival of a party of Dinga, bearing a bride payment in search of a bride for one of their young clansmen. The Waula councillor announced that the council had decided to prohibit large payments, exclude plumes entirely, and institute two types or scales of payment : one for previously married women, which would be deferred until at least a year after the beginning of co-residence or the birth of a child, and the other for new brides, which was to be limited to a cash component of $40, and three or four pigs. In the event, the girl, to whose father's house the Dinga party had been directed, when pressed for her thoughts about the marriage offer, signified her rejection by saying, according to an informant, that two of the _Epimachus_ spp. plumes making up the offered payment were too tattered. However, it did not appear that marriages occurring between this pronouncement and my departure in May 1973 were affected, at least as far as pigs and plumes were concerned.

In short, then, attempts to regulate the kinds and amounts of particular items in bride payments seem to have been made in Sinasina since at least the mid 1960s, though only the cash component was in fact limited by explicit council regulation. Fluctuations in other items may therefore be presumed to primarily reflect the play of other factors.

Disappearances : salt and stone axes

Salt[7] was the first item to disappear from bride payments (in 1944-48), though manufacture at the Wahgi springs continued until the 1950s (Hughes 1977:100).[8] This sequence is suggestive. While the industry was eventually displaced by imported refined salt, the earlier demise of salt as a bride payment item, at least in central Sinasina, suggests that its transfer in trade (and other non-marriage transactions) outweighed its circulation in bride payments. For central Sinasina, the pre-1933 trade use of salt was primarily for transactions with more northerly groups toward the Chimbu valley, which Hughes describes as one of the major routes of the southward-moving small shells, cowries and dog whelks (ibid.,187-191). From 1934, however, the sources of imported salt and shell in the region coincided amongst those more northerly groups.

Indirect evidence of serious disruptions in this particular sector of Sinasina exchange seems to be provided by the "Strange Case of Kere" described by Simpson (1954:100-103; for the original

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[7]Hughes gives pil as the Sinasina term for salt from the Wahgi springs (1977:87), which is correct only for some Sinasina speakers (i.e. Tabari, Kere, and ?Gunangi). Others, including Nimai and Dinga, use the term miri, and thus miri kegale (cf.murukakali, Hughes ibid.,89, citing Costelloe PR 7,1946/47,p.6), for the salt tablets. Nimai also exchanged it in bamboo containers, hence miri muge.

[8]Maahs, writing in 1950, did not consider it "...likely that the salt makers will go out of business....(a)s long as the area is not over-supplied with the white man's salt....With the white man's product available to supplement their own, it seems certain that the natives will be able to eat salt with their meat for evermore" (1950:18). Similar faith by Europeans was expressed in the future of both stone axes and shell (see below).

report see Downs, PR,21 July - 1 August,1940, and, for further, apparently confused, secondary comment, Hatanaka 1972:27-8). Combining elements of cargo 'cult', opposition to colonial intrusion, and extortion of surrounding groups' pigs, this 1940 incident centrally involved the Sinasina Kere. Their strategic location was not lost on Downs, who noted that "...the main route (more correctly, one amongst several,RH) to the salt mine or soakage lies through Kere" (ibid.,2). They had, he reported, marked a boundary between themselves and the Nimai and Tabari to the northwest and north of them, and announced that "(n)o one who belongs to the Kiap can cross this boundary and no one can now go to the salt mine" (ibid.,4). While the details are sketchy, it is not, I think, reading too much into the situation to see declining terms of trade occasioned by reversal of the sources of salt as a contributing factor (cf.Brunton 1971; Strathern 1971 b).[9]

Comparing stone axes with other (central) Chimbu valuables such as pigs, shells, and plumes in the late 1930s, Vial described them as "...the nearest to our money[10] in the way they are regarded" (1939:21),

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[9]It is interesting that this incident appears to predate by approximately 5 years the similar ones described by Strathern.

[10]Too much weight should not be given to this statement. For instance, Nilles, writing mainly of the upper Chimbu valley four years later, said "(t)he principal medium of exchange consists of the cowry and **tambu** shell....But the principal measures for valuing and comparing goods in general seem to be the pig, the goldlip shell and to some extent, the stone axe" (1943:12-13). In this case Nilles seems to be distinguishing between small shell as media of exchange for things of less value ("bark sheets, clothes, net bags, paint, small pigs, dogs and also food and nearly all articles of daily use" (ibid.13), and the latter group of valuables (pigs, goldlip and stone axes) as the major 'valuables'. Nevertheless it is possible that stone axes may have been of greater importance to people in the neighbourhood of Kundiawa (see the following footnote).

noting in particular their role in bride payments, in which as many as 50 or 60 (20-60 in Vial 1940:162), might appear, and in death compensation payments.[11] He also noted that steel axes were still only owned by a minority,[12] though the amount in the area was increasing, "...and most of the work is still done with stone" (ibid.,22). The latter, he considered, "...will continue to be made, for the steel will not take their place in making payments" (ibid.). The Sinasina data also show that steel had not entered bride payments by 1938, though their appearance was marked in the next five years (Figs. 4.2A, B). By 1944-48, the period in which the Dom stone quarry ceased production (Hughes 1977:142), they were almost

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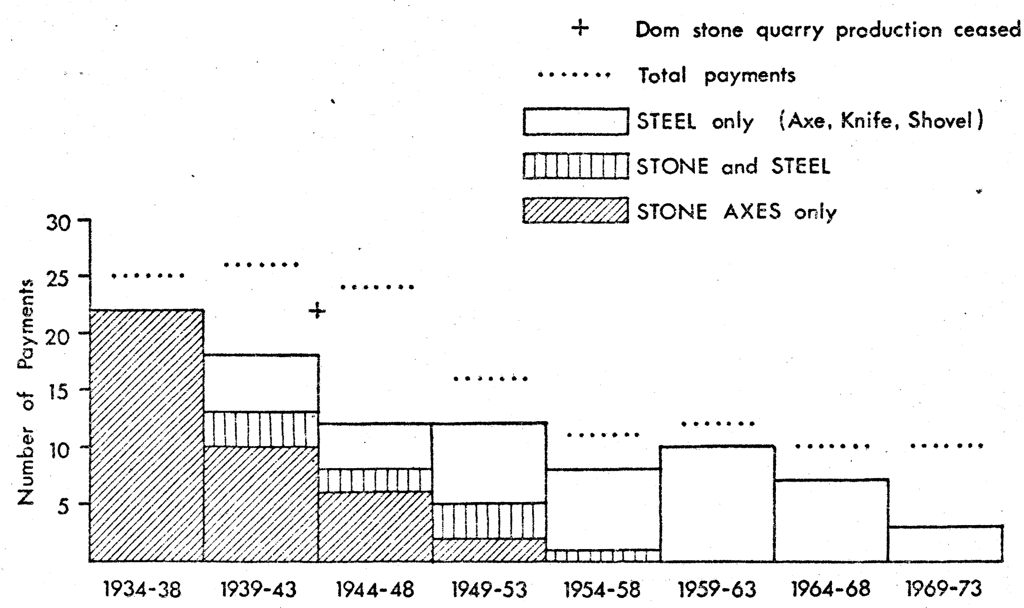
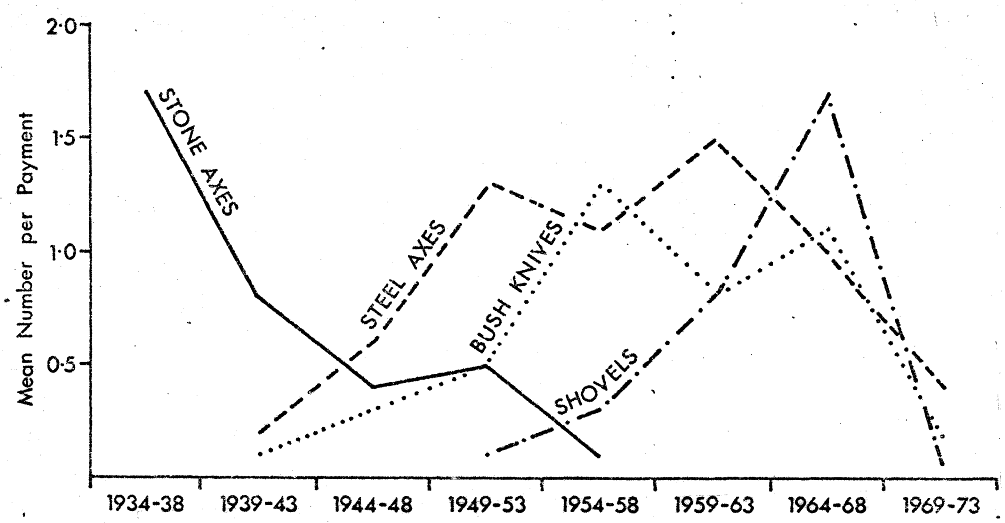
[11]Vial was in Chimbu from June 1938 to September 1939 (Kundiawa Station Diary, 23 June 1938, and 26 September 1939),i.e. 5 to 6 years after initial contact. Is it possible that the numbers of stone axes appearing in prestations had significantly increased by this time, particularly in areas close to Kundiawa and thus influenced by proximity to the new sources of salt, steel and shell ? Or had stone axes been particularly important here in the past, as might befit a 'crossroads' location linking (a) the heavy populations of the middle and upper Chimbu valley, (b) the large populations further west along the Wahgi, and (c) the Dom and Gumine areas from which salt and (Dom) axes came ? An ethno-historical reconstruction of bride payments in these various areas would be interesting.

[12]In a later paper, however, he estimated that as many as 70 per cent of men and youths belonging to tribes near government and mission stations possessed steel (1940:163).



A. Number of payments including stone only, steel only, and both stone and steel



B. Mean numbers of stone and steel tools per payment

Fig.4.2 STONE AND STEEL IN SINASINA BRIDE PAYMENTS level-pegging with stone. Though stone had been eclipsed by the end of the 1940s,[13] some continued to circulate in Sinasina bride payments for as long as ten years after Dom production had ceased.

Steel axes seem to have appeared regularly in Sinasina payments throughout the 1950s, but their value, relative to other goods, had dropped by 1952. Formerly, according to Nilles, two good sized pigs would be given for one axe (1953:3; two or three big pigs in Nilles 1943:13) ; by 1943 "...one middle-sized pig was given for a three-pound axe" (1943:13), and by 1952, "...a pig will hardly be exchanged for two axes. The same applies to all steel implements" (1953:3). The Sinasina evidence suggests that bushknives and shovels were added to prestations as they became more available in the 1950s.[14] The retention of steel through the mid-1960s in Sinasina payments contrasts with the Melpa situation described by Marilyn Strathern, though the overall replacement pattern in the latter area is otherwise broadly

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[13]According to Stoner (1950/51:485-6, photograph on p.485), "(e)ven now a proportion of the men carry stone axes of fine workmanship for tree cutting," and he also noted the continuing use of ceremonial axes in bride payments (ibid.,490). Writing in September 1952, Nilles considered that "today...there is hardly a man without (a steel axe)...,and a large number are in possession of three or four ...(1953:2). Stone axes could "occasionally" be seen in the hands of old men still working with them, and "(t)he ceremonial and ornamental axes of stone are still in use as before" (ibid.), though often exchanged (to Europeans?) for steel, money or other items. By 1959, stone axes were no longer used in central Chimbu bride payments (Brookfield and Brown 1963:64).

[14]Cf. Nilles who suggests that by 1952 shovels were in common use in the Wahgi area, but rare in the upper Chimbu valley (1953:2). In Siane, by 1953, bushknives were already held by "many men", but only a few spades, used for Government work (and nominally Government property), were held by village officials (Salisbury 1962:154). By 1961 spades were widely owned and used by women in cultivation (Salisbury 1964:6, fn.16).

similar. There, before 1933, stone axes appeared in half the payments recorded. By 1940 this proportion had diminished, and, during the following decade they were replaced "to a small extent by steel axes and knives, but these never attained the proportional significance of the stone axes" (1965:190). Instead Strathern suggests that pearl shell replaced both smaller shells (cowries) and axes in exchanges and, by the 1960s, steel axes were rarely transferred in bride payments.

Shell : boom and bust[15]

Of all pre-colonial valuables in the Highlands, shell was the one distinguished by colonial recognition and use as the major medium of exchange in foreigner-highlander transactions. Local preferences for particular species were identified by early explorers, missionaries and government officers, and supplies organised from source areas (Hughes 1977:52-3,1978). In the Chimbu region, shell remained the major currency item[16] in such transactions from 1933 until the

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[15]Hughes' excellent paper (1978) on imports of shell throughout the highland region appeared after this section was first drafted. He focuses explicitly on the pre-World War 2 period. My geographic range is narrower, but I continue the account up to the 1970s. Both our analyses are based heavily on the same primary sources from Chimbu.

[16]This currency function was of course partly shared with a wide variety of other items, ranging from steel tools, through cheap utilitarian and decorative manufactures (razors, face paints, mirrors, cloth, beads), to "consumption" items (matches, tobacco, salt, soap, and newspaper), all of which were used in barter by Europeans. Barter for foodstuffs and firewood, particularly using such items as salt and tobacco, continued until 1958 in northern Sinasina (and also central Chimbu, Brown 1972:88), when the Catholic Mission at Koge changed to using money (G.Buhler pers. comm. 20 January 1973).

early 1950s when it was replaced by money. Understanding of the changes in Sinasina use of shell in bride payments (Figs 4.3A and B) requires a sketch of the European use of shell in the region.

Pearl shell and small shell (cowries and dog whelks) were the main items used in Sinasina, the former as payment for pigs, land, and extended periods of labour, the latter, in far greater quantities, for smaller purchases and shorter periods of labour. Devaluation was rapid. According to Bergmann, small shell devalued approximately two to three fold in the five years between 1934-39 (pers.comm.,14 September 1974). This was expected, and he notes that his mission accordingly included other items (small knives, mirrors, matches and salt) in payments in the hope that, should shell devalue too fast, demand would continue for the new manufactures.[17] From the government point of view this unilateral action in a market situation consisting of only two major buyers seemed to hasten the process it was designed to counteract. Thus, in late 1936, the officer at Kundiawa reported that :

> "Considerable trouble is now being experienced in getting food on this station. Some time ago the Lutheran Mission brought in small knives and mirrors. These have become popular, and small shell is losing its appeal to the locals. The Mission brought in 80 dozen of each, bought for 2/6 (two shillings and six pence) per dozen retail. I am at present practically coercing

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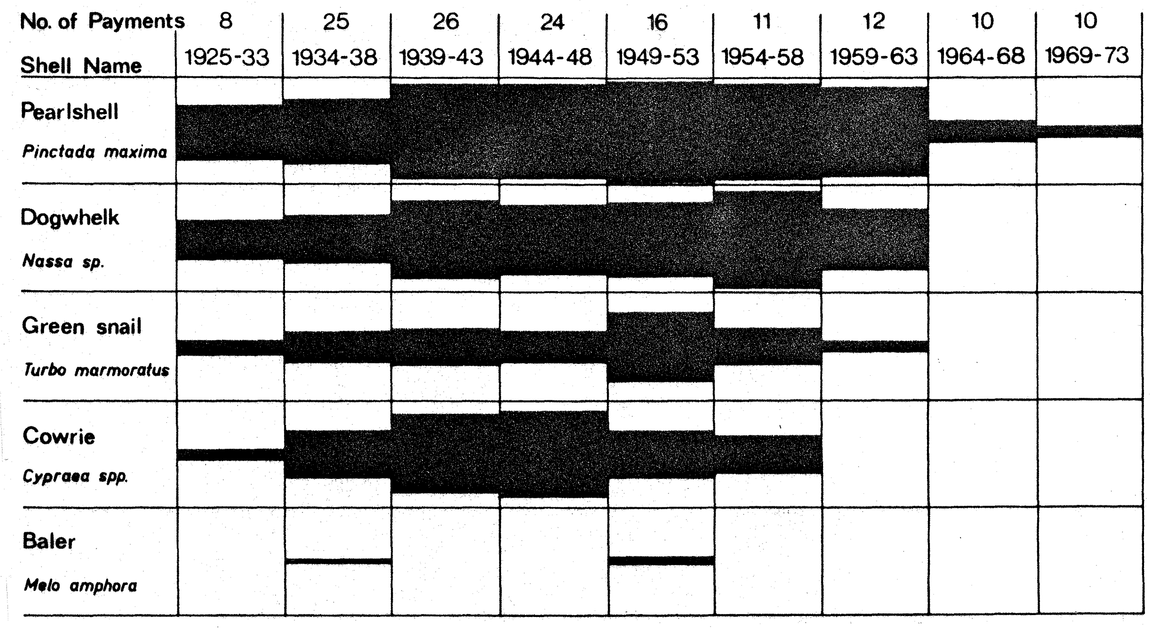
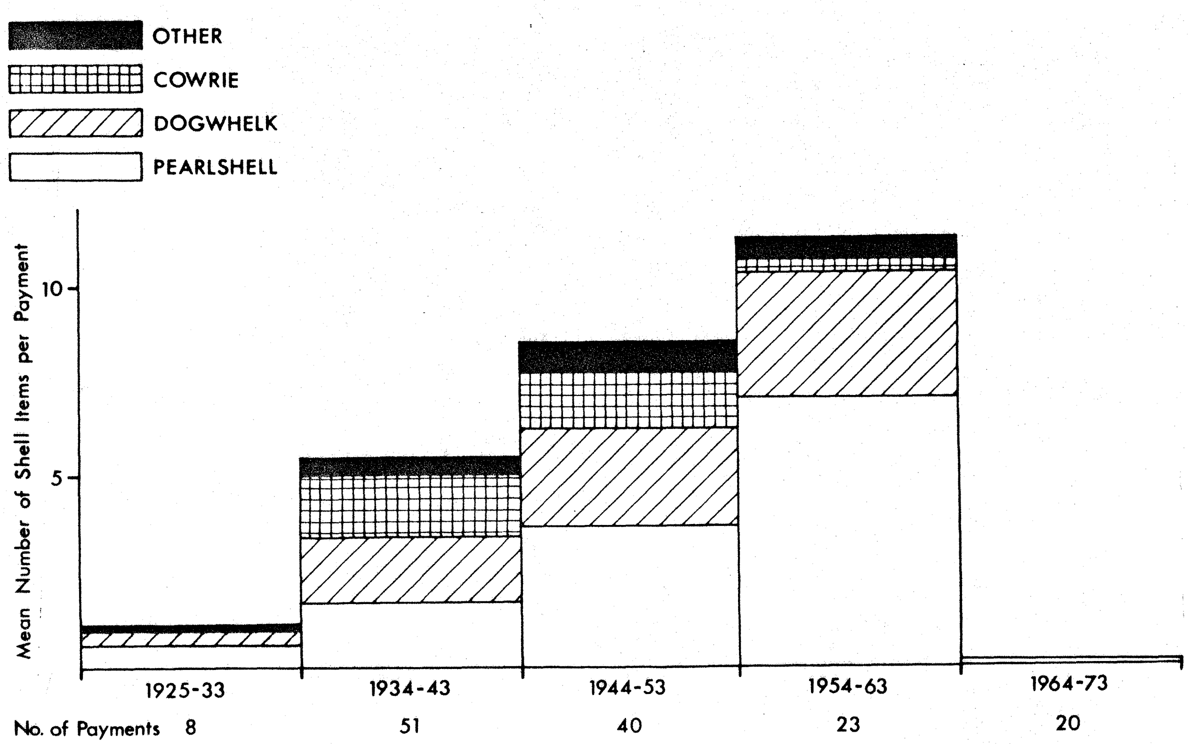
[17]Costed, in 1933, at Salamaua, the coastal centre from which Chimbu was at first administered, as follows : 'taro' knives 6 pence each, 8 inch knives 1 shilling each, matches 1¾ pence per packet, and salt ¾ pence per lb. Three-quarter size axes cost 3 shillings and a halfpenny each (McCarthy, Morobe PR 15,1933/34). In 1937 air freight charges from Salamaua to Chimbu were 9 pence per lb (Letter,20 April 1937, A.F.Kyle to D.O.,Salamaua : Carbon copy in Chimbu-Wahgi Post, MR and correspondence.)



A. Percentage of payments in which shell items appeared



B. Mean numbers of shell items per payment

Fig.4.3 SHELL ITEMS IN SINASINA BRIDE PAYMENTS the locals to bring food ; this is not advisable, nor can it last. The Mission have also asked me to cooperate in using goldlip only to purchase pigs. I agree with this, but we are now in the position of having no goldlip no pigs except for a fortnights' supply on this station, and no tinned meat....I am including small knives (taro) and mirrors in my next requisition. I am asking also for a spring balance, I will see the Revd. Bergmann, and fix with him a scale of payment for food to be adhered to...." (Kyle,MR,November 1936,p.2; parentheses added).

The disbursement of shell into the hinterland surrounding Kundiawa must have been considerable. In 1937 the combined residents on the Lutheran and government stations, some 300 persons, were estimated to be consuming over one ton of locally purchased food daily (Kyle,MR,April 1937), much of which was presumably traded for small shell. Which species of small shell predominated, dog whelks or cowries ? Sometimes both were used, as for instance when an officer "(p)aid off local casuals today for 5 days work - girigiri, tambu and beads" (Kundiawa Station Diary, 15 February 1937). Nilles, perhaps referring mainly to the upper Chimbu valley, seems to suggest in an early paper greater quantities of cowries, and to imply that, by 1943, they had devalued, relative to pigs, more than dog whelks :

"The medium of exchange consists of the cowry and tambu shell. These shells have undergone a kind of inflation, as a result of their being imported in great quantity. They are still valued as ornaments, as well as being a medium and means of wealth. Thus bark sheets, clothes, net bags, paint, small pigs, dogs and also food and nearly all articles of daily use are bartered for them. There is no price-fixing. The demand by the seller, and the offer and need of the purchaser are the factors involved. Thus the value of the thing changes. A prescribed length of rope of shells is the established unit for the cowry shell when more valuable goods, such as women (sic), are bartered. The unit for the tambu shell is taken from the length of a nose ornament of the same shell. The average length of the former is about five feet, and the latter two feet...A grown-up pig was formerly given for two ropes of cowries or two of tambu shells, but to-day pigs are not sold for these shells except a small pig for a tambu rope" (1944:12-13: for a description of the ornaments, 1943:111-112).

Greater use by Europeans of cowries is also suggested by some fragmentary radio messages recorded at Kundiawa during May of (?) 1938,[18] by patrol reports during 1936 and 1937 (see below), and, indirectly, in a later paper by Nilles. In 1953 he wrote that "(t)ill some years ago, the small giri giri shell was, to a certain extent the main medium of exchange" (1953:9),[19] whereas "...tambu... is at present much in demand. With this shell the natives have developed a new article of adornment, a kind of headband." (ibid., 8).

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[18] Hughes (1978:314) dates these to December 1936, probably because they appear in conjunction with Kyle's Monthly Report for November 1936 (dated 2 December) in a book of carbon copies of Monthly Reports and Correspondence for the period November 1936 to July 1937 (at Kundiawa). However, the page on which they appear is dated 25 May 193 (? 6 or 8). Internal evidence suggests that the May date is correct (see first message), and also that 1938 is most likely since the references to Taylor, and the scrounging of shell to put on board a plane at Hagen, seem to refer to material needed by Taylor on the 1938-1939 Hagen-Sepik Patrol. Taylor constructed an airstrip between 10 and 20 May 1938, and on 31 May received an airdrop of supplies (including benzine), though he had hoped a plane might be able to land (Taylor 1971:32-4). The pilot was probably O'Dea (ibid.,37). The messages read :

VHK 2 "...all stores are now ready except shell. We are not receiving supplies. Manus has let us down. Neptuna due about June 4th..."

VHM 5 "Shells(?) Buy (or By) 'Mantoro" - 500 fathoms 'tambu' for Taylor or do you require girigiri?"

VHK 2 "Need giri-giri. Supply 3,000 lbs per month. Receiving none at all. Suggest you take it up with Manus"

VHM 5 "Rai coast giri-giri?"

VH 59 "Signals O.K. Tell Ogelbeng 8 a.m. in event O'Dea landing - could Mr. Edwards putting (?) the benzine and giri-giri on board. Suggests Mr.Edwards scrounges shell from 2 missions and M.I.Leahy. Out of benzine and shell."

VHK 2 "O.K. Tell Mr. Taylor I have sent letter to Mission re shell".

[19] But see Nilles (1950:47), where pre-1933 is specified.

Demand for dog whelks, however, was certainly not restricted to the post-war period, since in 1940, Downs reported that

> "Tambu shell is badly wanted. Buttons cannot replace it. It is part of the local wealth. I have made ten pounds of it last for nine months. It is the only thing we need that we have not got. Hagen and Benabena use it too (AR,1940,p.18).

Trade for pigs normally required pearl shell, the "most appreciated shell ornament" according to Nilles (1943:112), which he classed, along with the pig, and "to some extent, the stone axe" as the "principal measures for valuing and comparing goods in general" (1944: 13). Pearlshell also suffered rapid local devaluation : "after the big increase of these from Mt.Hagen, the Wahgi people asked two shells for a pig, but the administration fixed the price at one" (ibid.).[20] By 1938 the government alone was purchasing locally-produced animals at the rate of approximately 230 per year (see Appendix 4: Table A4.1).

Kundiawa, although perhaps the largest, was not the only source of shell within the region. For many Sinasina, the small police post at Chuave was nearer. In a complaint about his supplies during World

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[20]Note however, Kyle's statement above (p.133) for evidence that the initiative for regulation came from the Lutherans. See also Brookfield (1969:11) and Hughes (1978:312) for the devaluation of pearl shell relative to pigs, with the former suggesting that it had spread to Chimbu by April 1934, the latter that it was still restricted to the western end of the Wahgi. According to Edwards, (cited by Vial 1938:20), the patrol officer at Hagen in 1938, "...the Hagen natives have realized that they can sell a pig to the Gormis post for one gold-lip shell, take that shell two or three days' journey towards Chimbu, exchange it there for two pigs, come home again and eat one pig, and then have as many pigs as they started with....So pigs are becoming scarce near Chimbu..." (cf. Salisbury, 1962:116, who extrapolates this account to include a corresponding movement of women, though Vial, following Edwards, makes no mention of them).

War II, the officer in charge at this station estimated his trade requirements at five drums of salt and 68 kg (weights in lbs in original) of cowries per three months, and one pearl shell per week for pig purchases (Dennis, CPR 11,1944/45,p.2).[21]

Although the hinterlands of stations and posts received the most regular supplies of shell, considerable quantities were also used by patrols. Thus six patrols between February and May 1936, for a total of 44 patrolling days, carried the combined sum of 65 pearl shell and 175 kg of cowries (Bates,PRs 19-24 February; 2-13 March; 19-24 March; 31 March-4 April; 21-25 April; 20-31 May; all of 1936). Although the amount expended is not recorded, such heavy outlays were probably unusual and primarily accounted for by extensive road-making in which road 'gangs' of over 1000 men were engaged in both the Chimbu valley and Sinasina. Further, one of the patrols delivered some of the shell (4 pearl shell and 23 kg of cowries) as supplies to the police post at Gorgme. A more normal level of expenditure is probably shown by six patrols, totalling 36 days on the road, between 23 April and 22 August in the following year, which record a sum of 33 pearl shells, 31 kg of "small shell" (cowries indicated in only one), 9 kg of salt, 55 'taro' knives and 54 small mirrors

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[21]Extrapolated to one year, some 272 kg of cowries, 52 pearl shells, and 20 drums of salt, and this for a small post with probably no more than five policemen. If comparable accounts were available, the bill for Kundiawa's daily ton of food and annual 230 pigs (in 1938), would probably make the figures for Wabag (in 1955), in the Western Highlands, of 614 pearl shell, 38 bailer-shell, and 167 kg of large and small cowries (Meggitt 1971:202,fn.21), seem like small beer,

(Kyle,PRs 23-26 April; 15-18 May; 18-23 June; 7-19 July; 14-22 August, all of 1937).[22]

By 1940, however, the government was tightening its belt, presumably as a result of the outbreak of war (3 September 1939). Discussing his road plans for Sinasina in April of 1940, Downs commented on the past diet of "over payment and coddling", and the fact that he could not "afford the displays of largesse that were such highlights of the past" (PR,28 March-9 April,1940,p.3). In July, when buying pigs for supplies near Minj (in the west) he noted cryptically that "(w)ith no goldlip...I was glad to be able to purchase pigs with knives, salt, poge(i) shells (Conus sp.,RH) and tomahawks although I did not desire to release more than four of the latter" (PR,1-9 July,1940,p.6).[23]

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[22] These 1936-37 data do not, I think, fully uphold Hughes' statement that "(p)atrol reports from the Chimbu post in 1936 and 1937 ...show steadily increasing quantities and an increasing proportion of shells of high denomination....in general a slow decrease in purchasing power is reflected" (1978:314), which he supports with "typical figures" from five patrols.

[23] Was such concern for economising solely due to the onset of war restrictions ? Earlier, in the Western Highlands, Downs noted that cutting (before transport) could increase the value of pogei shell (Conus sp.) by a factor of five, and that wastage on pearl shell from Rabaul was about 20 per cent. He also contrasted the estimated cost to the government of delivering one pearl shell from Rabaul to Hagen (4 shillings and 6 pence) with M.J.Leahy's costs for delivery from Thursday Island (2 shillings and 6 pence) (PR,31 Aug.1938-18 Jan.1939, p.7). From Chimbu he recommended standardization of the size of knives used in trade, the purchase of axe heads only ("as I have yet to see the original handle on an axe after a month"), and the bulk purchase of red pigment ("a consumable commodity which means that the demand for it will never decrease so it cannot be inflated. It is economical trade and fulfils a local want") (Downs,AR,1940,p.18). See also his concern for self-sufficiency in government pig raising (Appendix 4 below).

Two later consequences of the war must have cut back the supply of at least some shell in the Chimbu region. First the Japanese captured source areas in the islands and on the north coast (January-March 1942). Second, in the face of a probable Japanese advance into the Highlands all foreign missionaries were evacuated, in January 1943 (Williams 1975:12), thus reducing centres of local shell dispersion within Chimbu. To some extent this latter effect would have been compensated for, at least in the west, by the large scale cultivation of vegetables at Kerowagi for the provisioning of the military (Bowman 1946). For many Sinasina also it was offset by the extensive Allied operations in the Eastern Highlands and the consequent heavy demand for labour for airfield construction, road-making and carrying (Dexter 1961:234-245; Finney _et al_.1974:344). Despite the loss of northern shell sources to the Japanese, Thursday Island still supplied pearl shell which the United States Army airlifted to the highlands in great quantities (H.R.Niall,pers.comm.,30 April 1973). As noted earlier, only seven of 51 Nimai Waula clansmen who had been old enough to work in 1943-44 (and were still alive in 1972) did not make a war-time trip to Goroka to work for the Allied forces. Payment received by 19 of them included 16 pearl shells, six steel axes, two mirrors, two unspecified amounts of cowries, and one of beads. The predominance of pearl shell is striking. One man recalled that when offered an axe and a bushknife, he asked for, and received in their place, two small pearl shells.

The suggestion that the supply of small shell decreased during the war, while that of pearl shell increased, or at least remained stable, is supported by breakdown of the Sinasina bride payment data into five year periods. It will be recalled that the 'composite' (i.e. all shell items combined, Fig.4.1B) average of shell items per payment dipped slightly between the 1939-43 and 1944-48 periods. This decline was however, specific to cowries and dog whelks (and to a lesser extent, due to their smaller quantities, green snail shell); the average number of pearl shells per payment continued to rise, though less steeply than before (Appendix 3, Table A3.2).

It is perhaps significant that cowries did not regain their 1939-43 peak, while dog whelks, after rebounding to a higher level in 1949-53, remained numerically important until the 1960s (Fig.4.3A). These movements would support the suggestion concerning an initially greater influx of cowries. There are other indications that wartime deficiencies of supply may not be the sole reason for the early decline of cowries in bride payments. A patrol in Sinasina during January and February of 1945 found that in most places food was given freely and cowries were not accepted in return (Dennis, CPR 6, 1944/45,p.2). Although this seems strong evidence that major devaluation had occurred, interpretation should be cautious. It is true that these months are the time in which sweet potatoes are short, a point which strengthens the suggestion, but as described in Chapter 3, a severe dysentery epidemic was reported from the area during the previous year which may have complicated responses to the patrol's request for food. Suggestive evidence, then, but no more.[24] More useful is the observation two years later, from a patrol over the Wahgi river to the south of Sinasina where no post or station had yet been established, of a marked absence of pearl shell but an abundance of cowries "...judging by the long strings of it worn by the women and girls" (Costelloe, CPR 7,1946/47, p.3). These cowries had come of course from the north, through prestation and trade, therefore lending indirect but strong support to the idea of early cowrie devaluation in the core areas of Chimbu to the north, followed by a southward-moving wave of this shell. Other shell, including pearl shell, [25] also moved south, but presumably in much smaller amounts.

After the war missions and government switched, though not immediately, from shell to money as the currency for major transactions with the people of north and central Chimbu (Bergmann,pers.comm. 14 September 1974; Nilles, pers.comm. 12 August 1974; see Finney 1973: 39-42, and Finney _et al_.1974:344-5 for the change to money at

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[24]See also in this context the account given by J.L.Taylor to Salisbury of how "...during the War, when trade goods were scarce, natives in Komunku and Yamofwe often killed ten or more pigs when he camped for a night, even though he could give no shells in exchange. This was not done for other Europeans and from my (Salisbury's) conversations with the Yamofwe people I feel that Taylor's personal 'credit' was so great that he did not need to return any payment" (Salisbury 1962:116,fn.5).

[25]Cf.Healey (1977:405-6) who cites Wagner as noting that pearl shell from the north began to reach the Daribi of Karimui in the 1940s.

Goroka in 1947). In Sinasina, oral accounts and film[26] testify to the continued currency use of small shell and green snail shell until about 1950 at least. Supply of the latter from the new Catholic station established at Koge in late 1947 may explain their markedly increased occurrence in Sinasina bride payments in the period 1949-53 (Fig. 4.3A). In 1950, a dessert spoon-full of 'small cowries' (?dog whelks) was worth one shilling in Kundiawa (Hughes 1966:105, fn.2, citing Kundiawa News, Supplement, August 1965:9-10). Government patrols in Sinasina continued to use some shell for barter as late as August 1952,[27] though carriers were reported to prefer cash (at six pence an hour) in both Sinasina (Kelaart, CPR 2,1951/2,p.5), and central Chimbu (Kelaart, CPR 3,1950/51,p.4), at least a year or so earlier.[28] In one period of six months in 1952-53, Hughes notes that more than 3 tons of dog whelks were dispatched to highlands' patrol posts through Goroka, and describes how, by 1957, demand for 'small cowries' (? dog whelks) had collapsed, at least in Kundiawa, where a trade store threw out bags of them and they "...lay where they fell

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[26] 16 mm. film of trading at Peramara and Yoba by Catholic Mission in c.1948-50. The film was viewed, and copied, by kind permission of Fr.Gehlen, previously priest at Koge.

[27] A 17 day patrol, for instance, paid out 2 pearl shell, 0.9 kg of dog whelks, 7 axes, 7 knives, 1.8 kg of plastic bangles, 6.4 kg of salt, 10 mirrors, 4.1 kg of matches, and 2.3 kg of tobacco (Hayes CPR 5,1952/53).

[28] Salisbury's experience travelling through the upper Asaro valley to the north-east in late 1952, "(i)n what was supposed to be an unsophisticated area the only payment demanded was 'money' " (1962:165). Similarly, on arrival among the Siane, people near Pira first demanded money in exchange for produce (ibid.,165-6).

until trampled into the ground" (Hughes 1966:105),fn.2). Their occurrence in Sinasina bride payments peaked at the same time (Fig. 4.3A).

Pearl shell lasted a little longer. Beside bride payments, their post-war use in other contexts in Sinasina, such as compensation for adultery and pig trading, was noted in late 1951 (Kelaart,CPR 2, 1951/52, Appendix C). People near Kundiawa were reported to employ men from more distant locations, paying them 1 to 2 pearl shells for periods of 5 to 6 months (McBride,CPR 4,1951/52,pp.4-5).[29] Many Waula men recall that, on return from indentured labour in the early 1950s, they bought pearl shells, either at Goroka (cf. Finney et al. 1974:345), or at the Catholic store at Koge. Although the price of a pearl shell in highland retail stores jumped from £1 to £2 or £3 between 1950 and 1953 (Salisbury 1962:115,fn.4,126) - was this due to supply problems ? They were out of stock in Goroka stores in late 1952 (ibid.,164) - Nilles pointed out at the time that pearl shell while

> "...still the standard ornament for young and old and much sought after, has gone down in value. Today one hardly sees a girl without this shell decoration - some girls with as many as six or seven shells about their necks - but in pre-European times only a few could afford one shell" (1953:8).

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[29]The "compensation" payment (ibid.,7), made in an adultery case to the aggrieved husband, of 4 tomahawks, 3 dog whelk ropes, 3 pearl shells, 3 bush knives, and one green snail shell (which McBride estimated as worth a total of £8 at trade store prices), looks suspiciously like a returned bride payment. Note the correspondence between the items and the composition of recollected bride payments of the time (Fig.4.1B).

Other contemporary observers expressed concern at the

> "...spiralling trend, accentuated by the fact that local natives working on the coast are picking up items of Chimbu wealth cheaply here, and on return flooding the market... causing some deflation in the value of the local currency" (Hayes,[30] CPR 12,1952/53,p.13; see also McBride CPR 4,1951/52, p.7).

In response, Downs, by then District Commissioner of the Eastern Highlands, noted that some pre-war Chimbu bride payments had been similarly large, with the exception of pearl shell numbers, and he forecast confidently, though somewhat ambiguously, that pearlshell in Chimbu would "...never lose its value for some years" (Letter, 28 February 1953, Downs to Director, District Services and Native Affairs, attached to Hayes, ibid.)[31]

Devaluation was faster than Downs expected. Just to the west of Chimbu, Marie Reay records that in 1954 she heard Kuma hosts at a Pig Ceremonial request their friends and relatives to give them bird of paradise plumes, not pearl shells : "we have so much goldlip that it is just like rubbish to us" (1964:248). At Goroka, demand "...began to fall off in the mid 1950s, and by 1958 very little shell of any kind was being sold" (Finney _et al_. 1974:345-6), a decline and fall which these authors relate to monetization. By the early 1960s Goroka stores were shipping their remaining shell stocks to areas such as Mt.Hagen where demand for pearl shell still continued, or, in one case reminiscent of the fate of small shell at Kundiawa,

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[30] Hayes had noted earlier that some pearl shell in Sinasina were broken and buried with a dead person (CPR 5,1952/53,p.18).

[31] This letter gives the retail value of pearl shell as £2, and mentions that green snail shell has 'no value' in Chimbu.

selling some to a local plantation "...where it was ground up to make shell grit for chicken feed " (ibid.,346). In Sinasina, the bride payment evidence suggests an almost simultaneous disappearance there (Figs. 4.3A,B). Referring to early 1966, Hughes describes pearl shell as devalued but still used in Sinasina for bride payments and as an ornament (1966:105). His survey of household holdings shows, however, that considerably less than one shell per household was currently owned (ibid.,96).

By 1972, shell had no currency function in Sinasina, and, on recollected evidence, had rarely appeared in bride payments during the previous 5 to 8 years (Figs.4.1,4.3). A few items were still retained as minor ornaments, worn for instance during dancing in 1972. As such they were occasionally borrowed from relatives in other groups. A small survey showed that nine Waula households held a total of 12 items. Somewhat fortuitously, I think, the proportions in which the items had survived approximated their occurrence in the final decade of shell in bride payments : seven pearl shells, or pearl shell pieces (held by 5 households), three dog whelk headbands (three households), and one small piece of green snail shell and one bailer shell, Melo spp., (one household each). Transactions involving shell had, with rare exceptions, ceased. During 11 markets surveyed at Koge during 1972-73, only one seller, offering a cowrie headband for $4, was observed, whereas other, non-shell, items of ornamentation appeared frequently. The conclusion that shell was almost without value by the 1970s, while substantially correct, does not mean that its value elsewhere was not appreciated. Foreigners, especially tourists, are likely targets for offers to sell. In November 1972, I was offered two old dog whelk headbands at four and six dollars each by a seller from Dinga. More interestingly, while the owner of the most shell items (5) in the small survey reported above (who was also the oldest household head), expressed interest in requests for pearl shell from a visiting group of nine 'Hagen' traders (including a councillor) in August 1972, he turned down their offers of two dollars per shell asking instead for twice that price, on the grounds that such was the going price in the Hagen area.

Shell therefore collapsed as a Sinasina valuable within 10-15 years following the change to money as the 'official' currency of the region. Money itself was almost immediately used as an exchange item (Figs.4.1A,B). By mid 1952, "(v)ery large amounts" were reported as "often" included in Dom payments (Keogh, CPR 1,1952/53,p.12). This is hardly surprising : the first indentured labourers, recruited in 1950, had already returned, and though many, as noted earlier, had preferred to convert their cash into shell and other items, money was increasingly entering Sinasina. The first sales of coffee began in about 1958, and, in that or the following year, the government considered incomes large enough to levy a head tax of ten shillings per adult man. Thus money, having taken over the currency role of shell, at the same time ate into its function as an exchange valuable. Admittedly, it could not be worn personally as an ornament broadcasting its wearer's wealth (or wealthy connections), but it could be, and was, displayed in the context of prestations : either mounted fluttering on long bamboos, or flat on Kuman-style mingge-ende at marriage payments. Both kinds of display were practiced in the early 1970s. However, besides such utilisation of money, Sinasina increasingly turned, as shell devalued relative to other items in the post-war period, their attention to plumes.

Bird plumes and skins : from red to black[32]

The history of plumes during the colonial period counter-points that of shell. Initially of little numerical importance in Sinasina bride payments, plumes exploded into prominence in the 1950s. Unlike shell which disappeared so completely during the 1960s, plumes have gone from strength to strength (Figs.4.4A,B), though, as described earlier, by 1972 some councillors were proposing that their use in bride payments should be prohibited. Further, while pearl shell began, and remained the most important shell item, plumes appear to have undergone major re-evaluation.

These changes were summarized poignantly in 1972 by Aulakua Wemin of Dom[33] when describing how the payment he made for his wife in the late 1930s included only pigs, stone axes and pearl shell.

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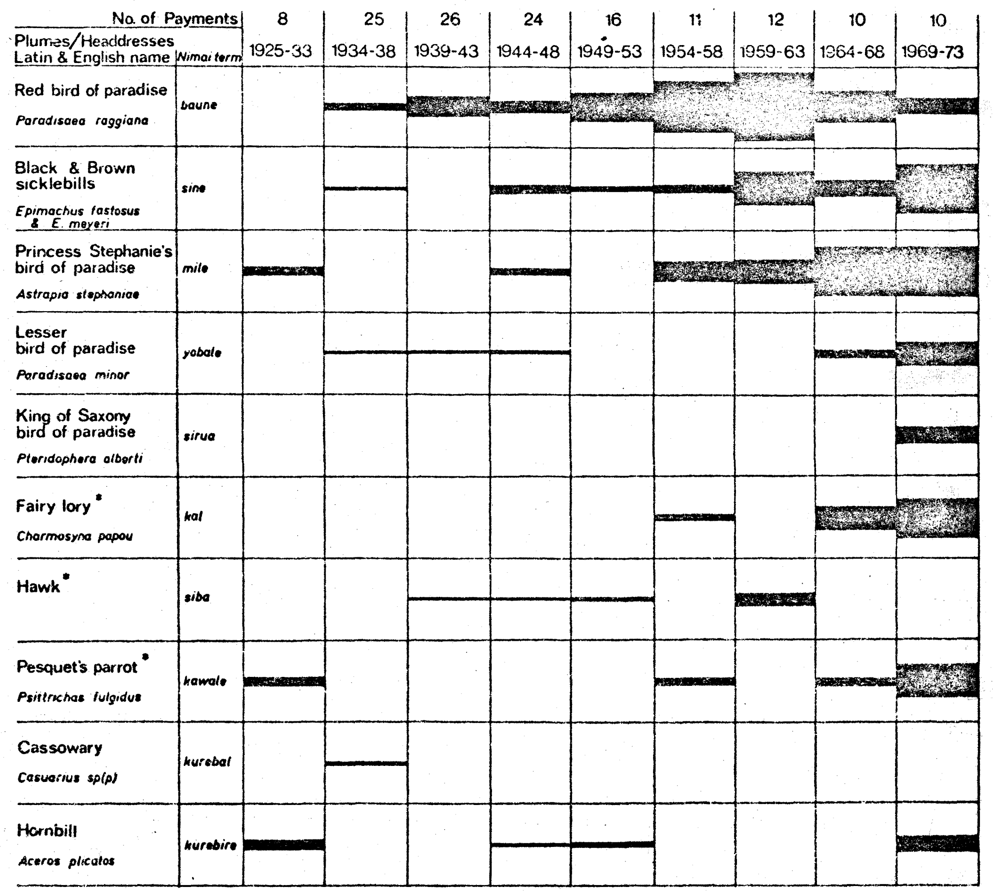
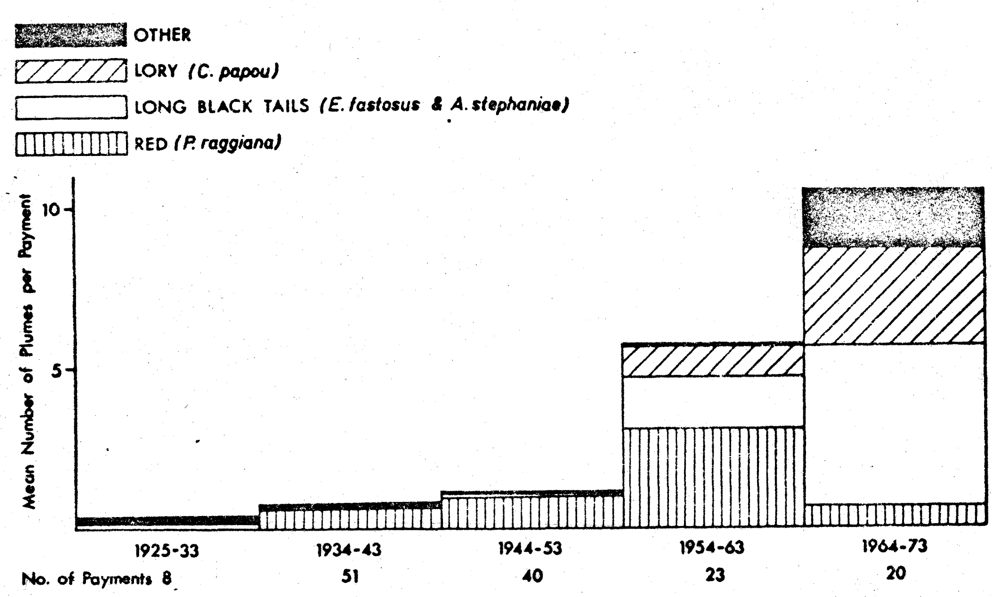
[32]For assistance with zoological identification of plumes and skins from colour transparencies I am grateful to Professor R.Bulmer (pers.comm.17 January 1974). For further information concerning nomenclature see Appendix 3).

[33]Of Dom Kumgau clan at Kagul. Aulakua worked for the government in the 1930s and 1940s as an interpreter, featuring prominently in Down's suppression of the Kere incident(above p.128 ; and Simpson 1954: 100-103, where his name is spelt Arakua). He later retired to work at home as a luluai and stood unsuccessfully for the 1964 House of Assembly elections (Criper 1965; Hatanaka 1972:45).



A. <u>Percentage of payments in which plumes appeared</u>



B. <u>Mean numbers of plumes per payment</u>

Fig.4.4 PLUMES IN SINASINA BRIDE PAYMENTS

This, he said, was

> "because throughout this area we did not use plumes in bride payments. Plumes we used for self-decoration when we danced at pig festivals. After the dancing, when we had killed the pigs, we stuck the plumes on top of the pork and gave it to all our affines. That was how we did it before. I myself saw it. But now all the whitemen have come and money has come. Before when we wanted to buy the red (P.raggiana) plumes we bought some with pigs and some with pearl shell. Sometimes we traded pigs for salt and then traded the salt for a plume. Now however all the young men have travelled to the coast to work for wages and bought black (E.fastosus and A.stephaniae) plumes and they say "Forget the red plumes". In the old days we didn't pay for women with money or other good things, but now people want to buy them with the plumes of E.fastosus and A.stephaniae and P.fulgidus - all these black plumes and money. Now its the same everywhere here, and its truly difficult to pay for a wife" (C/RH/72.4A).

Nimai informants generally agreed with Aulakua's account, stressing that plumes were not a major component of bride payments in the early years of the colonial period. Occasionally, they appeared in individual recollections (Figs.4.4A,B). They were of course important valuables, transferred by gift and trade, and ornaments featuring most importantly in the headdresses of dancers. Though my information is incomplete, it would seem that E.fastosus, 'hawk' and P.raggiana plumes were the most highly valued in the early 1930s. Although his dating is not clear, E.fastosus and P.raggiana are emphasized also by Bergmann for the Kamanuku (1971,Vol.2,p.52). Trade was primarily from the south and west.[34] A plume in good condition cost then a large pig.

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[34] Today none of the species valued by Sinasina are common, and some are not present, in Nimai territory. P.raggiana have been seen in second growth at c.1650 m, A.stephaniae, and P.alberti are reported to be present in the forest, L.superba is reported at c.2300 m in casuarina, and one elderly man could recall having seen E.fastosus or meyeri in the forest as a youth. Cassowaries are imported as chicks and are plucked, as are the occasional Sulphur-crested cockatoo (Cacatua galerita, Nimai anga) and Pesquet's Parrot (P.fulgidus). Table 4.3 indicates the current extent of reliance on imports.

The bride payment data support them, showing that up to 1953 plumes appeared irregularly in payments (two or three of every ten up to 1948, four out of ten in 1949-53, Fig.4.4A), and even then in small numbers (Fig.4.4B). From 1934 (until 1963) P.raggiana are the most commonly recalled plume, and the great surge in the numbers of plumes in payments, from 1.1 in 1949-53, to 5.8 in the next five years (Fig. 4.1B), is mainly accounted for by this species (Fig.4.4B). Aulakua's account of the replacement of red plumes by black ones following wage labour should not be taken to imply that this occurred immediately. Some Nimai who were sent as indentured labourers to New Britain in 1950 report seeing, on return to Goroka, other highlanders returning from Papua with P.raggiana. In 1954 the major reason given by 30 young Tabari men (at Ogonomo, north of the Porol range), volunteering for indentured labour was to acquire P.raggiana plumes which "...were locally unavailable, but readily obtainable from the Port Moresby area" (Colman, CPR 4,1954/55,p.5). This was presumably common knowledge for "...a previous batch of labourers from this area had gone to Port Moresby" (ibid). 1954 was also the year, it will be recalled, that Reay heard some Kuma to the west of Chimbu calling for plumes instead of pearl shells (p.145).

Ten years after the first movement of Sinasina men to the coast the long black plumes were increasing in importance (Fig.4.4B). Bulmer, working amongst the Kyaka Enga some 200 km to the west in 1959, observed two parties of Chimbu plume traders attempting to exchange some 36 P.raggiana skins, which they had acquired from

Moresby (and other coastal regions),[35] for pigs or for the "long-tailed birds of the mountain forest", i.e. Epimachus sp(p). and A.stephaniae (Bulmer 1962:17-19). It is no doubt fortunate for Sinasina that while they, in Aulakua's words 'forgot the red plumes', as they so clearly did after 1963 (Figs.4.4A,B), people in other areas of the Western Highlands still valued them highly (Bulmer, ibid.,17). A survey by the Stratherns among the Melpa groups in the mid to late 1960s showed that P.raggiana was by far the most commonly owned plume (56 of 70 men ; eagle and ?palm cockatoo were in equal but distant second place owned by only 27 men ; Strathern and Strathern 1971:29). Epimachus spp. and A.stephaniae were both rare, owned by only 4 and 2 men respectively. The Stratherns note, however, that although Northern Melpa can hunt these long black tails, they prefer, rather than retain them for their own use, to sell them to purchasers from the Wahgi and Chimbu (ibid.,30).

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[35] Comparing the high prices of $10 per skin, which the Chimbu claimed to have paid in Papua, with the extant rates for indentured labourers, $2.50 per month, Bulmer suspected them of exaggeration although noting that Papuan evidence supported them (ibid.,17; original values in pounds). The discrepancy may be explained by extra sources of income. Sinasina men who worked on Papuan plantations during the 1950s and 1960s explained to me that they strongly preferred working in the vicinity of Moresby because they were able to make market gardens and sell their produce in town. Some also raised pigs for sale, and one early entrepreneur was said to have reinvested his market earnings in a steer, the profits from which allowed him to break his contract and return home. Their preference, the reasons for it, and some of its consequences, were discussed as early as 1957 by the Central District Advisory Council (Anon. 1957:123-4).

In the past Sinasina did not, as noted above, normally include long black tails in bride payments. The recollected payments suggest that even by the late 1950s they were still outnumbered by P.<u>raggiana</u> (Figs.4.4A,B), a pattern that is supported by individual informants recalling which marriages first included the black plumes and the difficulties experienced in obtaining them. Why were the red plumes abandoned (though not entirely, Fig.4.4A), and replaced by the black? The question was not one to which Nimai were prepared to offer a simple answer. Black plumes, they recalled, 'came up' at this time. No one suggested that the supply of P.<u>raggiana</u> diminished, indeed, if numbers of Sinasina absent in Papua are any indication (see p.111), it is probable that access to red plumes was considerably better in the mid 1960s than ten years earlier. An account of plume trading on the Sogeri Plateau outside Moresby in (?) August 1966 by Aina Kora, who was completing a term of contract labour on a rubber plantation, is revealing. Taking advantage of a few days holiday granted on the occasion of the death of the central Chimbu leader Kondom Agaundo, he and a fellow clansman set off to purchase plumes both for themselves and for others who had invested money in the expedition. They sought, Aina recalled, A.<u>stephaniae</u> (he purchased two for $10 each) and lories (he bought five for $2 each), and he specifically told local sellers that P.<u>raggiana</u>, which were offered at $1 or $2 each, were no longer desired.

Here perhaps lies part of the answer. Red plumes had been scarce and highly valued by Sinasina in the 1930s, as evidenced by an exchange rate of one large pig for a single plume (which may be compared with 1972 prices of \$5-10 while a large pig fetches from \$100 upwards). When they became available in far greater numbers in the 1950s they were, after some time, devalued and suffered the fate of shell. That Sinasina replaced them with black plumes raises, though no Sinasina made this point, an interesting question of the relationship between Sinasina and the cultural preferences of Chimbu and the Wahgi to the west. Brookfield and Brown report that central Chimbu marriage payments observed during 1959-60 each included, _inter alia_, about ten A._stephaniae_, and twenty P._raggiana_ and P._minor_ plumes (1963:64). Brown's more detailed list covering the period 1958-65 suggests a ratio of about 5 : 1 in favour of P._raggiana_ (1972:91). If my dating of the rise of black plumes in Sinasina is correct, this suggests that central Chimbu were using black plumes to a considerably greater extent than Sinasina at this earlier date. Since central Chimbu are closer to Western Highlands sources of supply, and enjoy, primarily as a result of their more favourable location in relation to both altitude and government extension services (Howlett _et al_. 1976:Chapters 4,9), rather higher cash incomes, it may be that Sinasina have followed Chimbu in placing the long black tails at the head of desired plumes. This is, I must emphasise, conjecture, and I suspect that many Sinasina would reject, at least openly, the implication of incipient 'Kumanisation'.[36]

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[36]Healey (1973:121-3) reports that Jimi valley Maring and Narak have also shown a tendency to prefer long black tails as the centrepieces of their ideal headdresses for major festivities in recent years, a style adopted, he suggests, from the central Highland Kuma. The Jimi is particularly interesting as it seems to represent a meeting ground between two styles : beyond the Maring to the north-east are the Kalam who used to use long black tails as their main (continued next page)

My interpretation that plumes have been highly valued by Sinasina for bride payments at least since the early 1950s should be weighed against rather different accounts from the mid-1960s by Brown for central Chimbu and Hughes for Sinasina.

Brown reports that between 1958 and 1965 Chimbu bride payments varied widely in terms of the quantities and proportions of different items but, besides the disappearance of cowrie headbands and strings after 1959, the only consistent trend was an increase in money which became the "most important item" (1969:85,88). She suggests that

> "The increased interest in money and imported goods was accompanied by a declining interest in ornaments, although their quantity did not change much during the eight years. By 1964 there was little occasion for wearing ornaments and almost none for the full headdresses which were worn during the dancing before the large pig feast, no longer celebrated. Brides and their attendants were decorated and occasionally girls at large Catholic festivals wore bird-of-paradise plumes, but men hardly ever did. After a marriage payment had been received, the shells and feathers are distributed among the bride's party and, nowadays, put aside until the next marriage. The less valuable parrot and hawk headdresses were often offered to, and refused by, the young men, who did not wear them to courting parties as their elders did" (ibid.,89).

Elsewhere, both Brown (1972:48) and Brookfield (1968,1973) have described in more detail the division of opinion among Naregu concerning the future of pig festivals which resulted in an early 1960s victory for those favouring investment of time and land in cashcropping and other 'modern' activities. Their victory was, however, shortlived. The neighbouring Gena Nogar celebrated a festival

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[36] (Continued from previous page) centre-pieces, but in recent years, have turned to P.minor (Majnep and Bulmer 1977:57-61,135-8). They now mainly export black tails to the central highlands.

in late 1967 (Field notes 1967), which Naregu dance groups presumably attended. Yongamugl groups at Ku also held one in October 1968 (Field notes 1968), which, though more distant, would probably also have been visited by Naregu dancers.[37] And Naregu themselves again held one in 1971 (Brookfield 1973b; Brown 1972; Field notes 1971). Thus the downturn in "interest" in plumes, and other ornaments was temporary.[38] Though Brown does not contrast the quantities or kinds of plumes transferred in payments between 1958 and 1965 with those characteristic of earlier periods, it is possible that considerable increases had occurred (see Table 4.1; columns 1,4,7,8,9), if not changes in kind.

Writing of the Sinasina Kere in 1966, Hughes suggested that

> "(t)he devaluation of bird of paradise plumes by the appearance of European valuables seems to have been offset by the dwindling source of supply, and the depreciation of the value of money in terms of most indigenous products as the supply of money has increased. They are still essential for marriage payments and are highly valued for formal wear" (1966:105-6).

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[37] Nine per cent of the current wives of the members of the Naregu clan of Pentagu originated from Yongamugl (Brown 1969:86-7).

[38] Needed, but unfortunately missing, is information on the movement of plume prices and exchange rates during the 1960s. It may be noted that they appeared in Naregu bride payments in the late 1960s in similar quantities and proportions to those described by Brown. A Siambugla payment to Naregu, observed in April 1968 (Field notes and photographs 1968), featured a <u>mingge-ende</u> surrounded with many P.<u>raggiana</u> and A.<u>stephaniae</u>, and a few <u>Epimachus</u> sp(p). The payment also included 8 or more steel axes and 5 or more pearl shells, as well as money and pigs. The Naregu bride in return was despatched with at least 5 P.<u>raggiana</u> plumes and c.10 A.<u>stephaniae</u> plumes.

This is a problematic statement in that it refers to aggregate categories of plumes and European valuables, and, further, that it allows only for a dichotomy between some earlier time , when the relative value, and cultural significance of 'plumes' are assumed to have been high and their supply good, and 'now'. In so far as it indicates high money prices for 'plumes', and their essential role in marriage payments, in Sinasina in the mid 1960s, it supports my interpretation of the recollected evidence. On the other hand, Hughes' judgements of general devaluation and dwindling supply contradict my analysis. Both, however, are weakened by their indeterminate relationship to the undifferentiated category of 'plumes', and the latter, in particular, is not supported by Healey's recent work (1977:56-67, 322,391-2). Interestingly, Hughes' survey of the plume stocks held by households in two Kere subclans yielded means of 1.5 and 2.5 plumes per household (ibid.,96), both very low by comparison with the household mean of 11 which I found for a small sample among Waula members in 1972 (Table 4.3). But comparison, even if the samples were larger, is hardly meaningful, since the Kere had celebrated a pig festival within the previous year and are therefore likely to have distributed their plumes either in prestations or in trade to rebuild their pig herds (see Chapter 8 ,pp.517-22).

Before leaving plumes, a final point requires brief discussion. Is the present pattern of plume occurrence in Sinasina bride payments special to this prestation, or is it representative of the general circulation of plumes within the region ? Besides bride payments, plumes are, most importantly, used in headdresses for dancing primarily by men at pig festivals, but also on other occasions though with no apparent differences in emphasis), and in headdresses worn by children in the early stages of pig festivals ; as valuables they are transferred in a variety of prestations, and they are specifically traded for money and pigs. The use of some plumes as ornaments is specialised. For instance, cassowary headdresses are worn only by men (often on minor ceremonial occasions and, in the past, for fighting), but would not normally be appropriate wear for a member of a pig festival dancing group. Again the delicate plumes of the King of Saxony Bird of Paradise, normally worn as a pair, from the nose as part of a complete dancers' regalia, would not be used alone, whereas a single Superb Bird of Paradise breast plate could be, pinned to a fur cap on a minor occasion, or as appropriate wear for a non-dancer at an important event. Despite such exceptions, the evidence of a variety of 'collections' of plumes (Table 4.2) suggests overall similarities in the frequency of plume occurrence, and hence a shared hierarchy of evaluation. Further information on the plumes owned by nine Waula men show that 49 per cent were acquired by gift or prestation, and 42 per cent were acquired by trade (Table 4.3). Plucking of tame cassowaries and a Pesquet's Parrot provided 4 per cent, and 3 per cent were picked up unclaimed during ceremonies or on the road. A solitary L.*superba* resulted from hunting. The 49 per cent of plumes that had been acquired directly by their present owners from outside Sinasina is of course no indication of the true proportion originating elsewhere.

TABLE 4.2 Plume frequencies in six 'collections'

Kind of bird	Zoological and English name (1)	Nimai term (1)	6 Bride payments 1969-73 [4]		Traded for 35 pigs 1969-73 [5]		30 Pig Festival gifts 1972 [6]		1 loan for dancing 1972 [7]		Worn by 3 children 1972 [8]		Owned by 9 Men 1972 [9]		TOTALS	
			No.	percent	No.	percent	No.	percent	No.	percent	No.	percent	No.	percent	No.	percent
Birds of Paradise	*Astrapia stephaniae* Princess Stephanie's Astrapia	mile	48	34.5	56	32.4	17	27.0	4	18.2	19	43.2	23	22.6	167	30.8
	Epimachus fastosus and *Epimachus meyeri* Black and Brown Sicklebills	sine	13	9.4	5	2.9	3	4.8	2	9.1	-	-	-	-	23	4.2
	Lophorina superba Superb Bird of Paradise	kenil	-	-	1	0.6	3	4.8	2	9.1	3	6.8	7	6.9	16	2.9
	Paradisaea minor Yellow (Lesser) Bird of Paradise	yobale	5	3.6	1	0.6	1	1.6	-	-	4	9.1	2	2.0	13	2.4
	Paradisaea raggiana Red (Raggiana) Bird of Paradise	baune	2	1.4	1	0.6	2	3.2	-	-	-	-	5	4.9	10	1.8
	Pteridophera alberti King of Saxony Bird of Paradise	sirua	8	5.8	3	1.7	-	-	-	-	-	-	5	4.9	16	2.9
Lories	**Charmosyna papou* Papuan (Fairy) Lory	kal	40	28.8	97	56.1	17	27.0	10	45.4	12	27.3	33	32.4	209	38.5
Parrots	*?Alisterus chloropterus* Papuan King Parrot	galuma	-	-	-	-	1	1.6	-	-	-	-	-	-	1	0.2
	Cacatua galerita Sulphur-crested Cockatoo	anga	-	-	-	-	1	1.6	-	-	-	-	-	-	1	0.2
	**Psittrichas fulgidus* Pesquet's Parrot	kawale	18	13.0	9	5.2	11	17.5	4	18.2	4	9.1	20	21.6	66	12.2
Hawks		siba [2]	-	-	-	-	6	9.5	-	-	1	2.3	2	2.0	9	1.7
Cassowaries	**Casuarius benetti* Dwarf Cassowary	(kure)bal [3]	-	-	-	-	1	1.6	-	-	1	2.3	5	4.9	7	1.3
Hornbill	*Aceros plicatus* Papuan Hornbill	(kure)bire [3]	5	3.6	-	-	-	-	-	-	-	-	-	-	5	0.9
	TOTALS		139	100.0	173	100.0	63	100.0	22	100.0	44	100.0	102	100.0	543	100.0

(1,2,3) See note to Table A3.3.
(4) See Table A3.3
(5) Table 8.29.
(6) Received by Waula.
(7) From Tabari.
(8) At Dom Kagul.
(9) Table 4.3

TABLE 4.3 Acquisition of plumes owned by nine Waula households

Kind of plume or headdress				Mode of Acquisition					Region acquired from			
English and zoological name	Nimai term	Total number	No. of Households owning item	Trade	Gift exchange	Plucked	Found	Shot	Sina-sina (1)	West. H'lands (2)	East. H'lands	Coast
Princess Stephanie's Astrapia *Astrapia stephaniae*	*mile*	23	7	11	12	-	-	-	4	7	12	-
Parrot Mainly *Psittriches fulgidus*	*kawale*	20	7	7	11	2	-	-	12	1	5	2
Lories Mainly *Charmosyna papou*	*kal*	33	5	17	16	-	-	-	19	-	-	14
Red Bird of Paradise *Paradisaea raggiana*	*baune*	5	4	-	3	-	2	-	5	-	-	-
Cassowary headdresses *Casuarius* sp(p).	(*kure*)*bal*	5	4	-	2	3	-	-	5	-	-	-
Superb Bird of Paradise *Lophorina superba*	*kenil*	7	3	2	3	-	1	1	6	-	-	1
King of Saxony Bird of Paradise *Pteridophera alberti*	*sirua*	5	3	5	-	-	-	-	-	4	-	1
Yellow Bird of Paradise *Paradisaea minor*	*yobale*	2	2	1	1	-	-	-	1	1	-	-
Hawk headdresses	*siba*	2	2	-	2	-	-	-	1	1	-	-
Totals		102	9	43	50	5	3	1	53	14	17	18

Notes (1) Includes Gumine area to the south of the Wahgi

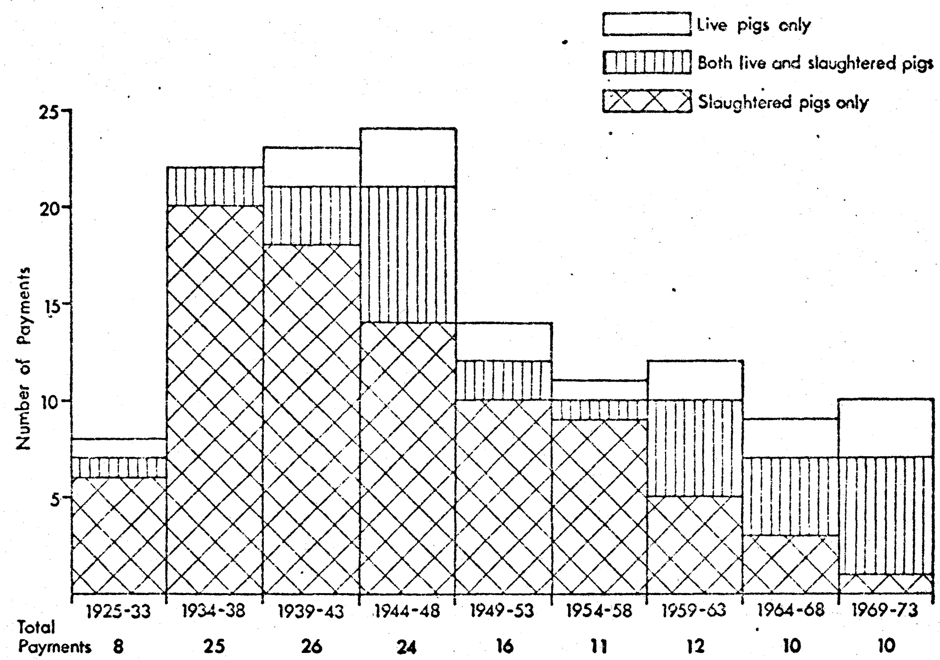
(2) Includes Kerowagi area in the west of Chimbu

Pigs : a special case

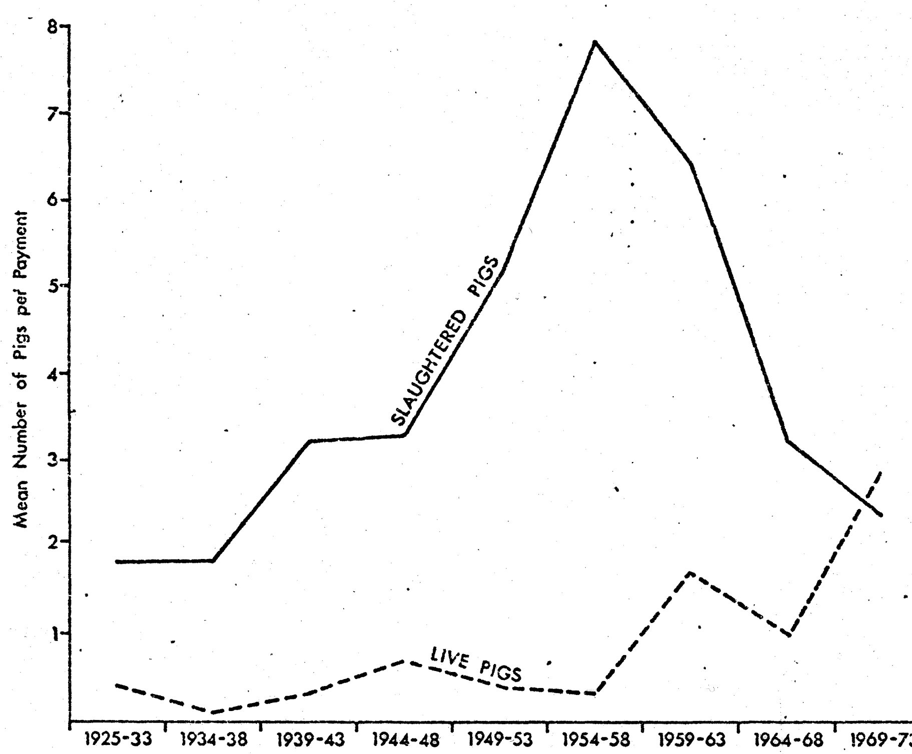
> "In the old days, people used to kill one pig at a marriage, not many as they do today" (Aulakua Wemin,C/RH/72.4A).

The quantitative trends shown by such items as shells, plumes, and money in Sinasina bride payments during the first 30 years of the colonial period pose no major problems. Massive increases in supply, new or improved access to source areas, and rapid monetization in the 1950s are well documented. Pigs, however, cannot be included in this general category since their status as locally produced, rather than imported, items is significantly different. They also differ from other items in that their slaughter on the occasion of marriage removes them from circulation. Nevertheless their numbers also rose (Figs.4.1B,4.5B). Had the average number of pigs per payment risen gently throughout the colonial period, it might be reasonable to assume a trend of increasing production, due to such factors as less disturbed conditions of husbandry following pacification, larger inputs of fodder resulting from new, higher yielding, sweet potato varieties (and increased cultivation), and, perhaps, improvements in pig productivity following interbreeding with imported stock (see Appendix 4).

This however was not the case. Unlike their stable occurrence in payments (in no five year period did less than 87 per cent of payments include pigs, Fig.4.1A), the average number of pigs per payment rose, then declined (Figs.4.1B,4.5B). After almost doubling in the 1940s from two to just under four, they doubled again in



A. Number of payments including pigs



B. Mean numbers of pigs per payment

Fig.4.5 PIGS IN SINASINA BRIDE PAYMENTS

the decade 1954 to 1963 to peak at eight.[39] In the final decade

TABLE 4.4 Mean numbers of pigs in Sinasina bride payments

Period	No. of cases	Number of pigs[(1)]	
		Mean[(2)]	SD
pre-1933	8	2.1	1.5
1934-43	51	2.8	3.6
1944-53	40	4.6	4.7
1954-63	23	8.0	6.2
1964-73	20	4.6	3.0

(1) Slaughtered and live.

(2) The difference between the 1954-63 and the 1944-53 means is significant (t = 2.24, df = 61, P .05), as is that between the 1964-73 and the 1954-63 means (t = 2.97, df = 41, P .01).

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39 In 1949-53, when the average rose from 3.9 to 5.4, Sinasina suffered an anthrax epidemic. This epidemic, which was first reported in central Chimbu in 1949 (Wakeford,CPR 2,1949/50,p.3; see also Kelaart, CPR 3,1950/51,p.12), seems to have spread to Sinasina by the following year as Burfoot, patrolling Sinasina in March and April, noted that the pig population had been depleted by anthrax (CPR 1,1950/51,p.12; Wakeford was also a member of this patrol). The disease was reported in Sinasina again the following year, though no difficulty was experienced in purchasing 32 pigs, indeed the number was only limited by the availability of trade goods (Kelaart, CPR 2,1951/52,p.16). An epidemic at about this time was recalled (in 1972) by Waula informants (p.483).

The highlands are considered to be anthrax enzootic areas in which outbreaks of the disease (first-scientifically ? -identified in 1946), either take an epizootic form causing heavy mortality in a relatively restricted area, or involve only individual cases sporadically (Egerton 1965b:141-2). Egerton's 1946 date for the first identification of the disease should perhaps be qualified by Nilles' report of anthrax in the upper Chimbu valley in 1938 (Nilles 1977:177). Epizootics, in Egerton's view, recur at regular (3-5year) intervals, and he suggests that populations develop immunity lasting for an animal's lifetime following an outbreak. He estimates mortality rates at 10-25 per cent of pigs at risk, suggests outbreaks are most likely during the wet season, and considers that the infection is transmitted by ingestion of infected carcases (1965a:139; 1965b:143). I have found no more recent reports of outbreaks in Sinasina, though Egerton mentions two at Kerowagi in 1960 and 1963 (1965b:142).

the average dropped back again to just over four. Thus the generally shared knowledge of more pigs today than in the past (summarised in the quotation from Aulakua above), slides over some interesting questions. Also problematic is the trend, which informants date as beginning in the early 1960s, for payments to include more live pigs. (Figs.4.5A,4.5B). Increases in the number of pigs transferred or slaughtered in bride payments have been reported from several other parts of the highlands, and a number of explanations for such 'inflation' have been proposed. I will consider three here ; those offered by Salisbury (1962,1964) for the Siane, by Meggitt (1971) for the Mae Enga, and, most recently, by Healey (1977) for the Maring in the Jimi valley.

Severely abbreviated, Salisbury's argument runs as follows. During a period of indirect contact (1933-44), the Siane enjoyed a marked increase in the supply of valuables (presumably shell and steel), and imported steel tools replaced stone ones. This combination allowed a "great florescence of ceremonial and warlike activity" (1962:121), marked, in economic terms, by "inflation in bride-prices and...a greater velocity of circulation for valuables" (ibid.,122). The effect of inflation was "to pull together larger groupings to participate in ceremonial exchanges and to increase the power of 'big men' relative to the power of 'nothing men' (ibid.,122). What did this mean in terms of pigs ? According to Salisbury, very few pigs were used (slaughtered) in bride-prices (and at other rites of passage), before 1933 (ibid.,100). By 1952, however, there had been a six-fold increase in the number of pigs killed in bride-prices (ibid.,132). How was this increase achieved ? As a result of larger ceremonies, and hence more guests to feed, "(t)he demand for pigs increased, and their exchange value, relative to shells, increased further" (ibid.,119). Supply, I infer, may have been increased partly by trade (ibid.,116,121), but Salisbury favours an increase in production as "suggested by informants' comments that more pig-houses outside the villages are now being built in the interval between Pig Feasts" (ibid.,119). But had production increased ? One of Salisbury's major theses was that the technological change from stone to steel did not result in an increase in subsistence production, there was, he states baldly, no change in the area cultivated between 1933 and 1952 (ibid.,107). There is, however, no mention of pig fodder in From stone to steel, and Salisbury therefore seems to imply that pig production increased independently of an increase in pig fodder (sweet potato). While this is possible (e.g. through an expansion of extensive husbandry), it seems to be the case that Salisbury has attempted to explain Siane bride price inflation in the period 1933-52 in terms of Fisher's quantity theory of money, without sufficient discrimination of his variables.[40]

Fisher's equation states that PQ = MV, where P = price, Q = quantity of goods or transactions, M = the quantity of money, and V = the velocity of circulation. Applied to Salisbury's analysis of

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[40]Cf. explanations of the price rise in sixteenth century Europe (Wallerstein 1974:71). In his analysis of the social effects of the devaluation of shell money among the Kapauku, Dubbeldam (1964:299-303) uses the same equation.

Siane bride price inflation, P = bride price, Q = brides or marriages, M = valuables, and V = velocity of circulation. To explain the increase (inflation) in bride-prices, Salisbury leans heavily on an increase in M, valuables (through imports of shell and steel), and a subsequent increase in V, their velocity of circulation (ibid.,121-2, cited on p. 122 above), which are, clearly, important factors in the case of shell and steel. But pigs fit most uneasily in this equation, mainly because no significant increase in imports is posited and their circulation ends with their slaughter. Since a major increase in production is apparently ruled out by an absence of an increase in fodder production, the rise in their numbers in bride prices (and other ceremonies), is not satisfactorily explained (and, in fact, not explicitly recognised as problematic).

By contrast, in a later paper which analyses changes between 1952 and 1961, Salisbury states categorically that in this period the Siane (to be specific, Antomona clan), increased their level of pig production by 30 per cent (1964:6-7.fn.17) He places this increase in a general context of other productive and political expansion, reporting a 40 per cent increase in the area of cultivated land, which he correlates with the initial development of coffee planting, with increases in the scale of political groupings, in the scale and size of ceremonial distributions of vegetable foods, in the frequency of small rites of passage for which pork was required, and in the number of pigs owned (ibid.,6-8). Noting that his two visits coincided with different stages in the progression of accumulation required by the Antomona pig cycle, Salisbury adjusts his two-fold actual increase in pig numbers downwards to an estimated 'real' increase of about 30 per cent (ibid.,7,fn.17). Thus for 1952-61 Salisbury suggests that internal demand, stimulated by political change, and helped by the technological change, resulted in increased levels of sweet potato production, and hence pig production.

For the Kundagai group of Maring in the Jimi valley, Healey has also reported an increase in the number of pigs killed in bride payments (1977:429,541-2). He suggests this may have been due to an increased supply of pigs, resulting, not from increased production, but from the apparent maintenance of pig population numbers at levels sufficient to hold konj kaiko (the major pig killing ceremonies), even though the Kundagai had not held a ceremony for fourteen years and were planning to abandon them. Thus, "(s)ince none of these animals must be set aside to reward spirits and allies there is an effective surplus..." (ibid.,429). While expenditure of some of this surplus in prestations causes some inflation in this sphere, this insulates, Healey hazards, the value of pigs in trade transfers, which are of considerable importance to the Jimi Maring.

In the Mae Enga case described by Meggitt, the number of pigs in bride payments has, as in Sinasina, first risen and then declined. Unlike Sinasina, Siane or Maring, however, Mae Enga bride payments involve the transfer of live, not slaughtered, pigs (Meggitt 1965: 113-127), which allows for a different interpretation of the increase. Meggitt shows that Mae bride payments, after a slight initial decline from an average of 9.5 pigs before 1940, to 7-8 between 1941-57, resulting, he suggests, from an epidemic of pleuro-pneumonia between

1944-47 (1971:202; previous publications also mentioned anthrax, i.e. 1958:288,fn.18, 1965:120), leapt to 23 pigs in 1958-62, before declining to 17.8 in his final period of 1963-67 (ibid.,204,fn.26), though his sample for the final period is very small. Other valuables, after doubling in the period up to 1957, slipped slightly from 17 to 15 in 1958-62, and then plummeted to an average of only two items in 1963-67. Money appeared during 1951-57 at a very low level ($0.50), jumped to $36 in 1958-62, and again to $141 in 1963-67 (ibid.,204). In Meggitt's view, monetization was the major factor involved in the late 1950s rise in the number of pigs. Not only did it replace other valuables, but it also sparked "like the earlier imported valuables... another acceleration of exchanges, the generation of more credit and further inflation" (ibid.,204). In short, "the number of marriageable women was increasing at a slower rate than was the supply of money available both for bride-price and for buying pigs to use in bride-price" (ibid.,204,fn.26).

In summary, then, to explain increases in the number of pigs in bride payments, Salisbury argues for an increase in production, Healey suggests an increase in supply resulting from the abandonment of other occasions for slaughter, and Meggitt argues for an increase in the velocity of circulation of live pigs made possible by a rapid, and large, increase in the amount of money available to the Mae. Are these explanations relevant to the Sinasina case ?

The case for an increase in pig production (and therefore, by implication, an increase in sweet potato production), is partly marred in Sinasina by the movement of the average number of pigs which, as noted above, after rising until 1954-63, fell in the next decade. The decline in the period 1964-73 is not, however, sufficient grounds for dismissing an earlier increase in production. The period 1954-63, during which the number of pigs per payment peaked at 8, also saw the introduction and early expansion of coffee planting by Sinasina.[41] It could be argued that the decrease in pig numbers in bride payments after 1963 was due to the consolidation of new patterns of allocation of land and labour to coffee (assuming such patterns to be competitive with those required by pig husbandry, cf. Brookfield 1968, 1973). What though of the four-fold increase from the 1930s to 1954-63 ? In the absence of any long-term data on pig (and sweet potato) production, the question cannot be properly evaluated. The most that can be said is that improved tools and new varieties of sweet potato were widely accepted (and the latter are said by most informants to yield better than older varieties), and that major movements of settlement to

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[41] Described in more detail below (Chapter 5). The four northern Sinasina groups of Tabari, Dinga, Nimai and Kere have been estimated to have planted the following numbers of coffee trees at the listed dates :

Year	Coffee trees
1956	49 265
1957	107 918
1958	157 004
1959	175 597
1962	273 260
1972	894 741

(Sources : for 1956-62, Shand and Straatmans 1974:40, Table 3.4; for 1972, see Table 2.5 below, p. 47). If these figures are correct, the planting rate between 1963-72 was 62 148 trees/year, in contrast to 32 554 trees/year between 1960-62.

lower altitude zones in which sweet potato matured faster, and, perhaps, yielded better, also took place (Chapter 5). While such changes could have enabled an increase in production, a four-fold increase seems unlikely.

Healey's suggestion cannot be specifically applied to Sinasina, since their large pig ceremonials were not abandoned, nor to my knowledge, delayed for lengthy periods. Nevertheless it can be restated more generally to include the whole class of occasions for which pig slaughter was previously prescribed. Could the increase in the number of pigs slaughtered in Sinasina bride payments have been the result of a decline in the significance, or occurrence, of other occasions on which pigs were killed ? Slaughter, both in the event of sickness, and to celebrate some rites of pasage, might be expected to have declined in frequency and in significance during the 1950s as Sinasina made increasing use of new health facilities and converted to Christianity. Yet one hesitates to gauge the potential influence of such factors since, simultaneously, new occasions for slaughter, such as baptism and the return of migrant workers, were appearing. Tentatively, I would conclude that marriage was not elevated to a sufficiently salient position in the diverse class of occasions requiring pig slaughter to justify use of this hypothesis as the major explanation.

In specific detail, Meggitt's argument also cannot be applied to Sinasina since, during the period of major increase, live pigs were not a significant component of bride payments and thus there was little possibility of increasing their velocity of circulation. Nevertheless, increases in the quantities of shell and money, and changes in the previous patterns of trade flows (cf. Hughes 1978: 317), could have increased the general supply of pigs available for bride payments. For those Sinasina lacking direct access to the salt springs and the axe quarry before 1933, pigs were perhaps the major means of entry into trade relations. It is reasonable to assume a general centre-periphery movement of pigs outward from the most densely occupied north, which lacked specialised products, to those areas closer to the sources, or trade routes, of axes, salt, shells, plumes and other items (cf.Healey 1977:334-6,404; Hughes ibid.,1977: 71). From 1933 on, however, the new influx of axes, shells, salt and other items was primarily from the north. It is therefore likely that the flow of pigs in trade to the south diminished considerably, and perhaps even reversed as southern areas adjusted to the change, during the 1930s and 1940s. More pigs were therefore available to northern groups. Some undoubtedly entered a new flow, composed of either direct sales to Europeans, or to groups living closer to the new stations. Pigs, however, were no longer such a significant means for entering trade. They rapidly became only one of a larger set of alternative means, which included, most importantly, sales of other produce, and. particularly after 1950, labour.

Further disruptions after 1950 possibly contributed to these processes. The older patterns of plume trade were transformed by increasing access to distant areas, and the portability of shell and money. These changes, even if they did not effect a reverse movement of pigs, presumably released some for use in bride payments and other 'internal' prestations. Following Meggitt, however, were increasing supplies of shell and money used directly to acquire pigs to use in bride payments ? Although direct evidence from the 1950s is lacking, information from 1972-73 shows a marked difference between the size of animals considered suitable for slaughter at marriages and those usually transferred in trade (Table 8.20, Fig. 8.12). The latter are mainly small, and would probably require two to four years of growth before reaching slaughter size. While it is possible that wealth differences within relatively short distances were sufficiently marked during the 1950s to allow Sinasina to trade for larger pigs which could be immediately expended in bride payments, this seems unlikely.[42] Nonetheless, despite the small size of traded pigs, trade was a significant means of acquisition in the early 1970s, and, by comparison with gift exchange, it drew in pigs from a wider catchment area (Chapter 8). The data are, however, too few, and relate to too short a time period, to indicate whether such trade regularly moves pigs from poorer to wealthier areas. In any event, argument from present conditions to past ones cannot be fully satisfactory.

There is a further factor which might explain some of the change in pig numbers in the Sinasina payments. Salisbury, Healey,

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[42]It remains a possibility. Where did all the shell go, and for what purposes was it traded ? An intensive study, such as Healey's of a large sample of individual trading and exchange histories from one of the core areas subject to early and heavy inflation and devaluation would be interesting.

and Meggitt base their explanations on increases in supply and velocity of circulation, in other words on the M and V factors of Fisher's equation (PQ = MV) referred to above. All three hold Q (the quantity of brides or marriages), constant. Salisbury and Healey in fact do not discuss Q, while Meggitt indicates that Q was increasing but "...at a slower rate than was the supply of money available both for bride-price and for buying pigs to use in bride-price" (1971:204, fn.26). But as suggested earlier, there is reason to believe that epidemics during the early years of the colonial period may have substantially depleted Sinasina cohorts born between 1930 and 1943, with the result that the numbers of persons reaching marriageable age, and hence the numbers of marriages, may have declined during the 1950s. If age specific mortality did occur, it can be argued that the movement of a depleted set of cohorts through the population pyramid would have resulted, with the drop in the marriage rate, in an increase in the average number of pigs killed per marriage. Similarly, later recovery of the marriage rate would be associated with a decrease in the number of pigs.

If it is assumed that Sinasina pigs are largely dependent upon human labour in husbandry and cultivation of sweet potato, their overall numbers are, other things being equal, related to the number of active adult producers, mainly, on the basis of 1972-73 observation, married couples. The number of such adults (and hence the number of pigs kept), would, on the assumption of age-specific mortality, have remained relatively constant well into the 1950s,[43] while the marriage rate would have begun to decline from about 1948, when the first of the depleted cohorts reached 18 years of age, and remained low through the 1950s until 1963[44] when the youngest age group affected reached marriageable age. It is therefore possible that from approximately 1948 until 1963 there were fewer marriages to be paid for by initially constant, and later declining, numbers of adult pig producers.

While this argument depends primarily upon variation in the ratio of pig producers to the marriage rate, it may also be remarked that the ability of adults to produce, and care, for pigs is likely to vary in relation to the number of non-, or less-, productive persons dependent on them. It follows that the level of pig production could be expected to vary inversely to the ratio of dependents (in this case mainly children and unmarried youths) to productive adults; that is to say, a low dependency ratio might, by lifting limits, allow a higher level of pig production than is possible while a high ratio obtains. Though this applies only to theoretical limits on

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[43] Movement of the depleted cohorts into marriage would not necessarily have reduced total pig numbers in proportion to the gradual reduction of the proportion of married adults to others in the population since (on 1972-73 evidence), young married couples tend not to own large pig herds.

[44] According to DDA estimates (see Fig.3.1). If, as I have suggested, ages were underestimated in the youngest category at the time of the first census, the marriage rate would have begun to rise earlier, i.e. from the late 1950s.

levels of production it is worth noting that a low ratio would have existed several years prior to the onset of the suggested decline in the marriage rate, and continued for some time into the 1950s. The dependency ratio would have begun to rise as the members of the depleted cohorts entered marriage. However, due to the reduced number of women entering fertility, the proportion of children in the population would not have risen dramatically, though the overall trend was presumably upward, fueled perhaps by the suggested increase in the number of children surviving infancy. This factor, then, while potentially operating to affect the quantity of pigs, could have reinforced the effects of changes in the quantity of marriages, though the latter, if the changes were sharp enough, would probably be sufficient to account for much of the variation shown by the average number of pigs per payment.

The suggestion that levels of pig production may be related to dependency ratios raises a further possible demographic factor : migration. The 1960s decline in the average number of pigs per payment roughly coincides with a major rise in out-migration (Chapter 3). Since resident populations characteristically have high dependency ratios, it could be argued that these were associated with a decline in pig production. Against such an interpretation are the facts that most migration is circular, and that much of the burden of sweet potato cultivation and pig husbandry is born by women. This is clearly an area where much more needs to be known about the reasons for finding work away from home. It may, however, be significant that many of the Chimbu respondents (from

Gumine) to the 1974-75 Rural Survey, in marked contrast to Enga men, indicated that accumulation for bride payments and the acquisition of other exchange items were the major considerations in their decisions to seek work elsewhere (G.T.Harris 1978:).[45] This suggests that if the level of customary payments is a major determinant of migration rates it seems unlikely that substantial decreases in home-based production for exchange would result from increased migration unless, and the qualifications are important, the relative proportions of locally produced and imported items required for payments were undergoing change, or the returns to migrant labour offered a more favourable means of obtaining those items such as pigs usually produced at home. Data on pig trade already briefly described indicate no substantial sales of large pigs suitable for bride payments. Was the income from migrant labour instead used more as a direct component of payments and for obtaining plumes ? The recollected evidence certainly indicates that cash and plumes increased more rapidly than pigs in the period 1964 to 1973 (Fig.4.1B). How, though, should this be interpreted ? That pigs were undergoing a relative decline in significance as exchange items, or that they were scarcer as a result of the deflection of a significant proportion of the productive man power into migration, and cash-producing activity at home ? A complete answer is impossible in the absence of satisfactory data on the price movements of pigs and plumes during the last decade (and this would be tricky material indeed to handle because of the rising quantity

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[45] In Northern Ghana, for instance, Goody found a correlation between high bride wealth payments and high rates of labour migration (1973:9).

of money in the region, and year by year fluctuations associated with coffee prices).

Perhaps the best that can be attempted is a qualitative assessment, supported where possible, with admittedly inadequate price data. The latter includes a rough time-series of approximate prices kindly provided by Fr.Nilles (Table 4.5), supplemented by information on recent transactions in Sinasina (Tables 8.27, 8.28, 8.30). The Sinasina data are important for showing that pigs are now exchanged only for money and plumes, and any assessment of their changing valuation must be made in terms of both. Nilles' data on cash prices for the period 1969-73 are in rough agreement with prices recorded in Sinasina during 1972-73 (cf. Figs 8.11 , 8.12), and I will assume that the same held for prices fifteen years before in the period 1954-58. Between these two periods, the cash price of pigs therefore rose by approximately 400 per cent. Although accurate figures on Sinasina cash incomes are lacking, some rough indicators of increasing money availability over these fifteen years are useful : between 1962 and 1972 the number of coffee trees in north Sinasina increased by 300 per cent (p. 169 , fn.41), and between c. 1958 and 1972 the level of taxation rose from $1 per adult man in north Sinasina to $8. In contrast, prices of the basic range of imported foodstuffs available in retail stores (rice, tinned fish and meat, sugar) remained remarkably stable during the decade 1962-72. Information on movements of the cash prices of plumes is unfortunately very scanty, and much variation would be expected according to the age and condition of plumes. On the whole, however. they

TABLE 4.5 Some approximate pig prices in Chimbu (1)

DATE	SMALL PIGS (5-20 kg)	MEDIUM PIGS (25-70 kg)	LARGE PIGS (70 kg+)
1933-38	Dog whelks, 1 rope 30 cm. 1 small Pearl shell 1 small Baler shell	Cowries, 1 rope 100 cms. 1 Pearl shell or 1 Baler shell 1 Axe	(Not usually bought) 1 large Pearl shell 1 large Axe
1939-43	Cowries, 1 rope 60-100 cms. 2 Bushknives 1 Axe	1 large Pearl shell 2 Baler shells 2 Axes	(Not usually bought)
1944-53	1 large Pearl shell 2 Baler shells $4	3-4 Pearl shells 3-4 Axes $15-20	(Not usually bought)
1954-58	1 large Pearl shell $5	$15-20	$40-50
1959-63 (2)	$8	$20-30	$50-60
1964-68 (3)	$10	$30-40	$80-100
1969-73	$15-20	$60-80	$120-160

(1) Source: J. Nilles, per. comm. 12 August 1974. These approximate prices thus refer particularly to the Chimbu valley, and, except where indicated, to Mission-Chimbu transactions. Where more than one item is listed, these are alternatives.

(2) Missions rarely bought pigs from Chimbu after this date.

(3) Chimbu increasingly bought pigs from Mission stations after this date.

appear to have remained relatively stable from the late 1950s to the early 1970s, the main exceptions being the price of P.raggiana, which seems to have declined, and that of E.fastosus, which has risen (cf. Gadjusek 1979:85) Certainly there is no evidence for a general increase of comparable magnitude to that shown by pig prices. Further, it appears that plume prices paid for pigs have also increased, though there are difficulties of interpretation here since not only do plume values vary according to condition, but pig values vary according to size. By the early 1970s, however, medium-sized pigs of 30-50 kg live weight were changing hands within Sinasina for either a single Epimachus fastosus (in reasonable to good condition) plus one or two other less valuable plumes, or for two to seven A.stephaniae plus 3-5 lories (Table 8.30).

A significantly different pattern of relationships between the exchange rates for pigs, plumes and money has been described by Healey in his intensive study of plume trading by the Kundagai Maring of the Jimi valley. He reports (1977;416,419,421-2) that the cash price of traded pigs (usually piglets,ibid.,413) rose by only about $2 between 1960 and 1974 (the modal value for 119 cases between 1956 and 1974 was $10). The average cash values of plumes, on the other hand appear to have remained stable (ibid.,423). Pig-plume transactions involved, for most plumes, the exchange of single plumes for single pigs (ibid.,Appendix 10,p.575). The exceptions were plumes of small monetary value such as lories, Pteridophera alberti, Lophorina superba, and Tanysiptera galatea (with individual values ranging from $0.44 to $3, ibid.,416), which were exchanged in multiple amounts for single pigs (ibid.,575).

The exchange rates for Sinasina pigs, in both money and plumes, thus appear to have risen considerably since the 1950s. This of course does not mean that their relative significance as exchange items has been maintained unchanged. By contrast with such new items as money, alcohol, and cattle they are fundamentally linked, in production and thought, with the past. Alcohol appeared rarely in prestations during 1972-73, and, as noted earlier, its use in bride payments was prohibited, at least within Waula. Cattle were still too rare to be used in bride payments, but at least two were slaughtered at the Dom pig festival during 1972.[46] Although only money had joined pigs as a regular item in bride payments, all three (and others waiting in the wings, such as trucks), by their existence, alter the significance of pigs. Pigs nevertheless remain the major item which all Sinasina can produce, and, since their production is severely limited by the labour capacity of a household , their relative scarcity has been maintained. If the eyes of ambitious Sinasina councillors and other leaders were set primarily on the manipulation of other, newer, items by the early 1970s, they not only continued to raise and exchange pigs themselves, but also fully understood their significance to the majority of Sinasina. When the Regional Local Government Office at Mt.Hagen suggested a tax on pigs, the Sinasina council rejected it immediately on the grounds that there were far too many, and that council rules were already quite unpopular enough (Sinasina LGC Minutes, November 1972, Resolution 334/72).

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[46]And many more at the Nimai festival in 1978, according to reports, but that followed a period of massive increases in coffee prices.

Movements of women and wealth

Twenty years ago Salisbury showed that within the Siane area (to the east of Sinasina) there was "...a tendency for women to pass from the south and west towards the north and east, and for valuables to move in the opposite direction" (1956:646), though the Siane themselves apparently recognized neither inter-group wealth differences nor differential movements of women. This tendency, he suggested, had increased since 1934, due to European settlement in the Goroka valley to the north. Research in other parts of the highlands has not confirmed this as a general tendency, holding for all valuables. Marilyn Strathern for instance, in describing the sources and movements of stone axes from the Jimi Valley southwards into the Wahgi, found no imbalance in the flows of women between the Kawelka tribe in the south and Jimi groups (1965:191). In Chimbu, Brookfield and Brown have pointed out that since there "...was no single source of valuables ...no single direction of drift could be expected" (1963:63). Though they note a possible exception at the head of the Chimbu valley, they found no discernible direction of flow in central Chimbu. Healey, however, working amongst the Maring, found a considerable change in the directional flows of women into and out of the Tsuwenkai Kundagai after 1950, and suggests that "...increasing intermarriage with Up-Jimi communities, and especially the excess of women sent from Tsuwenkai, is related to the Kundagai view of this region being a major source of valuable exotic imports" (1977:305, also

109).[47]

Information on the pre-colonial period in Sinasina is lacking, and would require intensive genealogical investigation, with samples from a considerable area and careful discrimination of marriages which followed post-defeat refuging from those contracted under more "normal" conditions. Further, from the perspective of Nimai in central Sinasina, items as important as salt, axes, and shell came from different directions (the south, west and both north and west, respectively: see Hughes 1973,1977), and it is possible that no overall tendency would be discernible (note for instance the distribution of 169 pre-1945 Waula marriages in Map 4.1 below). Over the last 40 years, however, this situation has clearly changed. Instead of looking to (almost) all four points of the compass for a variety of valuable items, the bloc of groups forming Sinasina has developed as a region lying to the south of both the 1933-50 sources of shell and steel (i.e. mission and government stations in the main), and the highway which, since 1953, has provided access to sources of money and plumes elsewhere. This northward orientation of Sinasina has been described earlier in terms of council, government and mission activity (Chapter 2). To what extent is a similar orientation apparent in the movement of women at marriage ? Some fragmentary documentary evidence may be considered first.

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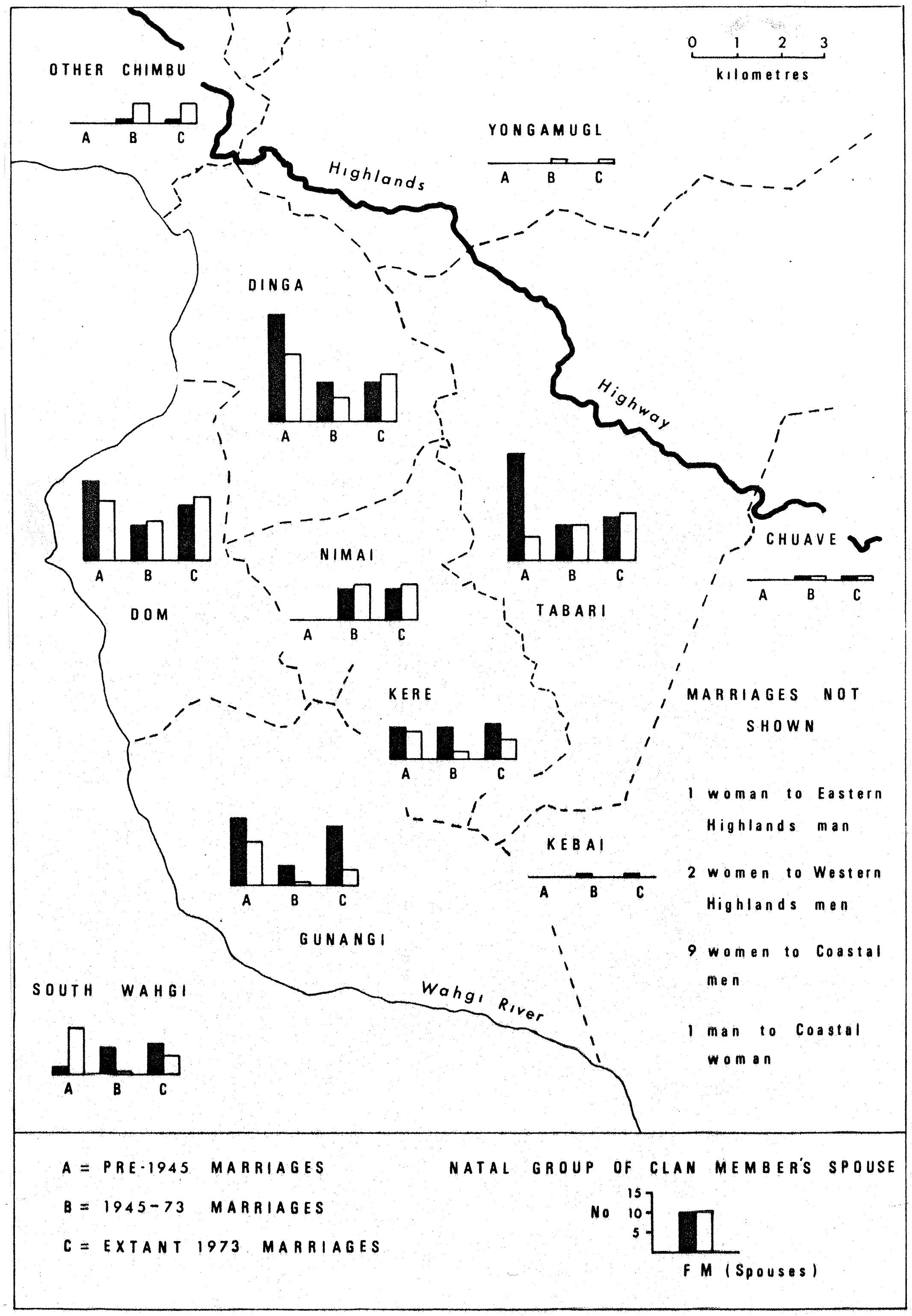
[47]His citation of Salisbury as saying that less wealthy Siane groups had a "deliberate policy" of sending women to more wealthy groups (ibid.,305), is incorrect. Salisbury's analysis of the post-contact movement is the "simplest reconstruction" of how higher exchange rates and bride-prices might have spread from a centre (1962:117).

As early as 1940, Downs, on the first census patrol of the Dinga, Nimai, Kere and Tabari groups commented upon the "abundance of females" among the "inner China Sina groups", referring, it would seem from internal evidence (the census data have not apparently survived), to clans centred upon the present Tabari rest houses of Yobakogl, Emimau and Masul (see Map 2.3; Downs,PR 28 March-9 April, 1940,p.4). This was due, he stated, to "...the local wealth won from casual labour which is greatly favoured by this clan. Nearly everyone a polygamist in China Sina" (ibid.,4). Since, as Downs himself noted, first censuses elsewhere in Chimbu yielded figures that were only 85 per cent as complete as second counts, and the latter were also often under-counts, some scepticism might appear to be warranted, at least in respect to the prevalence of polygamy. But what of a 1972 report suggesting that the Gunangi and Dom, the two major southern groups, were selling young girls for profit ; indeed that 23 marriages of Dom girls within the previous year had been explicitly for the purpose of raising funds for a compensation payment (Grierson,CPR 3 1972/73) ? At first regard this seems too neat, reflecting too closely the perception that Gunangi and Dom are part of a southern periphery, suffering the triple disadvantages of terrain (in particular the sharp fall to the Wahgi gorge), of locational isolation from the Sinasina centre, and of discriminatory treatment in the allocation of council funds. What though of the spatial pattern of actual marriages ?

The marriages contracted by members of Waula are not evenly dispersed. Map 4.1 shows the distribution, by natal group of spouse,



Map 4.1 Natal origins of Waula members' spouses

of (A) some marriages contracted before 1945, (B) most marriages contracted between 1945 and 1973, and (C) all known marriages extant in 1973[48] (see Appendix 5 for the tabulated data, especially Table A5.1). The manifest incompleteness of Category A (101 marriages of male members as compared to only 68 of females), makes the pattern of movement of women in this period unreliable. Nevertheless these earlier data are useful for showing the absence of pre-1945 marriages both within Nimai, which, like many other high-level Sinasina groups has split into lower-level exogamous groups only since approximately 1950, and with groups at one remove from neighbouring tribes, such as Kebai, Yongamugl, and those in the Chuave-Elimbari area (Kenagi, Kamale, Goge), with whom intermarriage is also said to be recent. The one important exception to this latter generalization is the area to the south of the Wahgi river occupied by such groups as Kia, Golun and Kere (S), which I will refer to collectively as South Wahgi groups hereafter. Members of Waula, and other Nimai clans, refuged amongst these groups following defeat in past wars, and claim a long history of intermarriage with them. Marriages in Categories B and C are on the other hand as complete as possible. Summarized in Table 4.6, they show a strong overall trend.

Since 1945 "southern" women (see notes to Table 4.6 for definitions) marrying into Waula have outnumbered Waula women marrying

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[48]Categories A and B include only those marriages either extant at the beginning of 1973 or which ended in the death of the Waula partner. Earlier marriages which a Waula partner contracted but which were ended by divorce are not included.

TABLE 4.6 Direction of marriages made by men and women members of Waula clan[1]

Direction of spouse's group	Number and percentages of marriages											
	(A) Contracted before 1945[2]				(B) Contracted 1945-73				(C) Extant 1973			
	Men		Women		Men		Women		Men		Women	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
South[3]	27	26.7	30	44.1	21	35.0	4	7.0	33	41.8	14	17.1
North[4]	74	73.3	38	55.9	36	60.0	34	59.6	43	54.4	49	59.8
Distant north[5]	-	-	-	-	3	5.0	19	33.3	3	3.8	19	23.2
Totals	101	100.0	68	100.0	60	100.0	57	100.0	79	100.0	82	100.0

(1) For more detailed information see Appendix 5 , Table A5.1

(2) Incomplete.

(3) Includes Kere (in Sinasina), Gunangi, Kebai, and South Wahgi groups.

(4) Includes Nimai, Dom (in Sinasina), Dinga, and Tabari.

(5) Includes Chuave, Yongamugl, other Chimbu, Eastern and Western Highlands Provinces, and Coast.

southern men by five to one. The imbalance in extant marriages in 1973 was two to one. In contrast, the movement of women in marriage between Waula and the three neighbouring groups in the "north" category has been in equilibrium since 1945, and the distribution of extant marriages remains so. The southern imbalance, however, is reversed in marriages with the "distant north" : Waula women marrying out in this 'direction' outnumber wives received by their Waula brothers by six to one. Unlike the southern imbalance, this holds not only for marriages contracted between 1945 and 1973 (Category B), but also for those extant in 1973. Most of such marriages, in other words, are recent.

Is this pattern unique to the one small clan ? It could be argued that imbalances at this level are offset by the marriages of other Nimai clans. This is possible. Unfortunately I do not have data on the marriages of female members of these clans. Information on the natal group membership of 343 extant wives of male members, however, reveals a broadly similar pattern : a lower proportion (32.9 per cent) coming from the south, a higher proportion (62.7 per cent) from the north, and a similar amount (4.4 per cent) from the distant north (see Appendix 5, Table A5.2, for detailed figures). But, without the complementary pattern of female marriages, this is inconclusive evidence. Nevertheless it is important in the present context for confirming the very low Waula figure for wives received from the distant north. This recent imbalance can be explored by a closer look at the Waula data.

In terms of numbers, 19 Waula women are involved. Seven have married into other Chimbu groups : one each to Kenagi (near Chuave), and Yongamugl, and five to members of Bari[49] settled on the Wahgi terraces between the Koronigl river and the Seventh Day Adventist centre at Moruma near Kerowagi in the west of Chimbu. Three have married men from other highland Provinces, and no less than nine have found husbands originating from coastal areas. Of the latter, five were said to be from "Lae", all of whom were, in 1972-73, living and working in the Western Highlands Province, while the others were reported to be a "Tolai", a "Sepik", and a "Samarai". The origins of one were unknown to the woman's relatives. Coastal husbands' occupations included a prison warder (who had met and married his wife while stationed in Sinasina), a policeman, and various clerical and store-keeping posts. It is probable that several of the other women had also met their husbands in Sinasina. Most of these "distant north" marriages, as noted above, were contracted recently ; all since 1960, but most in the previous three or four years. Although details are incomplete, one of the interesting characteristics of this cohort of young Waula women is the high proportion of them who have attended school, in all known cases at the Catholic Mission (Enrollment records, St.Michael's School, Koge). At least 11 of the 19, and 6 of the 9 married to coastal men, had had anything from

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[49]Elsewhere spelt Bandi. Their homeland is on the Kubor Range south of the Catholic Mission at Mingende, to the west of the Dom shown on Map 2.1 (See map of "Chimbu Tribal and Group Territories", in Brookfield and Brown 1963). Could, however, these resettled Bari be related to the 300 mentioned in 1952 as living in the "northern section" of Dom (Keogh,CPR 1,1952/53) ?

three to seven years schooling at Koge (this includes one or two years under catechists before entering the government-recognized Standard 1 Primary class), and two of them, after completing Standard 4 at Koge, had proceeded onto boarding school in Goroka. We can conclude, then, that in recent years an increasing number of young Waula women have found husbands outside the normal range of groups with which their parents intermarried.

This finding would seem to be contradicted by Young's general conclusion, based upon her study among the neighbouring Dinga and four other groups in Chimbu, that "(t)he migration space of traditional movement has changed very little since pre-colonial times. Young married women come from the same sub-clans as women in their fifties" (1977:264).[50] The contradiction may, however, be more apparent than real, since Young herself points out that her analysis omits the

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[50] A minor quarrel : the colonial period was forty years old in 1974 and thus the marriage pattern of women in their fifties is not strictly pre-colonial. More seriously Young's later comment that the pre-marriage moves made by an 'Emai' woman (her place of origin is unfortunately not given) to visit distant kin in Gumine "would not have occurred in pre-colonial days" (1977:315), probably underestimates earlier movements between areas in north Sinasina and those to the south of the Wahgi (cf. the time depth of Nimai marriages described above). Further, Young cites Emai as a village lying "near " the border of the tribal territory to explain the high proportion of women coming in marriage from other tribes (54.8 per cent; 262-3). Emai is, however, relatively central (Map 2.2), particularly for the large Dinga '2' subdivision of Dinga, and, if my 1968 informants were correct about recent changes in marriage restrictions, the proportion of non-Dinga wives would have been higher in the past (i.e. distance is not the major, or only, factor involved).

marriages of current absentees, both men and women, and notes that the latter may be marrying men from other parts of the country (ibid.,267). This possibility is supported, she suggests, by the results of the 1973/1974 Urban Household Survey which showed that 55.1 per cent of the married men living in Kundiawa (in 1974) were from outside Chimbu, and that over half of them had married Chimbu women (ibid.,167,fn.34). Further, in the case of one of her sample locations, Angangoi in the western Chimbu District of Kerowagi, she notes that there had been a number of recent marriages of young women to more favourable locations in the Wahgi valley, a trend which leaders explicitly said they had been encouraging as a means of access to coffee (ibid.,265-66). It is possible that the extent of such recent marriages, to both non-rural wage earners and to residents of more advantaged rural areas, is masked by the lack of data on the marriages of current female absentees, and by Young's inclusion of the close female relatives of both natal group members (i.e. mainly men), and members by marriage (i.e. mainly women) in her analysis of marriage patterns (ibid.,263,Table 4.5;264,fn.33;265). This latter categorisation would tend to hide differences in the inward and outward marriage patterns of groups primarily defined by descent (or affiliation) through males.

Young's report that Angangoi leaders had been explicitly encouraging marriages to men living at lower altitudes in the Wahgi valley is of particular interest in that Waula evidence suggests that some of the new marriage choices made by young Waula women are not unanimously approved by home-based relatives. Some Waula men, dissatisfied with the exodus from the land and region of their young women, and probably also influenced by rising school fees were responding by no longer sending their daughters to school. During 1972-73 the ratio of male to female primary students from Waula (n=24) was 2.4 to 1,[51] considerably higher than the ratio of 1.2 for all 5-14 year olds (n=66) in the clan. Comparison with the ratios for all students at the Catholic Primary School at Koge in 1964 and 1969 suggest that the trend was not restricted to Waula : in the former year there were 1.6 male students to every female one (n=301,Hardie, CPR 1,1964/65, Appendix E), by 1969 this had risen to 2.9 (n=349, Salmon,CPR 7,1968/69). One final point should be born in mind. There is no reason to believe that recent marriages with men from the "distant north" category are likely to be any more stable than those with more traditional partners made in the past. It would therefore be premature to conclude that the 1973 "pattern" is likely to reflect or predict that of five to ten years ahead.

Although hard evidence for this recent tendency is restricted to the micro-level of one small clan (and one, it should be noted, situated close to one of the earliest schools in Sinasina), an additional source of indirect evidence at a wider level is worth considering. If a significant number of women move at marriage to more advantageously located groups or areas, then given limits to

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[51]In 1974-75 the ratio in all northern Sinasina (that is, the census division of Sinasina) schools was 2.1. Waiye, in this year, had the lowest ratio for all Chimbu census divisions with 1.7 (Howlett _et al_.1976:162, Table 7.3).

the population affected, it is reasonable to expect that poorer groups might suffer absolute losses of adult women. In other word the proportion of adult men to women might be expected to increase with distance from the sources of wealth (cf. Salisbury 1956:648). Examination of DDA censuses at the level of the seven major (tribal) Sinasina groups shows (Table 4.7) that although total masculinity ratios vary little from the overall Sinasina figure of 116 (with the exception of the small Kebai group), adult masculinity ratios range from a low of 114 (Tabari), to a high of 126 (Gunangi). Here apparently

TABLE 4.7 : Masculinity ratios (MR) (1) of Sinasina tribes,1971

Tribe	Total Population (2)	Total MR	Adult Population (3)	Adult MR	Coffee trees per capita (4)
Gunangi	3974	115.9	2641	126.1	47
Kere	2296	116.8	1416	125.1	23
Dom	2763	116.4	1793	124.4	28
Kebai	769	133.0	495	122.0	55
Dinga	4097	117.5	2467	120.5	38
Nimai	2016	116.1	1239	120.1	51
Tabari	9764	114.9	5908	114.0	60
Sinasina	25679	116.4	15959	119.8	47

(1) Masculinity ratio = males per 100 females.
(2) Administration census records, Sinasina,1971.
(3) 16 + years.
(4) DASF, Sinasina coffee census 1972.

is a suggestive variation, with the three most northerly groups of Tabari, Dinga, and Nimai showing the lowest ratios. Unfortunately, accurate information on wealth differences (i.e. per capita income or similar), is not available at the tribal level. Coffee tree figures have been shown to suffer from serious undercounting (Wilson and Evans 1975:9), though the 1972 Sinasina census, which partly revealed the extent of past undercounting, was probably more careful than most.[52] In the absence of better data, however, the 1972 figures may be tentatively used as an indicator of wealth differentials. When adult masculinity ratios were regressed with per capita coffee holdings (Table 4.7,column 5), a slight tendency for ratios to rise as coffee holdings fell was shown, but the correlation (R= -0.65) was not significant at the 5 per cent level. (Regressions of the MRs with other possible indicators,i.e.male absenteeism,and tradestores per 100 persons, resulted in even weaker correlations). In short the available macro-level data for Sinasina offer suggestive but not conclusive evidence for differential movements of women.[53]

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[52]See Howlett *et al*.(1976:222-3) for a review of the reliability of such statistics.

[53]Seven groups is a tiny sample. It would be interesting to examine the relationship with Chimbu-wide data. This unfortunately is not available to me. It may be noted that if the 'southern' groups of Gunangi, Kere, and Dom are combined (excluding Kebai), and contrasted with the 'northern' groups of Nimai, Dinga, and Tabari, their adult MRs (of 125 and 116, respectively) are significantly different (chi squared 4.8,p.$<$ .05).

This recent trend in marriage patterns, apparently reflecting new evaluations of scarcities and opportunities, may also throw light on an earlier 'event'. In the late 1940s several large Sinasina exogamous groups suddenly began to permit intermarriage between some of their internal segments. Why this should have occurred when it did is problematic, particularly since I have suggested that Sinasina may have suffered both overall and age-specific population loss from epidemics in the early years of the colonial period. Fission is more usually understood, in the segmentary model, to be a consequence of population growth, not retraction. Brown, for instance, who also cites common traditions of "recent segmentation" in central Chimbu, suggests that they "support other evidence of population growth" (1969:79).[54] In the light of this view, what are the grounds for considering the Sinasina change an 'event', rather than part of normal segmentary processes ?

The evidence is varied. Burfoot, who patrolled the whole of Sinasina in 1950, reported a "...definite breakdown in marriage taboos taking place through the entire area and this breakdown, in most cases, has commenced only in the last 4-5 years"(CPR 1,1950/51, p.15). Though he unfortunately did not list the particular groups

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[54]'Recent' meaning within living memory in the case of the Naregu. Brown recognises other factors which may lead to fission, notably territorial separation, and disputes resulting in separate action. It may also be noted that Pospisil, arguing against population growth as a cause of the redefinition of exogamic boundaries in a Kapauku community, cites depopulation as a factor in some Irian Jaya cases (1971:225, citing Bureau for Native Affairs 1957).

involved, Burfoot did consider the change interesting enough to record specific, albeit ambiguous, reasons offered by 'native headmen' considered below). In the case of the Nimai, the evidence, which includes accounts of informants, who range from men who were leaders in the 1950s to persons contracting the first marriages, as well as information on the current marriages of most Nimai men (Table 4.6 above; Appendix 5,Table A5.2), is unambiguous : up to c.1950 no intra-Nimai marriage had taken place. In about that year, intermarriage began between all four present clans, except between Waula and Ogole, and Waula and Dugul.[55] Evidence from other large Sinasina groups is not so exact. Amongst the Dom at Kagul, intermarriage between Kumankane and Kumgau is reported to have begun in the 1940s, between Kumankane and both Digakane and Erakane a little later, but between Kumgau and the latter two groups not until after 1966 (Interview,24 April 1972). At Kebil, in Gunangi some intermarriage between the Kinku and Maukava, but not between all their constituent subgroupings is said to have started at some undetermined period after contact (Interview,7 September 1972).[56] By the Dinga at Emai (though here my information relates only to the later period of the 1960s), I was told that intermarriage between Siba and the rest of Kireku, and between Dikasuku and Nul-Ninegu, began in

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[55]In 1973 Waula still did not intermarry with either group. A suggestion that marriage with Dugul be allowed, in 1972, was vetoed by the older men.

[56]Hatanaka's data (1972:18-20) appears incomplete on this point.

about 1966 and 1967 respectively (Interviews, 12 Jan. and 14 March, 1968). This evidence from groups other then Nimai is therefore fragmentary. While also indicating a later series of boundary redefinitions, it does nevertheless suggest that Burfoot's description of a recent and relatively widespread change in the 1940s is reasonable. In support of the 'event' hypothesis, the size of the groups before and after boundary changes is significant. In 1950 the Nimai numbered just over 1500 persons, a large exogamous unit by most highland standards. After fission, the segments included 620, 586, 235, and 125 persons respectively (see Table 3.1).[57]

Why did intermarriage between smaller, lower-level, groups begin at this time ? According to Burfoot, 'headmen' advanced three reasons :

(1) A shortage of marriageable girls,

(2) the instability of marriages contracted with girls from distant places "who now often leave their husbands on the slightest provocation, without fear of physical retribution", and,

(3) a decline in the power of "natural" headmen, due to government and mission influence (CPR 1, 1950/51,p.15).

Two further explanations, offered to me in 1972, may be taken as glosses to the third of Burfoot's reasons. In the case of the Gunangi at Kebil, intermarriage, it was said, was simply due to Lutheran proselytisation.Mission activity (teaching and practice), on the part of both Lutherans and Catholics, must certainly have been one factor,

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[57]The figures from Dom (Kagul) and Gunangi (Kebil) are broadly similar (in all cases, figures are for 1971) : for the former, Kumankane (484), Kumgau (340), Digakane (742), and Erakane (297), totalling 1863 ; and for the latter, Kinku (797), and Maukava (543),totalling 1340.

and it is presumably not coincidental that the change was noted soon after the start of post-war mission expansion into Sinasina. Whether mission influence necessarily led directly through a decline in the power of leaders, to change in the boundaries of exogamous groups is questionable, and probably impossible to ascertain at this late date. Nevertheless, in so far as both missions vigorously attacked the institution of polygamy,[58] and required that plural marriages be broken up before baptism, then mission activity clearly contributed to marriage instability (the second of Burfoot's reasons), even if not restricted to marriages between partners from distant locations.

An account of the Nimai change, given by Bal, a leader who became the Nimai luluai later in the 1950s,[59] is more complex, not inappropriately

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[58] For Catholic policy see Colin Simpson's conversation with Fr. Schaefer (at Mingende) in 1953 :

"'You've induced them to give up polygamy ? ' I (Simpson) asked.

'Practically. Very few...now take a second wife.'

'And if they do - ?'

'They are excommunicated.'" (Simpson 1954:164; for a recent, concerned, discussion of Catholic policy see Knight nd.)

For Lutheran policy and practice in 1952, see Julius (nd:8-9). Two of the first intra-Nimai marriages involved, according to one of the then brides, women who had been discarded by their polygynous husbands at the time of the latter's baptism. On the question of a decline in the power of leaders as a result of mission influence, Julius (ibid.9) notes that the only objections he heard to the Lutheran Missions's ban on polygyny came from two "important men" of Tabari who argued that it was resulting in a reduction of family size.

[59] Interview, 26 March 1973 (T/RH/13 B). For an account of his career see Golla (1971).

perhaps since one of his daughters made the first marriage between Bomai and Dugul clans. According to Bal, the Nimai were united during his youth, at least as an endogamous group, and in their common use of a single structure related to war ritual. However, partial separation, short of intermarriage, into the four present groups resulted from an argument over the internal payment of compensation between one group which was primarily responsible for initiating a war with the neighbouring Dom, and another which had lost a man in the fight. Following the dispute, "they killed and ate pigs separately" but they did not intermarry. Intermarriage only began later,

> "when the whitemen came, they put everyones' names in a book, and everyone saw that the list was long, and Ogole, Dugul, and Bomai intermarried, and Waula and Bomai intermarried. Thus it was only when the kiap came and took the census that everyone intermarried. Now we do it this way, Dugul say they're Dugul, Bomai say they're Bomai, and Ogole-Waula the same, that's what people say. Before, when we were getting a bride, or sending one of our women in marriage, I would go and give the pork belly fat and make a speech. That's what I used to do. But now, since we've all separated to intermarry, I'm ashamed (to do this), and so I no longer go to Mui's house (my companion), I don't show my face at your house, nor at the Dugul houses. I'm ashamed and I stay here."

This account squarely contextualises eventual intermarriage in a developing sequence of fission, familiar from other segmentary studies, but the suggested catalyst, the census, is interesting. Equally interesting is Bal's description of the effects of segmentation, which stresses, with the poignancy of an ageing leader, his inability to continue acting as a leading participant in the marriages of the new exogamous units. Without speculating on the degree of pre-1940s unity in a group as large as the Nimai, his account is suggestive of possible relations between government influence, the decline in headmens' power, the influx of imported valuables, and new marriage rules. As described earlier, the activity of censusing from 1945 on is likely to have increased the consciousness of subgroup definition. Not only did lower level groups achieve (or attempt to achieve) a measure of identity by means of the census, it seems possible that they were able, due to the increasing flow of imported valuables into the exchange system, to act autonomously in at least some spheres of exchange.

This discussion is also relevant to the second of the headmens' reasons recorded by Burfoot, the instability of marriages contracted with girls from distant places, due to such girls no longer fearing physical retribution from their husbands. While it is possible that the strength of a husband's arm contributed to pre-1940s marriage stability, a more complex reality would seem to lie behind this statement. Before the 1940s, affinal ties linked groups (which were large, and therefore to a limited degree all marriages were 'distant'), in a web of relationships through which flowed military assistance and valuable goods. By the late 1940s, however, war in the old sense was, if not a memory, at least no longer part of the dominant definition of current social reality. "Fighting in this area", said Fr.Schaefer at Mingende in 1953, "is completely finished - except for occasional brawls" (Simpson 1954:167). If military alliances no longer dominated decisons affecting inter-group relations, so also were the constraints exercised by the pre-colonial pattern of a limited number of major trade sources (stone, salt, shell, and plumes) no longer fully operative. New constraints, and opportunities, were emerging and we would, I think, be underestimating the political skills of Burfoot's informants if we placed too much weight on the flighty heels of girls from distant places as a factor which contributed much to the redefinition of marriage units.

If changing economic, political, and military circumstances can be read into the second and third reasons for reductions in the size of marriage units reported by Burfoot, what are we to make of the first, a shortage of marriageable girls ? That such a shortage was perceived accords partly, but only partly, with the suggestion of heavy age-specific mortality losses in the 1930s and 1940s described in the previous chapter. The statement is problematic because it lacks a defined second variable : a shortage, we need to know, in relation to what ? According to the argument for earlier demographic loss, which assumes equal losses among the sexes, the expected answer would be a shortage in relation only to normal rates of marriage (i.e. marriageable men should have been as scarce as girls). But it is difficult, if this were the sole shortage meant, to see how reductions in the size of marriage units could have been expected to improve the situation. Further, why would the headmen have mentioned girls in particular ? Thus the statement seems to imply, not simply a reduction in the marriage rate, but an absolute scarcity of marriageable girls in relation to men seeking wives.

These two categories do not necessarily share the same age boundaries. Marriageable girls can be assumed, with some safety, to include only those aged approximately 16 - 22 years of age. The category of men seeking wives, on the other hand, is far less precisely defined. Under stable conditions, it might be expected to include only a limited age class, perhaps a few years older than that of the young women,[60] but there is little likelihood that conditions were stable at this time. As described above, major fighting had ceased, new goods were dramatically altering the older exchange flows, and mission activities had begun to influence such practices as polygyny. What evidence then do we have of changes in the category of men seeking wives by the late 1940s ?

Bergmann's description of Chimbu society in the early 1930s stresses that there were significant numbers of men "...often more than 40 years of age and older, who lived single and...never had been married" (1971,Vol.4,p.89). He gives no precise estimates of numbers, noting on one occasion that there were "very many" (ibid.,89), and "several dozen...in each tribe" (ibid.,91) at another. He had the impression that batchelorhood was more pronounced in eastern groups (presumably including Sinasina ?), than amongst the Kamanuku and immediately neighbouring groups with which he was most familiar (ibid.,91). Brown and Brookfield, describing central Chimbu groups, report that "...early census accounts showed that only about half the adult men were married..." (1963:74). Bergmann relates the high incidence of batchelorhood to high masculinity ratios, the practice of polygamy, and wealth differences, concluding that "...many men could not get a wife and of course the ones who were poor and had little or no influence were the ones to stay single" (ibid.,89).

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[60] Hence the possibility, if early epidemic losses were precisely age-specific, that a shortage would be sharply experienced, at the time that the first depleted cohorts of girls reached marriageable age, by the cohort of men just old enough to have escaped serious losses.

This changed, he suggests, in the colonial period, when alternative means of access to wealth became available, and polygamy declined, with the result that "...this type of poor unmarried men has nearly vanished entirely" (ibid.,91).

If Bergmann's description of the situation in the 1930s is assumed to hold for Sinasina, then, by the late 1940s it is possible that the category of men seeking wives could have included, not just a 'normal' (i.e. in accordance with previous wealth differentials) proportion of young men of marriageable age, but additonal, indeterminate, numbers of both similarly aged, and older, men, who had previously lacked the means of acquiring wives. Although no estimates of the possible increase can be made, the important question to ask is whether new opportunities for aquiring valuables (for funding marriage) were sufficiently open by the late 1940s to have caused a significant increase in the number of men seeking wives. The general answer, I think, is that they were, especially in the case of the northern Sinasina groups which appear to have all participated in war-time work in the Goroka area. Some qualification needs to be entered with respect to local variations : Dinga, for instance, were advantageously located for the marketing of food and other supplies to Kundiawa, while some Tabari clearly benefitted from their position athwart the emerging highlands road. As early as 1940, as noted above, Downs linked the latter advantage to a high rate of polygamy and a low masculinity ratio. The fact that there may have been discrepancies between direct access to the new wealth (i.e. through work), and control over the wealth thus acquired (i.e. by fathers over their sons' wages, by big men over the wages of their followers,cf. Salisbury 1962:127-132), need not invalidate the suggestion that the number of men seeking wives increased, since reponsibility for raising the funds necessary for a marriage exchange is normally shared, not restricted to the individual.[61]

Granted, then, the possibility of a real shortage of marriageable girls, why should the headmen have felt that the scarcity could be alleviated by a reduction in the size of marriage units, which, in absolute terms, could not affect the overall supply of women ? On present evidence, I see no simple answer to this question. In the case of the Nimai, for instance, the result of dividing into four (potentially) exogamous groups clearly increased the opportunities for marriages within the immediate neighbourhood (and, conversely, reduced opportunities elsewhere as other groups similarly divided to begin intermarrying).It is possible that such an increase could have marginally improved the chances of a successful marriage, due perhaps to communication advantages resulting from proximity, but the latter would not appear to be of major significance at a time when the cessation of warfare was removing earlier constraints on inter-group travel and communication. It is perhaps worth pointing out that, given the interdependence of Sinasina groups in terms of marriage, [illegible]

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[61]This raises the intriguing question of the extent to which older men in positions of power might have sought to maintain their positions by restricting entry to marriage through manipulation of the size of bride payments. Given the increasing flow of new valuables (shell and steel in particular) throughout the period, it is impossible at this point in time to distinguish the relative importance of increasing supply, from the deliberate raising of exchange payments.

implementation of the change by one major group - for whatever reason - could, by reducing the number of their women available to other groups as potential spouses, have soon driven others to follow the same policy. In this perspective it is interesting to speculate that the initial change might first have been instituted by a relatively disadvantaged group experiencing a general loss of women to richer groups. The alternative, that the change was first implemented by a richer group seeking to keep valuables within its own borders, would seems less likely due to the advantageous possibility of obtaining 'cheaper' brides from poorer groups.

Summary

Using a recontructed index based on recollected bride payments, this chapter has described a forty year sequence of changes in the Sinasina use of valued goods or items. Disaggregation of the payments into a number of major items revealed different trajectories of change or fluctuation. My exploration of these, though particularly aimed at tracing the development of the early 1970s triad of money, pigs, and plumes, also glanced along the way at consequences resulting from the decline or demise of other items. Pigs received special attention, partly because they have maintained their value robustly, and partly because their production within Sinasina gives them a unique status. In the later part of the chapter I broadened the discussion to present evidence for changes in the movement of women at marriage, suggesting the emergence of a pattern favouring areas enjoying new advantages. Evidence for a significant change in the size of exogamous groups was also considered.

It is easier perhaps to suggest that "(t)he transference of goods, wives, families and land are all integral parts of a whole flexible system centred in the distribution of population" (Brookfield with Hart 1971:332) than to demonstrate, especially within a relatively restricted area and over the medium term, the specific interrelations involved. In the next chapter I narrow the focus even further to a single Sinasina tribe to look at processes and events affecting the empirical patterns of settlement and enclosure.

CHAPTER 5

Settlement and enclosure

Introduction

The starting point of any inquiry into rural spatial organisation in Chimbu is necessarily the work of Brookfield and Brown who, in a number of papers, have described the post-1953 effects of the introduction of coffee on the cultivation, husbandry, and settlement systems of the Mintima Naregu in central Chimbu. In particular, they have paid increasing attention to the interrelation between the fluctuating land and labour requirements of the pig cycle, and those of the new cash crop. In sharply abbreviated form, they describe the following sequence :

Chronological summary of events concerning settlement and enclosure following the introduction of coffee among the Mintima Naregu,1952-71 [1]

1952-54	Coffee introduced. 8 ha planted by 1958, 30 by 1962, and 66 by 1967.
1956	Pig festival held. [2]
1958-62	Coffee, most cultivation, and settlement included within a single enclosure system. Between 1958 and 1962, enclosure system extended southwards (downslope) by c.1km. to include expanded food crop cultivation. Settlement, however, especially that of men, remained relatively centralized.

[1] Sources : Brookfield 1966, 1968, and particularly 1973b; Brown and Brookfield 1967. The Mintima study area included some 8.9 km^2 between the altitudes of 1500 and 2250 m supporting a population of c.1000.

[2] The previous one, which Brookfield (1973b:158) dates approximately to 1947, was probably held in 1949 (Wakeford, CPR 2, 1949/50, p.2).

1959	Creation of Waiye Local Government Council.
1963	Following an increase in pig numbers, pig invasions and extensive damage to cultivation. Single enclosure system broke down, and deep fenced corridors from unenclosed land into enclosed areas created to integrate pigs, gardens, coffee and people.
1963-64	Conflict between 'traditionalists' wishing to hold another festival, and 'progressives' preferring to pursue investment in coffee. The latter temporarily successful.
1964-65	Increased centralization of settlement. Experiments with centralized coffee-processing, which later collapsed.
1966-68	Increased out-migration.
1969-72	Pig festival planned (flutes blown 1969). Further centralization of cultivation and settlement. Pig festival held (1971-January 1972).

Comparison between this Naregu sequence and change in Nimai settlement and enclosure, however approximate, is only possible if differences in boundary conditions are clearly stated. Pre-colonial settlement patterns in the two areas were, I argue below, different. Secondly, whereas Brookfield and Brown describe little change in Naregu prior to the introduction of coffee,[3] this is not possible for the Nimai, whose territory has been the site of significant government and mission establishments. Further, the Naregu were subject only to Catholic mission influence, the Nimai to that of both Catholics and Lutherans. The two territories also differ in terms of altitudinal span. Mintima Naregu land rises from 1500 to 2250 m, that of the Nimai from essentially 1800 m, with only small pockets below this altitude,

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[3] According to Brookfield (1973b:150), all current men's house sites had been occupied since 1933, and the Mintima ceremonial ground site had been used for several generations.

to over 2600 m (Map 2.4). Probably as a consequence of this difference, Naregu planted considerably more coffee, with approximately .06 ha per capita by 1967 (Brookfield 1973b:156), compared to an estimated .01 ha per capita among the Nimai by 1972. In addition, the Naregu experienced an earlier introduction to modern political institutions, participating in the establishment of the first Chimbu Local Government Council in 1959 under the leadership of Kondom Agaundo, the foremost Chimbu politician and spokesman for development in the early 1960s (Brown 1967 a,1972). The Sinasina council on the other hand was not formed until 1964, at which time the Nimai were described as "(a) difficult group to assess - they have no leaders" (Parker,CPR 9, 1964/65,p.3).

The pre-colonial pattern

Nimai say that when the first exploring party passed through Sinasina they were mainly living in settlements conspicuously sited on ridge tops, almost invariably in the southern part of their territory above 1990 m. Defence appears to have been an important determinant of these locations.[4] Most of these previous settlement sites are named and still show signs of prior occupation due to the practice of planting useful and ornamental tree species on and around them.

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[4] According to Sikene, an elderly Ogole man,

"In those bad days when we were fighting, my parents had a house at Moregabil (Map 5.1). They only planted food at Koge, going back to sleep at Moregabil. They would come down to Koge to harvest food then go back up the hill to eat and sleep. In the morning we'd come down again to get food. That's how it was" (T/RH/13/A).

The 1933 settlement pattern may be described as one of "clusters of hamlets". Recent discussion of highland settlement has shown that a simple nucleated - dispersed dichotomy, though useful for the broad contrast between the eastern and western highlands (Read 1954) is inadequate for descriptions of single systems (Waddell 1972a:31-2) or fine grained comparison. In a recent essay in comparison Brown and Podolefsky have introduced a third category "hamlets or clustered settlements" (1976:216). The problem is nicely put by Strathern. Placing Hagen firming in the 'dispersed' rather than the 'village' category, he approached the question of what are their relevant settlements by first considering "which sets of houses are referred to by the people themselves as different...'house-places' " (1972:60). However, because of tendencies toward aggregation and a resulting range of consolidation from single houses up to hamlets, it was "...not always easy to state where one house place ends and another begins" (ibid.). Beside warning of terminological confusion, the example is valuable for stressing the extent of variation, both within any area at a specific time, and over time, either on a cyclical basis [5] or as a result of movement into new areas. Granted considerable variation then, by describing the Nimai pattern (and probably that of most Sinasina), as one of "clusters of hamlets" it is my intention to place it first within the broad category of 'nucleated' patterns characteristic of the eastern highlands. Hatanaka's suggestion that

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[5] Pulsating or oscillating patterns of settlement have been described for the Siane, Maring and central Chimbu (Salisbury 1962; Rappaport 1968; Brown and Brookfield 1967).

Sinasina nucleation is recent, and the result of mission influence (1972:9,13) is not supported by evidence.

The boundary between the nucleated east and the dispersed west was distinct enough to elicit close comment by early observers. In 1933, the first group of Europeans to traverse the area, after passing through "a big village" on the east bank of the Marifutiga River (Leahy, Diary 31 March 1933), crossed the river on April 1, and passed (i.e. in Sinasina) through "several villages in which the houses were grouped together, each group being set in a fixed garden, and a good track fenced on each side through the middle of the village" (Taylor, Mt.Hagen Patrol,1933:112). Two days later, after crossing the Chimbu River, and moving into central Chimbu, M.J.Leahy observed that the settlements now had "no barricades (and) houses (of a) long oblong shape (were) built not in a clump but here there and anywhere (with) no provision for defence or protection from night raids" (Diary, 3 April 1933).

Four and a half years later the contrast between the two settlement forms was still striking enough for a Government officer patrolling east of the Chimbu River to note that on one day (at Dingamambuna and Arua), the "houses (were) set out like villages", on the next, as he moved west and north up the Ge-nigl river (and later the Chimbu valley), they were no longer "grouped", but, lapsing into uncharacteristic metaphor, "plastered over the mountain like stars in the milky way" (Kundiawa Station Diary, 19-20 December 1937). Similarly, at the head of the Chimbu, there were no villages, only single houses (ibid., 30 December 1937). The boundary between the two patterns has been pinpointed more exactly by Bergmann. Distinguishing 'hamlets', by which he referred to the western (or central Chimbu) pattern of three to six houses built fairly closely together (which others have described as dispersed), from 'villages', which he noted as sometimes extending several kilometres along whole ridges and including several hundred houses, Bergmann placed the boundary at about 10 km east of the Chimbu River (1971,Vol.1, 28-9; Vol.2, 1-4). "The Yongumugl (see Map 2.2) are still living in hamlets ; the Sinesine in villages" (ibid.,Vol.2,p.1). [6]

By clustered hamlets I mean then distinctive groupings of houses (a 'hamlet'), consisting of a men's house with surrounding women's houses, usually in close association with other such groupings, which were often strung along a ridge. The extreme extended forms described by Bergmann, may perhaps have been more characteristic of northern Sinasina (i.e. the Yobakogl complex in Tabari), though they are also common today in the south. A useful description of Nimai settlement in the early 1950s is given by Julius, the then Government

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[6] Puzzled by the difference, and noting that the boundary coincided with no major break in language or custom (ibid.,Vol.2,p.1), Bergmann concluded that asking the people drew forth only the reply "our father and grandfathers lived that way and we do the same" (ibid.,2). He noted however that (?)Kamanuku linked their dispersed pattern to the health of their pigs, arguing that it minimised the opportunities for witches to harm pigs (and people), and reduced the chances of pigs eating human faeces (? presumably of persons other than their owners), and mentrual blood, both of which they said caused pigs to lose weight, sicken, and die (ibid.,2-3).

Anthropologist, who visited

> "thirty-five of these hamlets (all in three clans of the Numai group) and the pattern was the same, with little variation in size, in all of them....(p.2) (They were) small (practically never with populations more than forty-five), usually consisting of one or two men's houses, associated with a few houses for wives and other female relatives (p.1)....(They were) not scattered. In most cases, one has a group of about five or six hamlets in a comparatively small area and to visit a number of hamlets in a rather short time is easy" (Julius n.d.:2).

In the 1930s, then, the Nimai were settled at a number of sites in the higher, southern, part of their territory, and it is said that warfare with the Tabari and Dinga had driven them to abandon lower altitudes to the north. Some of the more important of the southern sites are shown on Map 5.1. Supporting evidence comes from the information on the burial sites of 26 grandfathers and 32 fathers of present (1972) adult Waula men. Of the earlier generation, 7 each were buried at the major sites of Kenama (at 2000 m) and Gairema (2400 m) (Map 5.1), and 11 on the ridges south and south-west of Koge.[7] Only one was reported as buried outside Nimai territory, just to the north-east near Yobakogl in Tabari territory. While some continuity with this distribution is shown by the younger generation of fathers, eight of whom were buried on the Kumangol-Paraul and Igin - Gilinil ridges south of Koge, one at Kenama, and eight at Gairema, several interesting changes are evident. Four others, for instance, were buried at considerably higher points on the Kenama and Moregabil ridges, and one even higher at Malgana. Two were buried above Iremil.

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[7] Four at Kolai and Mugaletaiyre at c.1860 m (Map 5.1B), three a little higher at Paraul and Kumangol at c.1950 and 2000 m (Map 5.1) and four at Gilinil and Igin (Map 6.1) at c.2000 m.

But the major change, confirming the accounts of serious defeats in the late 1920s and early 1930s is found in the burial of no less than eight men of this generation outside Nimai territory : one each in Dinga and Tabari, and six to the south (two each in Dom and Gunangi territories, and two among groups south of the Wahgi).

Early colonial penetration 1933-45

"Pacification" during the late 1930s set in train processes with immediate and continuing effects on Nimai and Sinasina settlement. Prior to the first census in 1940, a rest house was temporarily established, not, significantly, at Koge, but nearly 2 km to the southwest at Kuguruma (Downs,PR,28 March-9 April, 1940 Diary), at almost 2000 m (Maps 5.1, 5.1A). Within a few months, however, Downs established a "Government Pig Farm" on the site of the present Koge village (Map 5.1B). This was one of three such 'farms', [8] or, more strictly,'pounds', set up in Chimbu by Downs during 1940, in order to

> "...impound the hundreds of pigs that were seized in a very successful means of stopping tribal fighting after most other sanctions had failed. We had the co-operation of unarmed groups of around 1000 (men) who accompanied a patrol for this purpose. Instead of chasing people we collected pigs which was more dignified, less dangerous in terms of violent confrontations etc. We used to coral the pigs and then negotiate for the delivery of fight leaders or murderers for which we had a warrant to arrest. Breeding sows were returned to the extent of 50 per cent of those taken. All else were removed to a distant "pig farm".... We then used imported Berkshire boars to improve

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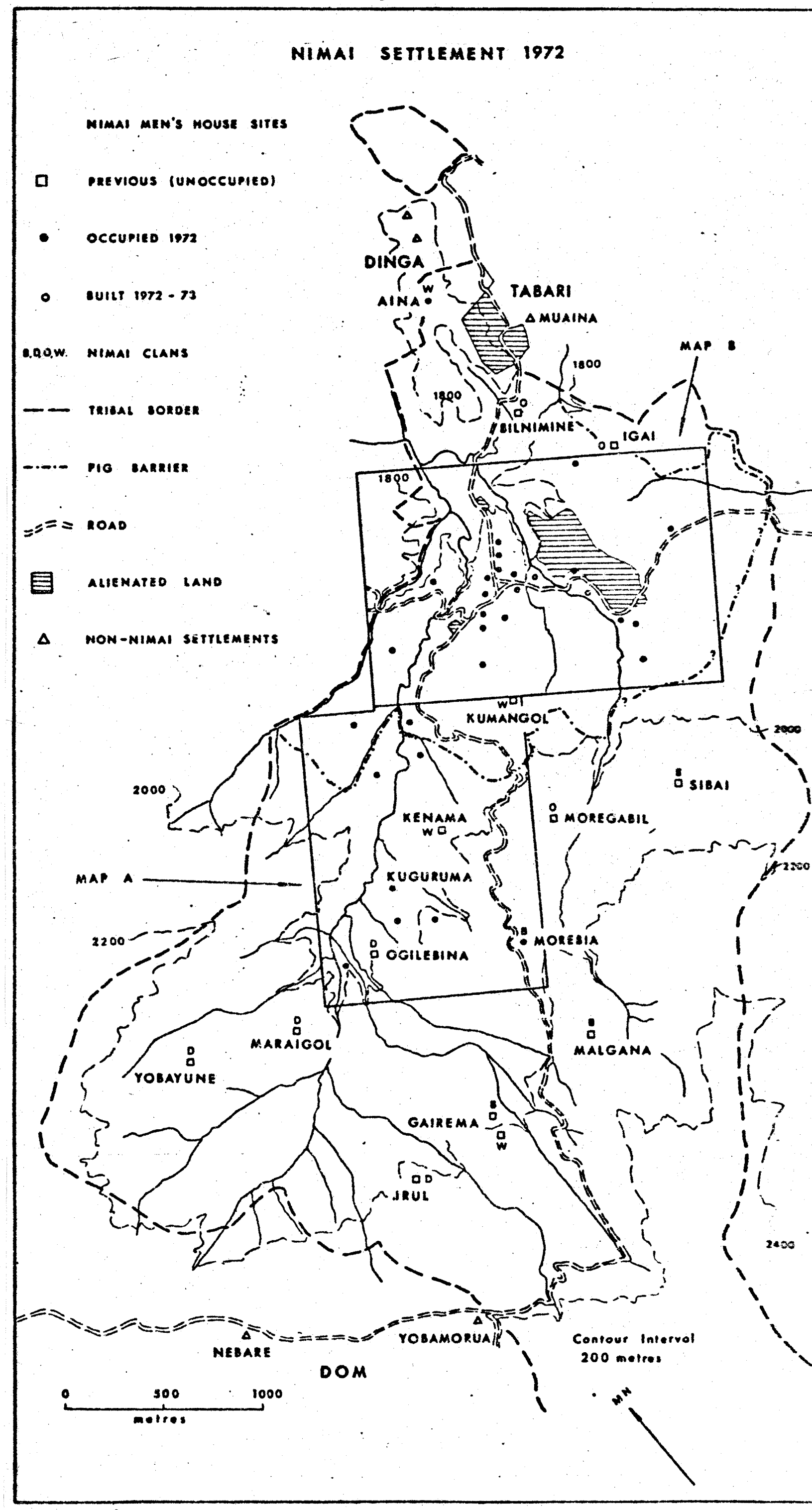
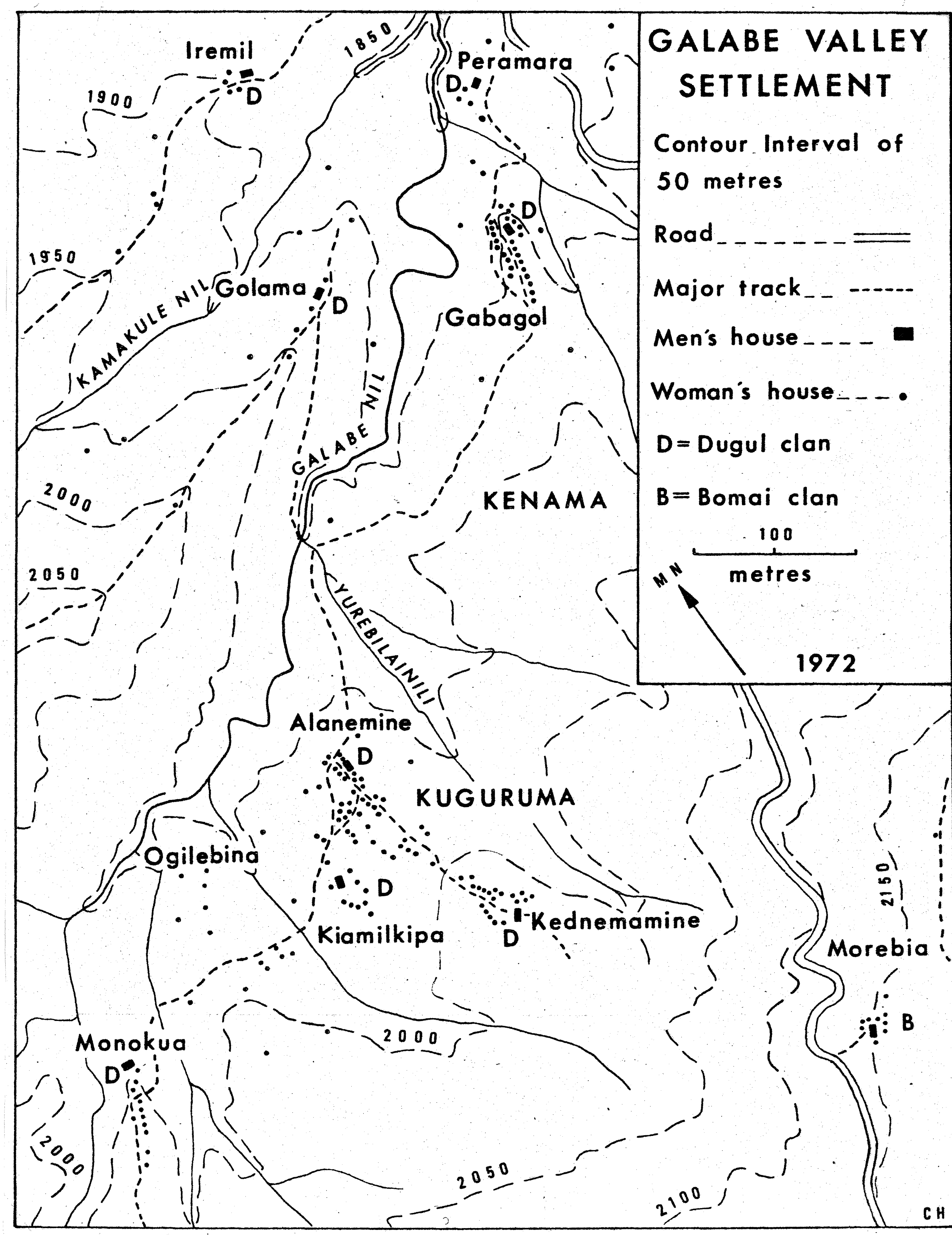
[8] In describing the number as three, Downs is probably including animals kept at such police-staffed base camps as Chuave and Awagl, since his reports at the time mention only Koge as a "farm" (Downs,MR December 1939,p.3; MR October 1940,p.2 and PR 23 September-17 October, 1940,p.6).

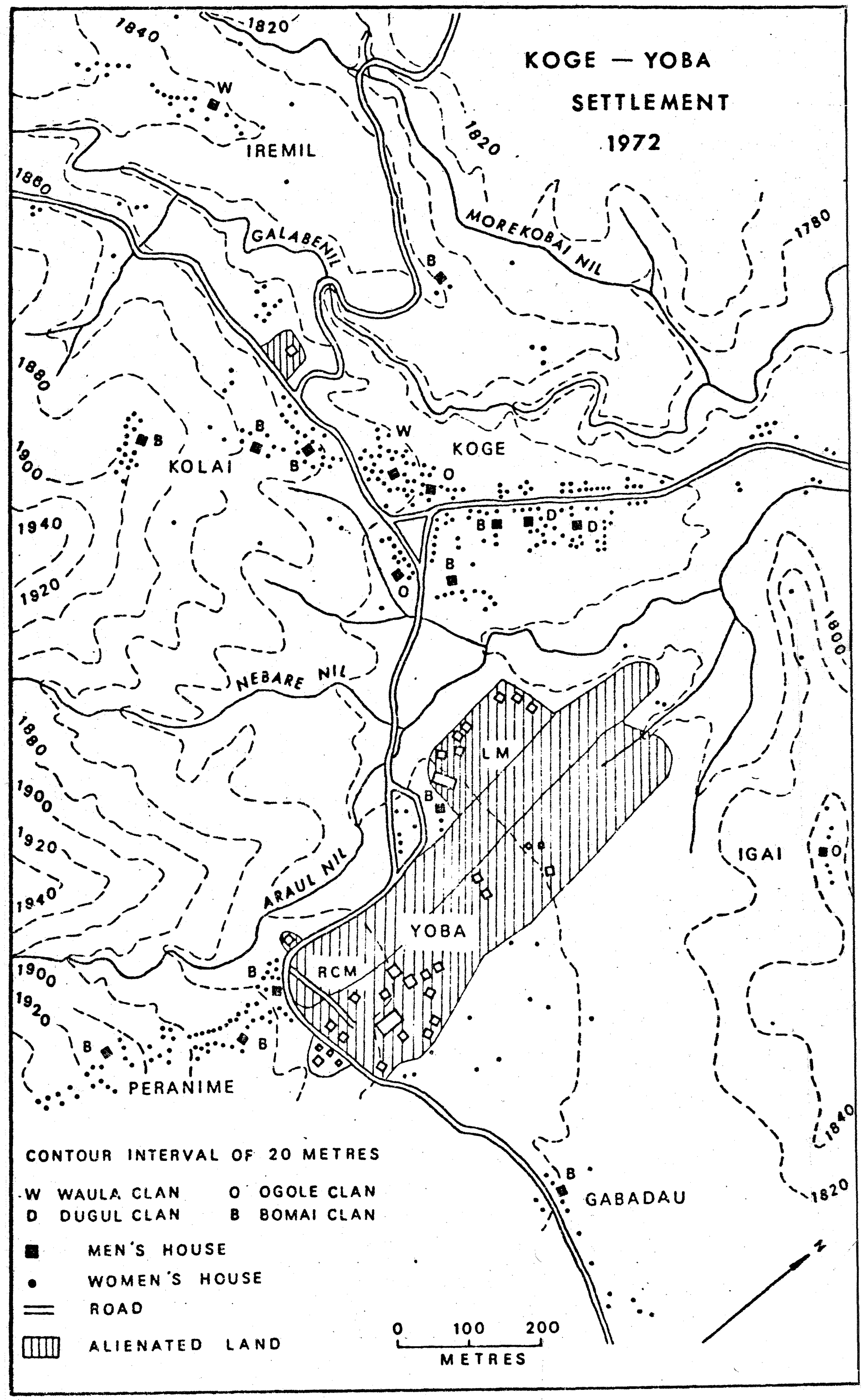


Map 5.1 Major Nimai settlement sites

(for insets, see Maps 5.1A and B)



Map 5.1A Nimai settlement in the Galabe valley (see Map 5.1, Box A)



Map 5.1 B <u>Nimai settlement in the Koge-Yoba area</u>

(see Map 5.1, Box B)

the breed. As the government was too hard up to provide adequate trade goods, money or even food, and air services rather far apart, we also found the pig impounding sanction was a means of financing the government in the area, i.e. we became the largest owners of livestock and could trade back for labour and food.... The pig thing worked because it struck at the social status of a group, completely stood all marriage contract payments on end and was a disaster for any group. We only had to do it three times. After that, everyone else quietened down" (Pers.comm., 18 April 1973).

As a 'Farm', Koge was in the hands of either a resident policeman or interpreter, supported by a few local employees. Aulakua Wemin, an interpreter from the neighbouring Dom at Kagul, who was in charge in the early 1940s, remembers how

"I looked after the pigs at Koge, and, like a kiap, looked after Koge too....When I was there, everyone lived at Kuguruma, Gairema and Sibai (Map 5.1), all those places where they used to celebrate their pig festivals, thats where they were. There was no one at Koge except me....Siba, of Ogole clan, he was at Yoba Peranime near the present mission....My house was on the site of the present market and further down where there's coffee now, we had an enclosure for all the large pigs. We made another enclosure at Yoba for the smaller ones ; it was a large one, which we divided in two, one half for the sows and the other for the boars. When the kiaps at Kundiawa wanted a pig for slaughter, we sent them a big one and they'd kill and eat it. The small ones remained at Koge, were looked after and fed by such men as Omun of Nimai Bomai, Taiya of Nimai Waula, and Tabare Gul and Bulage Aregawa. They stayed at Yoba and the whitemen came and asked them what pay they'ld like - an axe, or a kina, or salt - they'ld get what they wanted and look after the pigs until they were big, then send them to Kundiawa for slaughter. Sometimes the kiaps would tell us to kill and eat one at Koge...." (C/RH/72.4A).

Thus in 1940, Koge became a minor Government central place. A rest house was built,[9] replacing the earlier one at Kuguruma, and, with its resident official it served as a minor base from which

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[9] It was used by a patrol in September 1941 (Warner Shand,PR M.10,1941/42,p.1). The buildings and enclosures are visible in 1943 airphotos.

pacification patrols operated. The neatly marked tracks radiating out from the site, so evident in 1943 airphotos were not simply, however, the result of orders from Kundiawa. As early as 1940, Downs noted how the Dinga, and the Tabari Sine from the Yobakogl area, had suggested to him that the main Kundiawa-Goroka track be re-routed through their territories and thus also through Koge, instead of the alternative route through Yongamugl, Womai, Dumun and Masul to the north. Indeed, without waiting for his instructions they had "developed the secondary bridle track that goes through (their territory)...in a remarkable manner". It was not, however, "a very direct route", and Downs planned a route further to the north (Downs,PR 28 March-9 April 1940,p.3). Nevertheless Koge remained a strategic site due to its cross-roads location at the point where the track from Dumun in the north (on the main Kundiawa-Goroka route) cut the Dinga-Tabari secondary track, and from which a further one climbed southwards over the Suai-Wone ridge to the Gunangi and Dom.

To this site, where previously "only kunai grass had grown, there weren't even small trees there but when Aulakua went to Koge they planted trees and they've grown now (Kum Taul of Dom Digakane, Kagul), some Nimai soon began to move. By February 1945, 93 persons (probably of Dugul clan) were recorded as residents at Koge (Dennis,CPR 6,1944/45,p.3). The nearby sites of Kolai and Yoba had populations of 100 and 92 respectively. Moving south and uphill, Sibai had 192, Kenama 155 and the two settlements at Kuguruma 177 and 150 each. If these figures are approximately accurate, some 285 Nimai, or 30 per cent of the total population, were living within 400 metres of Koge and below c.1900 m. The remaining 674 (70 per cent) were more than 1 km away, and all over 1950 m.

Mission influences 1946-53

Following World War II the importance of Koge changed rapidly. No longer a Government 'Pig Farm', but still the site of the Nimai Rest House, it now also became a centre for both Lutheran and, in particular, Catholic activity.

The former mission arrived first and, by 1947, was established at its present location between the old Yoba airstrip and Koge (Map 5.1B). This was only one of at least five other similar stations (two in Tabari, and one each in Dinga, Kere, and Dom), established in Sinasina at about this time by the Lutherans. Although all were under the direction of the central Lutheran station at Kundiawa, none had resident European missionaries and day-to-day leadership was in the hands of Finschafen pastors and Chimbu or Sinasina converts. Following government intervention in 1952/53, the Koge station remained modest. By 1972, only the incomplete structure of a new iron-roofed church, and the somewhat larger than usual (for Koge) dwelling-houses, served to distinguish it from non-mission Nimai settlement (Map 5.1B). Thus, for the Lutherans, Koge was, and remained, only a centre for its Nimai congregation.

In contrast, the Catholic station, first established in late 1947 by Father Joseph Kuppers [10] and seven catechists, was, and remained, the head station for Catholic activity in Sinasina. A possible site, at Peramara just to the west of Koge, had been surveyed by Father C.Morschheuser in 1934 but pre-war plans of expansion had been curtailed by government restriction following the deaths of Morschheuser and Brother Eugene in the Chimbu valley. Kuppers settled first at this site (later to be occupied, from the mid 1960s until 1974, by one of a chain of Collins and Leahy trade-stores), but soon moved his station just to the east of Koge at Yoba on completion of the airstrip in 1949-50. [11] The Catholic station has always been headed by a European priest, and, until decentralization moves were initiated after 1969 (Knight 1971), it grew steadily in terms of the number of its resident staff, the number and permanence of its buildings, and the diversity of its concerns (including, at various times, a farm, bakery, wholesale and retail stores, gasoline pump, hospital, primary school, and, in 1972, a Vocational School). Its large church is the centre of Sinasina - wide Catholic ceremonials,

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[10] A German priest who had worked at Mingende from 1936 until detainment in early 1943. According to Waula, the station was the result of a deputation of six men (five Nimai Waula and one Dinga Siba), who journeyed to Mingende to request a station at Koge. Fr.Kuppers recalls only that he acted under his Bishop's instructions (pers.comm. 1973; unless otherwise indicated, all subsequent information from Kuppers relates to correspondence and conversations with him in 1973).

[11] Built, in his words, with two spades by 1000 men and women in 10 days. Construction was jeopardized by the outbreak of a major intra-Nimai fight, in which 80 were injured. It was the last such fight until c.1962.

regularly drawing large weekly congregations from throughout northern Sinasina (and also to a lesser extent, the south), and, on Church festival days, huge ones from the whole region.

By 1950, then, the two missions were established on adjoining areas of land, between 1800 and 1840 m, [12] just to the west of the pre-War central place of Koge. What effects did these institutions have on Nimai settlement? According to Hatanaka,

> "Villages composed of strings of hanlets were established by Lutheran missionaries after 1940, particularly in the parishes of Emai, Du, Mu, and Yondumo. In these areas the Dinga, Kere and Tabare built large villages, and converts and intending converts left their clan's territory to live in these mission stations. All buildings and gardens at those stations were fenced off. The inhabitants broke off most ties with their clans and tribal brethren, and became a separate community....The Tabare-Sine clan had only eight square miles of arable land, and at least half of this was fenced off as a station in about 1950...." (1972:9).

Besides obscuring the extent of pre-colonial nucleation (as argued above), this view also, I suggest, exaggerates the direct influence of the Lutherans. There is no argument that Lutheran evangelists did establish 'mission' settlements, as they did in other parts of the highlands (Waddell 1972:27-8; Westermann 1968:91), nor that intending converts were supposed to live in them, at least temporarily. What is at issue is the weight to be placed on these facts. The sources of Hatanaka's statements are presumably (no references are given), two reports of late 1951 and early 1952 (Kelaart, CPR 2,1951/52,p.14-15; McBride, Special Report - Missions,1952), in which the mission

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[12] Previously much fought over, and, since much of it was swampy and undrained, mostly used for pig-grazing.

villages were first described (in critical terms), and given a preliminary investigation. Although aware of Government-Mission conflict (ibid.,31-2) Hatanaka accepts the evidence of these reports apparently without question. However, Julius, (the then Government anthropologist), after a two-week investigation of the Sinasina Lutheran settlements later in 1952, reported that converts did not take up permanent residence in them (n.d.,13 ; all subsequent page numbers refer to this report), that most settlement residents continued to make their gardens on their usual lands (15,17,20-1), that interaction with non-Lutherans continued (8-9), and that Kelaart's figure of four square miles for the 'station' fenced off by the Tabare-Sine converts was incorrect (17).

Although correcting Kelaart's exaggerations, Julius was nevertheless sharply critical of the intentions, methods, and practice of Lutheran (and, to a lesser extent, Catholic) evangelization. He examined five settlements (at Koge, Emai, Du, Mu, and Iopaikua - presumably Yobakogl), and concluded, on the basis of a comparison with the non-Lutheran settlements among the Nimai, that the former did represent a significant departure from the local pattern both in size and style of living (2). The Koge settlement, for instance, (on the present Lutheran site between Koge and Yoba, Map5.1B), covered approximately 4 ha, and included 37 houses, two of which were occupied by evangelists with the remaining 35 holding a total of 148 persons (14-16). Closely reflecting the fact that the settlement was sited on land belonging to the Bomai and Ogole clans, 52.7 per cent of the inhabitants belonged to the former clan, 29.7 per cent to the latter, with the remainder coming from Dugul and Waula clans (8 and 2 persons respectively), and from the Kere and Dinga tribes (9 and 7 persons).[13] In contrast, the populations of the non-mission hamlets (as described above, p.212), rarely exceeded 45, occupying one or two mens' houses with an associated cluster of womens' houses. Although individually small, a group of five or six of such hamlets were usually located within a comparatively small area. As regards settlement size then, Julius was clearly comparing the mission settlements with a single hamlet, not the latter clusters. As regards style of living (over and above the obvious differences of religious teaching and church activities), he noted in particular that the Mission settlements lacked men's houses and that residents were living in "individual family dwellings" (13) [14] Julius concluded that "<u>the tendency of the settlements is to turn the people away from the hamlet idea to that of larger village groupings</u>" (22, emphasis in original). Although accepting that residence in the settlements was not permanent, he considered that "the pattern is being established". The settlements

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[13] In response to his inquiries of Bomai members as to why they had moved into the settlement from hamlets which lay within 15-20 minutes walking distance, Julius was told : "they could not 'hear' the Mission's talk properly if they stayed in their hamlets" (15). Similar answers were given at other mission settlements.

[14] His comment that "one of the more serious features of the settlements is that the people are for some time removed from the type of life to which they have been accustomed and are segregated from the general running of affairs in their own communities" (13), when seen in the contemporary context of Government actively supporting the removal of c.20 per cent of adult men for periods of 12-18 months indentured labour, points to the constraints limiting the perspective of a government anthropologist.

were detrimental, he argued, in that they increased house-to-garden distances, they resulted in increased numbers of persons living on land to which they did not hold sub-clan rights, and, in that they temporarily segregated converts from non-Lutherans, they expressed a contempt for outsiders (22). On the grounds that the Administration had an interest and concern in the people's disposal of their land, and since it was likely that the settlements would grow, he recommended action to discourage them.

Such action was soon forthcoming, at least in the case of the Nimai. Three months after Julius' visit, the Nimai Lutheran settlement was again visited by a Government officer. His description suggests the number of houses had increased, though in a smaller area.[15] It was, he wrote, on "...about a third of an acre...adjacent to the Koge airstrip, and a huge church, together with 7 houses for mission personnel, and 52 more houses for local natives resident there, are jammed together so close as to exclude the light of day from entering the residences" (Hayes, CPR 5,1952-53). Citing their insanitary condition and state of disrepair, and considering them to represent "an extremely dangerous fire risk, particularly undesirable on account of the proximity of the settlement to the airstrip", Hayes invoked Section 112 B of the NAR and, presumably, ordered their clearance.

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[15] Julius' figure of 4 ha is, however, ambiguous. It may refer to the whole enclosed area rather than that occupied by buildings. Elsewhere he contrasted the "fairly good" standards of housing and settlement plan at Mu and Emai, with those at Koge and Iopaikau where houses were "crowded together in a very small area" and some were definitely inferior to those in the non-mission hamlets (13).

Settlement trends 1953-64

Despite such active intervention by the Government against the new Lutheran settlements, changes in the overall pattern of Nimai settlement continued after 1952. Although detailed information is lacking from 1953 until the late 1960s, airphotos (1955, 1966, 1971), partial information on trends in land use, council records, and discussion with some of the people involved, allow a reasonable description of the extent of re-arrangement and a tentative analysis of some of the major factors.

The most obvious change was a steady downhill, and hence northward, movement of settlement. The general extent of this trend is clear from a rough comparison of the numbers of settlement sites located in the northern and southern parts of Nimai territory in 1951 and 1972. Information on the distribution of the Nimai population over 17 named sites at the earlier date comes from an unusually detailed census summarized in Table 5.1. Although this material has some problems, the general pattern is unambiguous, and, I believe, reliable. Of the sites listed, only three (Kolai, Yoba, and Igai) lie to the north of the division between Inset Maps B and A on Map 5.1 (i.e. in, or to the north of, Map 5.1 B). These were occupied by 281 persons, or 19 per cent of the (located) Nimai total of 1447. All other sites, with a total population of 1166 were located further south, and above c.1950 metres. Although population numbers are not available for all the settlement sites occupied in 1972 (for locations of men's houses see Map 5.1) an approximate comparison is possible by assuming that each of the 1951 subclan hamlets (i.e.Table 5.1, column 3)

TABLE 5.1 Nimai hamlet locations and populations, September 1951[1]

Clan	Subclan	Hamlet[2]	Population
Bomai	Omunkamen	Malgana	148
	Naurugau	Sibai	122
	Tinebia	Sibai	55
	Kwikane	Gairema	25
		Kolai	100
	Wabebai	Ogukul	85
		Subtotal Bomai	586
Dugul	Tobma	Komine	115
		Biasiba	49
		(Unrecorded?)	118?[3]
	Tsil	Morenil	46
		Ogilebina	78
	Dugul	Kumankane	100
		Ulungwi	68
		Iabile	45
		Subtotal Dugul	620
Waula	Gunakane	Kenama	118
	Golunkane	Kolai	57
	Ywikane	Kumangol	60
		Subtotal Waula	235
Ogole	Garenbia	Igai	39
	Barikane	Yoba	35
	Yaumapala	Yoba	51
		Subtotal Ogole	125
	Total		1566

(1) Source, Kelaart (CPR 2,1951/52,Appendix A,p.2). I have excluded the small 'clan' of Numaikirine (population 155) which Kelaart censused with Nimai. In all later censuses they appear with Dinga.

(2) Spellings adjusted from original,i.e.Malgana = Magane, Sibai = Supai, Kumangol = Mangolete.

(3) Kelaart gave Tobma a total of 282 but listed only the two hamlets of Komine and Biasiba. The Dugul subtotal of 620 is his.

represents a men's house.[16] According to this measure, 5, or 25 per cent, of the 1951 men's houses were located in the north and 75 per cent in the south. In 1972, the proportions were almost reversed with 19 (68 per cent) of 28 men's houses in the lower altitude area of the north, and only 9 in the south.

I describe this movement as a trend. It consists of the relocation of individual men's houses (or establishment of new ones), and their associated women's houses. What Julius feared did not occur : the Lutheran innovation of family houses without a men's house centre did not survive the mission settlement of the early 1950s.[17] As far as I am aware no men's house has been established or relocated against this trend (i.e. in a southward, uphill direction), at least since the early 1960s.[18] Although the precise dating of each such move was not possible, various sources show the trend continuing into the early

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[16] This is obviously a crude measure since we know from Julius that the 35 Nimai 'hamlets', belonging to 3 clans, which he visited 8 months after Kelaart's census, rarely had populations of more than 45. Each hamlet had one or two men's houses (Julius nd.,1-2). A more refined analysis using an average men's house size would not greatly alter, however, the pattern distinguished here.

[17] There is a 1955 report of an interesting dispute at Du (in Kere) between the Lutheran and non-Lutheran members of a men's house. The former were living with their wives in separate houses, and the non-Lutherans wanted to take over the men's house (? or the land on which it stood). "The argument became heated and at one stage the natives wanted to cut the house in two, also the whole house-line, including gardens....In other parts of Sinasina there are small Lutheran settlements which are separate from the old house-lines" (Haywood, CPR 11, 1954/55).

[18] One minor exception occurred in 1972-73 when a small new Waula men's house, with members from the hamlet in Koge, was built 200 metres in a southerly, upslope, direction across the road.

1970s. In many, perhaps most, cases, moves were made immediately preceding a pig festival, a customary time for rebuilding houses.

As Nimai settlement has moved downslope and northward, so too has it tended to become more clustered. By 1972, the central and largest cluster was the Koge-Kolai complex which included 10 men's houses from all four Nimai clans and extended some 800 metres from south to north (Map 5.1 B). The Peranime-Yoba cluster of the Bomai clan around the two Mission stations was almost part of a continuous settlement joined to Koge, especially after the establishment, during 1972-73, of two new men's houses, one between the Araul river and the road bordering the Catholic Mission, and the other between Koge and Yoba beside the Nebare stream. A further cluster was developing to the west of Koge, made up of two men's houses (one Waula, the other Dugul) on the Iremil ridge, and the three Dugul sites at Peramara, Gabagol and Golama. While the other, higher, Dugul cluster at Kuguruma continued, it had lost members to sites lower down the Galabe river (i.e.Gabagol).

The emergence of Koge as the central Nimai settlement, is, at least in retrospect, relatively unproblematic. As described earlier, it became the site of new Government functions within Nimai in 1940 and some of these continued following the war. The significance of the general Koge-Yoba area as the centre of new activities and influences was reinforced by the establishment of the two Mission stations. Besides providing outlets for some local produce and labour, these also provided the only available educational facilities until the early

1960s.[19] In 1951, there were approximately 40 students, including some non-Nimai, at the Catholic school at Koge, where, under two untrained New Guinean teachers they laboured at "elements of reading, writing, and arithmetic and a lot of religion" (Kelaart, CPR 2, 1951/52,p.12; cf. Julius nd.). Considerably larger numbers of children, for instance 156 Nimai in 1954 (Colman, CPR 4,1954/55,p.7), attended what were probably pre-baptismal classes only. By 1958, however, the central Mission schools (i.e. Koge for the Catholics, Mu for the Lutherans) had been improved to meet government requirements. By 1964, the Koge Catholic school had 301 pupils (not all Nimai) enrolled to Standard 4, and was already forwarding the occasional primary student to more advanced schools elsewhere. The Koge Lutheran school remained small, with only 70 students up to Standard 1. Thus in the decade 1953-1962 the existence of two primary schools at Koge-Yoba, soon to be followed by a third (Government) one at Muaina, only 1 km to the north, offered a major attractive force to residence in the lower half of Nimai territory.

During the same decade, moreover, coffee was introduced and increasingly planted by Nimai in the same 1800-1900 m altitude zone (pp.46-7 ,285-90). After an apparently slow start, some 50 per cent of adult men were estimated to be growing the crop by 1962 (Shand 1966:70).

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[19] The Administration established a school at Kundiawa in 1937 which one Nimai Waula member attended briefly before employment as an interpreter before the War. This was closed from the early 1940s until the early 1950s. At least two Nimai, including one member of Waula, attended this school after it had been re-opened. Government primary schools were not established in Sinasina until the early 1960s.

Extrapolation of tree censuses would suggest that by 1965 approximately 50,000 trees had been planted in Nimai, which, given a planting density of 2700 trees/ha (p.286), would have occupied some 18.5 ha. The immediate consequences for land and labour cannot have been great. With the Nimai population numbering 1954 in 1965, average per capita holdings would only have been 0.0095 ha; those of households (assuming an average of 4 persons) only 0.0379. These are roughly a third of 1972 sizes. Extrapolation from estimates of labour requirements of the latter (Chapter 7), would suggest that the average household coffee holding in 1965 needed only about one and a half hours labour per week annually. However while this calculation is useful for a general perspective it is obviously an underestimate. In the first place not all men had planted coffee, and thus the holdings of those who had were larger than these averages. Secondly, coffee was mainly planted on land falling in an altitude zone with which Nimai are relatively poorly endowed. Finally, the labour requirements of coffee are highly seasonal with the four flush months probably absorbing some 60-70 per cent of the crop's annual total (Chapters 6,7). In short, then, the emergence of a coffee 'zone' in Nimai territory was an additional factor in the settlement re-arrangements of this decade.

In summary, between 1953 and 1964 there was a downslope movement of Nimai population which resulted in a closer concentration of settlement sites in the lower, northern, part of Nimai territory around the major central complex of Koge-Yoba where most significant modern facilities were located. Further presssure on this part of Nimai territory was exerted by the simultaneous expansion of coffee plantings within the same zone. These trends, well advanced by the mid 1960s (as evidenced by 1966 air photos and observed in 1967), continued into the early 1970s. They took place, not in isolation, but in conjunction with the continuation of the older cycle of contraction and expansion of land use for rootcrop agriculture and pig husbandry. Pig festivals were celebrated in c.1954, in 1961, and in 1969. It is not, perhaps, fortuitous that following a major intra-Nimai clash in c.1950 (p.220), the next serious inter-clan fight occurred in 1961-62,[20] in other words at the peak of, or just following, a cycle of internal productive expansion, and following a decade of considerable spatial and social rearrangement.

Settlement, enclosure and the Council 1965-73

That the trends described in the previous section had reached levels at which their combined consequences were of perceived concern is suggested by the alacrity with which the newly established Sinasina Council attempted to lay down rules controlling the movements of the two most mobile elements of the system, people and pigs. The first council was elected in August-September 1965, following more than a year of preparatory patrols and propaganda, and the first permanent posting of an officer to Sinasina (Chapter 2). After a 'trial' year, elections for a second council were held in August-September 1966 at which most (27 or 28 of 36) of the first set of

[20] In which the major combatants were Dugul and Waula and the proximate cause alleged adultery by a Waula man with a Dugul wife. Ogole fought as allies with Waula and suffered the only death. The next serious clash occurred in 1973/74.

councillors were re-elected. Two rules passed in 1966-67 are of particular interest in this context.

It will be recalled that in central Chimbu the Naregu fencing system 'broke down' in 1963 (p. 207). Although direct evidence on the situation in Sinasina at this date is lacking, it seems that by 1965 similar pressure by pigs on cultivation and other land uses was felt both in Sinasina and in Chuave-Elimbari, the neighbouring council area to the east.[21] In the latter area,[22] councillors 'unofficially' decided that villagers should enclose their pigs, and fences utilizing natural boundaries where possible, were built. In some cases neighbouring villages shared the task, establishing joint enclosures. Pigs outside these enclosures apparently could be killed on sight, though to what extent this occurred is not known. In Sinasina, soon after its first election, the council discussed possible rules for minimising damage caused by pigs after a councillor had suggested the enclosure of pigs.[23] Factors discussed by

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[21] I do not mean to imply that pigs did not previously pose a hazard to gardens. In August 1952, for instance, Hayes reported that "(h)undreds of complaints of trespass by pigs were brought before me for settlement..." (CPR 5,1952/53,p.13). Much earlier Downs had had new government roads fenced against pigs (Downs,MR May 1940,p.1)

[22] For much information in this and subsequent paragraphs concerning the period 1965-67, I am indebted to the then council advisor, Fred Parker (pers.comm.,30 October 1968).

[23] Was he influenced by knowledge of actions in Chuave-Elimbari, or possibly by the example of the council advisor (Parker), who was also the sole government officer stationed in Sinasina ? Almost a year earlier, just after taking up residence at Koge, Parker recorded that he was advising the inhabitants of Koge to remove fencing between houses (CPR 9,1964/65,p.3). In a pers.comm.,(30 Oct.,1968) he notes that : "I had been enforcing the removal of all fences around individual houses in villages, leaving only one around (continued over page)

councillors included :

1. the large labour input required to fence cultivated land,
2. the lack of suitable fencing timber in some areas.
3. the inequity of the fact that while only some had large numbers of pigs, all had to fence their gardens.
4. the lack of hygiene when pigs shared human settlements, and
5. the protection of schools, aid posts, roads and other new institutions.

Although there was general agreement that some action was necessary, opposition to enclosures was voiced by two groups who claimed to be short either of timber (Tabari at Yobakogl), or land (probably the Nimai). Two alternatives were suggested : that each clan should make a large permanent pig enclosure (i.e. the Elimbari solution), or that each pig-owner should be responsible for the enclosure of his pigs. By advocating the enclosure of pigs, both suggestions broke with the usual Sinasina practice of enclosing gardens against pigs, which were allowed free run of the unenclosed fallow, as in central Chimbu. Although individual responsibility on the part of pig owners was favoured by the council advisor, he drafted a rule enabling the council to allocate an area in each ward as 'pig land'. However, neither suggestion, when forwarded to higher authorities, was considered permissible : group enclosures on the grounds that "no rules could be allowed which compelled a pig-owner

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[23] (Continued from previous page) the village. Prior to that each village area was laced with small and large fences, usually between all the houses".

to put his pigs on another individual's land, [24] and because the Department of Agriculture considered the risk of disease too great, and individual enclosures because it was not "policy to pass rules compelling a person to fence his pigs". [25] Unable to legally enforce pig enclosure, the council therefore ruled that the owner of a pig which trespassed on either private or public property was guilty of an offence, and where damage was done, liable for compensation (Pig Trespass Rule, No.2 of 1966, Sinasina LGC).

Such government restriction upon council initiative or action was by no means unique to Sinasina. Salisbury, for instance, has discussed how government authorities, while encouraging councils to take responsibility and act, at the same time advised caution when councillors wished to make rules to produce action (1964a : 232-236). But in Sinasina, unlike the Gazelle peninsular where initial enthusiasm was replaced by frustration in the face of such apparently paradoxical authority (ibid.,243), some councillors, despite, and in some cases prior to, the official veto, proceeded to establish communal pig enclosures. [26] Without waiting for an official decision some Sinasina areas began to construct large pig enclosures soon after the

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[24] Letter, 24 December 1965, District Commissioner to Sinasina Council Advisor; File 42-3-3, District Office, Kundiawa.

[25] Letter, 3 March 1966, Regional LGC Officer to Sinasina Council Advisor; File 42-3-3, District Office, Kundiawa.

[26] Similarly councillors among the neighbouring Yongamugl at times over-reached their legal powers. In 1967, four were charged with having illegally imposed fines on people who had failed to clean their houses (Sydney Telegraph, 23 November 1967).

initial council discussions. Upon completion, fences around settlements, and some areas of cultivation, disappeared or at least diminished. As Salisbury has noted, ambitious public works were often undertaken in the first flush of council establishment (ibid.,232), and this autonomous action in Sinasina appears to have been carried out on just such an initial wave of enthusiasm. According to Parker,

> "So the Rule was passed and the fun began. Some areas had already begun their big fence (Masul, Dumun, Igindi) and then as these were completed all fences were wiped around villages and later gardens....The whole thing was pushed very hard by the Councillors - this was their first exertion of authority and it was all their idea. There were numerous arbitrations in siting fences, [27] damages to gardens in the pig areas etc."(Pers. comm. 30 October 1968; cf. Hughes 1966: 64-66, who notes the start of such action among the Kere).

In early 1968, when I first visited Sinasina, members of both the Nimai and the neighbouring Dinga believed that the council had passed a rule enforcing clan pig enclosures (referred to in pidgin english as kemp pik), of which there were then at least three in Nimai territory. [28] They were enclosed by fencing, with ditching in some

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[27] At the February 1967 council meeting, for instance, the Nimai Bomai councillor complained that "ol man insait long Koge wokim tupela banis pig na koros" (the people at Koge are making two enclosures and disputing), according to the Minutes. Although the record is ambiguous, it seems that a vote was taken approving two enclosures. The Vice-President, at least, commented that if people disapproved it was permissible for individuals/small groups ("ol wan-wan man") to make their own enclosures.

[28] One at Kuai on the northern border, one on the northward-facing flank of Igai ridge to the north-east of Koge, another at Igin on the slopes to the south of Koge. I believe there were also others at higher altitudes to the south, used by members of Bomai and Dugul clans. Kuai was used primarily by members of Waula and Bomai, Igai by Ogole, and Igin by Bomai.

cases, and the skilful use of topographic barriers. Each pig-owner was said to be responsible for the maintenance of a certain length of fence or barrier,though pigs were free to move anywhere within the enclosures. The only pigs observed outside were either piglets in the company of their owners, or larger animals carefully tethered in abandoned gardens. Cultivation below c.1980 metres was by then generally unfenced, though at higher altitudes fencing appeared to have been retained. The construction of these enclosures was probably carried out in 1966.

Just as Sinasina councillors attempted to control the mobility of pigs, so too did they seek to limit the mobility of people. Initially they attempted, though without immediate success, to encourage the formation of villages, contrasting the old way of life with the new era they were entering. Councils in other parts of Chimbu (Waiye-Digibe in 1964, Mt. Wilhelm in 1966) with apparently similar intentions, had previously proposed rules for such a purpose but these had been rejected.[29] But in 1967, much to the surprise of officials in Chimbu, a similar rule prepared by the Sinasina Council (after a resolution in January 1967; Sinasina LGC Minutes) was approved. The Council thereby gained the power to declare land for residential use, which, after the recording of customary rights, would be considered a village (Village Planning Rule, No.4 of 1967, Sinasina LGC). Once declared, residence outside such villages for

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[29] Note the continuity of policy with that followed in the early 1950s in relation to the Lutheran villages.

more than four days in any one month could be prohibited. When discussing the proposed rule councillors had stressed that nucleation would enable then to carry out their duties more easily (e.g. enforce hygiene, hold meetings, and mobilize labour). Since each councillor represented some 700 persons, who could, under normal Sinasina settlement conditions, be scattered over several kilometres, their reasoning has some force. However, in addition to their official duties, maintenance (and establishment) of their positions as political and quasi-judicial leaders should also be included in any consideration of their motives. Two further points should also be considered. For a period, at least, Government officers had not only made known their dislike for the Chimbu and Sinasina pratice of humans and animals sharing the same roof, but actively attempted to alter it.[30] Further, the Nimai have had, on their doorstep, a European-staffed Catholic Mission with extensive agricultural activities as an example of human-animal separation. In addition, many have worked at, or visited, coastal and highland establishments where residential nucleation and the separation of animals are readily observable characteristics.

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[30] Thus, on a wartime patrol through Dinga, Dom and the (southern ?) Kere, Jones noted tersely that "(a)ll the natives were ordered to build separate houses for their pigs" (CPR 9,1944/45,p.3). At about the same time, Winterford, in the Chimbu valley, mentioned that a new type of house had been developed and was being promoted, apparently with some success, and that "(e)very endeavour is being made to try and get the women to refrain from sleeping with their livestock" (CPR 3,1945).

By 1968, then, the Nimai as a result of participation in the Sinasina council had experimented quite radically with their settlement and enclosure patterns. Although the restrictions of the 'village' rule seem never to have been paid more than lip service (there was talk of abandoning it as early as February 1968, Sinasina LGC Minutes), those relating to pigs have been the subject of much concern. It would be misleading, however, to distinguish too clearly between the two rules since, at one level, they are inextricably linked. Together they established a dichotomy, albeit a fragile one at times, between settlements (in p.e. haus lain), including a varying amount of immediately surrounding land, and the 'kemp pig', or area(s) of free-range pig pasturage. In ideal terms, at least, a wedge had been driven between people and their pigs.

The fragility of the dichotomy established by the first attempts at clan pig enclosure was exposed to the Nimai in 1968, when, in preparation for their 1969 pig festival, members of Waula and Dugul clans decided to return their pig enclosure at Kuai and Igai to cultivation. Clearing began in April, and, by October 1968, both areas were entirely cleared and planted (Field Notes, 1968). For several Waula, adjustment to the new circumstances was facilitated by the location of their pig houses against the northern fence of the previous enclosure, now garden, at Kuai. Entrances were opened in the walls adjacent to the fence, thus allowing pigs to retain use of the buildings, while being released by day to forage in the adjoining fallow to the north which belonged to the Tabari. Following the 1969 festival, the enclosure system was rearranged : rather than separate clan enclosures, a central enclosed block of cultivation and settlement emerged (Map 5.1).

Between September 1971 and April 1973, the intricate issues of pig control were the subject of numerous discussions, both at the regional level of the council (and occasionally beyond), and at the local level of Waula clan. These are summarised chronologically in Table 5.2.

TABLE 5.2 Chronological summary of Regional (mostly council) and Local (Waula clan) discussion and action concerning pig control, September 1971-April 1973[(1)]

1.	14 Sept.1971	(R)	Council (Cl. hereafter) discusses pigs in settlements.
2.	16 Nov.1971	(R)	Cl. discusses pigs in settlements and inability of c'lors to enforce rules.
3.	24 Nov.1971	(R)	Combined Chimbu Councils Conference discusses pig rules, and resolves that all pig rules should be strongly supported/enforced.
4.	21 Dec.1971	(R/L)	Newly elected Waula c'lor initiates cl. discussion of village rule in relation to conditions at Koge.
5.	18 Jan.1972	(R)	Cl. discussion of pig rule, especially distance of pigs from settlements.
6.	20 Feb.1972	(L)	Waula c'lor tells clan members to keep pigs out of settlements, and especially to look after fences.
7.	26 March 1972	(L)	Ditto, supported by Cl.Rules Inspector, with threat of stiffer fines (up to $10 from previous $2).

(1) Sources : Sinasina LGC Minutes; Chimbu Councils Conference Agenda and Minutes; Field notes.

8.	24-26 May 1972	(L)	Combined Chimbu Councils Conference discusses pig rules.
9.	25-6 June 1972	(L)	Waula c'lor admits boundary between settlement/pig enclosure too distant from former and should be moved. Inspects boundary but no further action.
10.	19 Sept.1972	(R)	Cl. discusses non-observance of pig rule, and passes motion asking that the Kiap police the rule during his census patrol.
11.	1 & 8 Oct.1972	(L)	Waula discuss possible enclosure changes in the light of future pig festival planned for 1976-77.
12.	3 Nov.1972	(R/L)	Impending arrival of census patrol enforcing Cl. rules. Waula move pigs away from settlement areas.
13.	17 Dec.1972	(L)	Waula discuss possible enclosure changes.
14.	17 April 1973	(R)	Cl. informed by a Tabari 1 c'lor that his people were now bringing pigs into settlement area to fatten them for future festival (held in late 1974).
15.	1973-late 1975	(L)	Nimai enclosure system breaks down. In Sept.1975 pigs observed throughout main settlement area of Koge.

At the regional level of the council, discussion focused on a regular set of themes. In each case, a specific agenda item tabled by an individual councillor provided the starting point.[31] Initiating councillors were not restricted to a single part of Sinasina, but

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[31] In the minutes of council meetings these included _toktok long pik_, _toktok long lo(w) bilong pik_, _toktok long kemp bilong pik_, _Koge haus lain_, _kemp bilong pik nau man_, and _pik igo insait long haus lain_.

included representatives from Gunangi,Tabari, Nimai and Dinga. In each case councillors complained that their "people" were either bringing pigs into settlements and houses (Table 5.2; items 1,2,5, and 10), or conversely, that their people were sleeping in the pig-houses not in settlements (item 4). In short, they expressed concern that the dichotomy between pigs and people established by the earlier council rules was breaking down, and that pig damage to gardens, and to such institutional buildings as aid posts and schools was increasing (items 2,10). They therefore asked, rhetorically, whether the rules still existed (items 1,10), and if so, sought advice as to means of enforcing them, since as one councillor put it, "he had spoken to his people until his jaw ached and make no mistake, his people were serious in their obstinacy" (Sinasina LGC Minutes, 14 September 1971, p.11). Eventually, in September 1972, the council passed a resolution asking the kiap to enforce the council rule during a forthcoming census patrol.

At the local level of Waula clan, discussion, though similar, took a rather different direction as their councillor, elected in September 1971, gradually reached a compromise between the rules and on the ground realities. In the months immediately following his election he was active both in telling the council that the village rule was no longer operative at Koge, and in passing on to his ward members (at a series of quasi-monthly gatherings held at the Waula men's house in Koge),information concerning the council's rules and intentions. In the course of the latter meetings, he initially emphasised the importance of the rules, and the responsibilites of all in upholding them. By late June of 1972, however, while still insisting that pigs should be separated from people, he admitted that the pigs were too far away and consequently their health was suffering. He therefore suggested they should draw the boundary closer to the Koge settlement, and, with this intention, walked its bounds the following day. Action was deferred until the onset of the rainy season when the ground would be easier to work. Discussion resumed at the beginning of October when, immediately after the re-distribution of pork received from the Dom pig festival, a meeting was held at which the councillor addressed clan members on the size of their debt to Dom, and the need to devote themselves to producing pigs for a return gift at their own festival some four years in the future (see p.501).

Discussing husbandry methods, he suggested that healthy pigs should be kept in sties or pens since they might come to harm if left to forage freely (he had constructed pens for his own animals). On the other hand, slow growing animals should be allowed, under careful supervision, to forage freely, though they could be housed amongst the coffee trees (i.e. close to settlements). Waula and Ogole together, he concluded, should re-site the present pig-settlement boundary, bringing their section of it close to the Koge settlement. In response, another clan member suggested that they abandon Koge completely, and establish instead a new men's house at a site just over 1 km to the south at about 2000 m, where new women's houses could be built in the surrounding *Miscanthus* fallow. Koge was all very well, he thought, but the trouble was that it offered too many distractions. Women simply didn't think about pigs properly when living in the settlement. If they moved further up-hill, some could build houses in the nut pandanus groves, access to the forest would be easier, and, in the evening all the men could gather together in the new men's house. The councillor agreed, adding that the older people could stay at Koge to look after the houses and fulfil council requirements for road work, while the younger ones could take their wives and move to the 'bush'. If needed for government or council activities they could be summoned temporarily to Koge. In his view, Koge's disadvantage was that disputes too readily escalated due to the density of population. Despite exhortations (by the second speaker) to begin cutting timber for building the next day, no immediate action was taken though discussion continued over the next week or so with some favouring a move out of Koge, others preferring relocation of the pig/settlement boundary. Considerable interest was expressed in the news that neighbouring groups had uprooted the crosses placed several years previously by the Catholic Church in their ritual centres (ere more), and buried them, an act which was said to have resulted in fatter pigs. It was said that later, when the councillor had completed the tax patrol he was presently engaged on, the pig barrier would be re-sited, a special meal of rice and fish cooked and fed to the pigs, and the Waula crosses would also be buried (there were two, one at Koge, the other at Iremil).

In the event, these actions were not taken before I left in May 1973. The arrival of the census patrol in November caused a number of Waula to temporarily move their pigs further away from the settlements at Koge and Iremil. At approximately the same time, a number of men (including the proponent of a new men's house cited above) began to build houses at over 2300 m amongst the nut pandanus groves in the south, and a small group left the Koge man's house and constructed a new one some 200 m away on Kolai ridge, where, amongst other things, they could be closer to their pigs. At the last clan meeting held by the councillor, in December, consensus had still not been reached. Although the councillor agreed that men using distant pig houses could sleep in them, he warned that this should be contingent on the maintenance of peace. With the advent of self-government, and the possibility of increased fighting, he felt that the settlements should not be abandoned entirely. Alternate nights in settlements and at dispersed pig houses, he suggested, might be a good idea. For all official purposes, however, he stressed that the only Nimai settlement was that at Koge. Those at Kuguruma, Gairema, Igai, or Iremil, for instance, should not be treated as settlements (and hence liable for inspection in accordance with council rules ?). In discussion which followed, it was apparent that there was a division of opinion between Waula living at Iremil and those based on Koge. While some of the former felt that there was no need to relocate the pig boundary (probably because of the proximity of their settlement to the boundary), the latter seemed to agree that it should be brought closer to Koge.

Although no change was effected before May 1973, within the next two years the enclosure system was dismantled, and, by September 1975 when I briefly revisited Nimai, pigs moved throughout the areas previously enclosed against them, thus apparently replicating the experience of the Tabari in 1973 (Table 5.2; item 14). There was a noticeable rise in the number of small fences, i.e. around houses and kitchen gardens, even in the heart of settlements.

Residence, health, and witchcraft

Evidence in the previous section indicates that locational decisions affecting residence, settlement, and enclosure made by Sinasina take into account a very wide range of information about the total environment, both physical and social. Inevitably, my focus on changes over nearly 40 years has underplayed the significance of Sinasina structuring of this information. In the past, for instance, a variety of classes of supernatural beings were believed to inhabit certain locations or zones thereby influencing the ways in which people behaved in, or near, these areas.[32] Although many of such beliefs seemed to be of little significance by the 1970s, the same cannot be said of witchcraft (kum), belief in which certainly constrained much social action.

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[32] I did not investigate this field of Sinasina thought in the depth necessary for detailed description or analysis. In brief, the forest, (sigul), rivers, and lower altitude grasslands (same) appear to be the zones most affected. Within the forest there were not only believed to be worms (aba) with mystical powers (Hide 1969), but also certain supernatural creatures, or classes of supernatural creatures, (Ningiaule pupitala, Oikegeba, Yuriyalbia, all of which were said to be kinds of kagai or nature spirits c.f.Bergmann, 1971,Vol.4,pp. 7-8). Further, the spirits of the dead (gil) were said to inhabit Suai, the highest peak in the forest. Outside the forest other creatures (Barime kagai) were said to infest certain areas of the same, and rivers.

Witchcraft in the Chimbu region has been described by a number of writers (Aufenanger 1965; Bergmann 1971,Vol.2,p.2,Vol.4,pp.15-34; Brown 1977; Nilles 1950; West 1940), and this is not the place to consider these accounts in relation to Sinasina information in any detail. In summary, the main elements of Sinasina witchcraft belief are that witches are feared for their supposed appetite for the meat and 'fat' or 'grease' of humans and pigs. Their attacks are believed to result in either sickness or death for the person or animal attacked. Witches, most significantly, are not strangers. Only persons (male or female, but predominantly I believe female) living within a local group such as a clan or subclan are suspected of witchcraft. Characteristically, suspected witches seem to fall at either end of the spectrum of social importance : they are either poor, unhealthy and 'strange', or, at the other extreme, particularly wealthy. In the former case, suspicion follows the assumption that they are jealous of other's greater fortune, in the latter, that their fortune has been achieved at the expense of others. Witchcraft, then, may be seen as the companion of wealth and health, with belief in its efficasy acting to limit the extent to which a person can afford to deviate from others in terms of either poverty or wealth. In particular, it is a powerful sanction enforcing the wide distribution of pork and other goods within a local community.

According to Bergmann, the Kamanuku of central Chimbu, whose settlement is dispersed, explained to him that one reason for living apart from each other was to minimise potential harm from witches : "(i)f we are so close together and we do something...they do not like, they have far more occasion to harm and kill us. They can also then much more easily kill our pigs etc. ('eat their liver' so they will get sick and die')" (1971,Vol.2,p.2). Although I made no explicit inquiries into the matter, I believe that Sinasina think of the relations between settlement form and residence, the health of people and pigs, and the dangers of witches and other mystical beings, in rather more contradictory terms (partly, perhaps as a result of recent changes). Without considering lengthy case materials, my points must be briefly stated rather than demonstrated.

In the early 1970s Koge was viewed by many as having some of the attributes of a 'town' : stores, a market, much coming and going, in brief, all the hustle and bustle generated by a large (in relative highland terms) gathering of people living in close propinquity. Beyond its bounds lay, not only other smaller settlements, but gardens and bush, the locations of daily work and foraging pigs. The basic elements of the 'good life' necessitate ample amounts both of ordinary food, which the good generous person ought to produce and share liberally, and of special foods, pork in particular, which also ought to be shared extensively. Sharing,[33] being seen to share, much of the ratification of a person's social performance, thus depend upon nucleated residence. Conversely, the successful production of ordinary and special foods requires attention to scattered gardens and groves, and the close management

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[33]Not fully analysed unfortunately, is information on daily food (and other) sharing by Koge sample households. What can be stressed is the very heavy daily traffic in food between members of the different households.

of pigs whose vigorous foraging activities continually threaten the gardens of others. With its central, almost but not quite, 'township' status, Koge offered both the attractions and disadvantages of all social agglomerations : more intensive social activity which, depending upon one's perspective, could be seen as either (or both, at differing times) gain or cost. As the locus of social performance, one's presence was necessary there. Yet, on the other hand, production of the means for satisfactory social participation demand that one also goes 'outside', that one puts aside the distractions of 'cards' and conviviality, and attends to work. Too prolonged a withdrawal to an isolated garden or pig-house, however, could invite speculation. Obvious health and fortune would suggest a lack of generosity ; poverty, conversely, the suspicion that one was harbouring jealousy. In the following chapter I examine in greater detail the empirical patterns which result from the compromises made in relation to these choices.

Summary

This chapter has described general trends in the overall pattern of Nimai settlement and enclosure in the 40 years of the colonial period, emphasising the relocation of population downhill, the increasing concentration of settlement sites at lower altitudes, and attempts to adjust the free-ranging husbandry requirements of pigs to these changes. Rules formulated by the council for the Sinasina region to regulate the local movements of people and pigs have been shown to contradict local priorities. These, eventually, and particularly under pre-festival conditions, have resulted in the breakdown (? perhaps temporary) of the patterns created by the council rules.

This chapter also completes my examination of how changes resulting from colonial incorporation have affected, and continue to affect, certain aspects of Sinasina society and economy. Having explored with largely diachronic evidence factors relating in particular to the numbers of people, the continued significance of pigs, and some of the interrelations of people and stock on the ground, I now turn in Part III to describe, at a much more local and restricted level, the production and use of pigs in the early 1970s.

CHAPTER 6

Production: land, labour and livestock

Introduction

The three chapters in this Part of the study present a description of Sinasina production, focused largely on the husbandry and use of pigs. In this first chapter, pig production is contextualised within the overall patterns of labour allocation and land use. Data on levels of production of the two major crops, sweet potato and coffee, and the proportion of the former fed to pigs, are discussed separately in Chapter 7. In Chapter 8 pig production and use are examined in detail, with the presentation explicitly concerned with cyclical features.

For the purposes of exposition, this chapter divides the production system into three major components, labour, land, and livestock. My account of these is based on investigation among, and refers explicitly to, members of Nimai Waula clan. For some aspects (i.e. holdings of coffee and pigs), my data base is the whole clan consisting of approximately 67 households; for others (in particular labour allocation and food crop cultivation), I draw on a much smaller group of only ten households which I refer to as the Koge sample. It will be recalled that members of Waula clan were divided between two major settlement sites, Koge and Iremil, and a number of other, minor, locations (Chapters 2,5). All the households of the Koge sample belonged to Waula, and all were residentially based on the Waula section of Koge in June 1972. By residentially based I mean that the men used this men's house as their centre, if they did not sleep in it, and that each household had a woman's, or family, house within 100 m of it (in most cases considerably less). Some also had other, much more scattered, garden-, or pig-, houses. Following the largely synchronic presentation of the three main components, I use case histories to show the more dynamic, short-term, relations between actual residence, the distribution of cultivation and livestock, and changes through time.

Labour: the allocation of time

A survey[1] of 27 members of the Koge sample households covering three four-week periods allows a quantitative description of the general allocation of time, the division of labour, and other dimensions of labour use. The three periods (19 June - 16 July 1972, 23 October - 19 November 1972, and 5 February - 4 March 1973) were chosen to represent the major seasonal patterns of rainfall, on the assumption that the rainfall regime at Koge would prove similar to that recorded at Kundiawa. The comparisons in Table 6.1 (lower half) show this to have been broadly correct.

The sample included 23 adults aged 17 years and over, and four younger girls aged 11-14 years. The number present at any one time

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[1] Modelled on that used earlier by Waddell (1972a). For full details see Appendix 6. In the interests of comparison, the tabulated data are presented in closely similar form.

TABLE 6.1 Actual weekly precipitation (mm) at Koge during the survey, and comparison between Koge and Kundiawa weekly means[1]

Survey Weeks	Period 1 (19 June-16 July)	Period II (23 Oct-19 Nov)	Period III (5 Feb-4 Mar)		
1	6.8	59.0	48.5		
2	4.6	77.1	151.0		
3	18.1	39.2	126.4		
4	31.6	78.1	55.0		
Weekly Means				Whole Survey	Calendar year
Koge					
(a) Actual survey	15.3	63.4	95.2	58.0	43.5
(b) Calendar months 1972-73	15.6	43.8	87.2	48.9	43.5
Kundiawa					
(a) Calendar months 1972-73	14.5	40.5	61.7	38.9	40.0
(b) Calendar months, 13 yr. mean	21.6	43.0	61.5	42.0	43.5

(1) Sources: Koge, field data; Kundiawa, Bureau of Meteorology, Melbourne.

varied both between periods, and from day to day, as members arrived from, and departed for, visits, employment, and other periods of absence from their territory. Information concerning all absences (defined as involving at least one night away), which accounted for some 15 per cent of total potential time, is discussed separately in Appendix 6. The following material refers to time spent while based in Waula territory.

The general activity pattern

The average member of the sample was active for some 48 hours a week, distributed over the activities listed in Table 6.2. A broad distinction can be drawn between 'traditional' and 'modern' activities, the former including the categories of food production, house construction, other subsistence tasks[2], and social-ceremonial activities, the latter coffee production, commercial activity, and activities concerned with modern agencies. With modern activities occupying some seven hours weekly (14.5 per cent), the predominance of traditional rural activities is marked.

Of the nearly 40 hours a week spent in the latter activities, almost 32 are concerned with food production, house construction and other subsistence tasks. Just over 18 hours a week are specifically devoted to foodcrop cultivation and husbandry. Sweet potato gardens absorb the greater part of this, with 3.3 hours spent in the more occasional tasks of clearing and fencing, and 11 in the more regular

[2]The term subsistence is used here only in a general sense. It is not intended to contrast with 'social' or 'trade' (see Chapter 1).

TABLE 6.2 Mean time (hrs) spent per person-week on all activities (Koge sample)

Activity		Period I	Period II	Period III	Total	Per cent
Food production	Sweet potato (clear/fence)	4.5	1.3	4.2	3.3	6.8
	Sweet potato (plant/weed/ harvest)	11.9	9.0	11.7	10.9	22.6
	Other vegetable cultivation	0.6	0.8	1.0	0.8	1.7
	Nut Pandanus	-	0.1	1.7	0.6	1.2
	Pig husbandry	2.8	2.7	2.9	2.8	5.8
	Subtotal	19.8	13.9	21.5	18.4	38.2
House construction		1.5	7.3	2.6	3.8	7.9
Other subsistence tasks	Household	7.1	8.2	8.4	7.9	16.4
	Tools/equipment	0.7	0.3	0.3	0.4	0.8
	Firewood	0.9	0.7	0.8	0.8	1.7
	Gather/hunt	0.2	0.3	0.4	0.3	0.6
	Subtotal	8.9	9.5	9.9	9.5	19.7
Coffee production	Maintenance	0.2	0.2	0.1	0.1	0.2
	Pick	3.2	0.6	0.9	1.5	3.1
	Process	0.7	0.1	0.2	0.5	1.0
	Subtotal	4.0	0.9	1.2	2.0	4.1
Commercial	Marketing and purchasing	1.7	1.2	1.5	1.5	3.1
Modern Agencies	Council	0.4	1.4	2.6	1.5	3.1
	School work	1.4	0.2	0.1	0.6	1.2
	Government	0.2	0.1	0.2	0.2	0.4
	Church	0.7	1.2	1.6	1.2	2.5
	Subtotal	2.7	2.8	4.5	3.4	7.0
Health	Visit clinic	0.2	0.1	0.8	0.4	0.8
	Sick at home	0.3	2.0	0.6	1.0	2.1
	Care of sick	0.1	0.5	0.2	0.3	0.6
	Subtotal	0.7	2.6	1.6	1.6	3.3
Social/ceremonial	Pig festival	2.4	-	-	0.8	1.7
	Marriage	0.5	-	0.1	0.2	0.4
	Mourning	0.1	5.4	-	1.9	3.9
	Courting	0.5	1.0	0.8	0.8	1.7
	Disputes	0.4	0.6	0.5	0.5	1.0
	Other (1st menstruation etc.)	0.8	1.3	0.6	0.9	1.9
	Visiting/entertain visitors	1.5	1.2	1.8	1.5	3.1
	Gambling	2.6	1.0	0.8	1.4	2.9
	Subtotal	8.8	10.6	4.7	8.0	16.6
Totals	Travelling time only	8.6	6.4	9.0	8.0	16.6
	All activities: duration minus travel	39.7	42.4	38.5	40.2	83.4
	Total	48.3	48.8	47.5	48.2	100.0

routine of planting, weeding, and harvesting. The small figure of 9.8 hours for other vegetables probably underestimates the time spent on other crops but, due to the characteristic mixture of crops within some gardens, it was usually impossible, particularly in the case of women, to separate time devoted to different crops. Specific visits by men to attend to such 'male' crops as bananas and sugar-cane were, however, readily identifiable, as, similarly, was time spent in the care and harvesting of nut pandanus.

The 2.8 hours spent attending to pigs includes only labour directly devoted to their case, that is to say the regular tasks of letting them out in the morning, leading them (if kept within the enclosure system) to foraging grounds, tethering them (and checking and moving their tethers during the course of a day), returning them to shelter at night, and feeding them. It also includes such occasional tasks as castration, and searches for a newly farrowed female, or a lost animal, but excludes the cultivation of sweet potatoes fed to them. Only indirect estimates of the latter labour are possible.

The rather substantial figure of 4 hours invested in house construction and maintenance, largely the result of a flurry of house-building in Period II, may exaggerate the usual input in this activity, at least if Sinasina houses are assumed to have a life expectancy similar to the four years recorded by Brown and Brookfield (1967:130), for central Chimbu houses. It is possible that the considerable amount of time spent on house-building in 1972 was due to three years having elapsed since the previous pig festival, the latter customarily involving extensive rebuilding. Other subsistence tasks occupied nearly 10 hours a week, of which the majority was taken up by the daily round of household activities concerned with food preparation and childcare.

An average of only two hours a week was spent on coffee production, divided mainly between picking, and the various tasks of processing beans from the cherry to the parchment stage (pulping, washing, and drying). Maintenance inputs (weeding, pruning) were minimal, and selling (included in the marketing total) also required only 0.1 hour per week. Other commercial activities, market buying and selling, and retail purchasing, occupied a further 1.4 hours, though a significant proportion of this time (0.6 hours) was spent only attending the market. Situated on the doorstep of the Koge residents, it provided a focal gathering point twice weekly.

Participation in the activities of modern agencies ranges from the voluntary (church services) to the compulsory (one "morning" of council road maintenance per week for adult men, and occasional school maintenance tasks for parents with children attending school). Direct contact with specific Government departments was rare. Together, these activities accounted for an average of just over 3 hours a week.

A variety of social and ceremonial events occupied a substantial 8 hours a week during the survey. These included attendance as spectators at the early (dancing) stages of a pig festival, participation in a range of life cycle ceremonies (marriage, baptism, first menstruation) as well as a number of more frequent, small-scale activities such as courting, dispute-settlement, gambling and casual visiting.

Seasonal variations

Table 6.2 shows that there was a considerable amount of variation from the average week for the whole survey during the three periods. While some of this was due to chance occurences, such as the death during Period II, much is apparently explained by seasonal factors. Only two of the major categories, other subsistence tasks, and commercial activities, show little change between periods. Of the five others, food production was relatively high and stable during Periods I and III (19.8 and 21.5 hours), but dropped significantly to 13.9 hours in Period II, largely as the result of a decrease in the time spent on sweet potato garden preparation - clearing and fencing in particular. This decrease correlates with a major increase in house-building, up from 1.5 and 2.5 hours in Periods I and III, to 7.3 hours in Period II. Since these are tasks primarily undertaken by men, the relationship between the fluctuations seems to be firm. Some of the decline in subsistence food production, particularly as registered by the tasks of planting, weeding and harvesting was also probably related to an attack of upper respiratory tract infection, which affected women in particular (Appendix 6), during Period II. In addition, Period II coincided with the final month of one woman's pregnancy.

The seasonality of coffee is strongly marked. Period I sampled the flush months of May to August, and absorbed almost twice the labour of the other two months together. The rise, during Period III, of time spent on modern agencies is also directly related to seasonal factors. The heavy rains in early 1973 caused continual damage to steep roadsides necessitating real roadwork on Mondays, instead of the token brush and scrape which characterised the task during Period I.

Some of the fluctuations in the amount of time spent on social and ceremonial activities also result from seasonal factors. The increased availability of cash from coffee sales during the flush was presumably responsible for the increase in gambling during Period I, and may also affect the scheduling of other events. Some ceremonies, such as pig festivals and food exchanges are also seasonally scheduled, the former generally in the period August to October when pigs are said to be fat, the latter according to the maturation of such crops as taro, yam and nut pandanus.

The division of labour by sex and variation by age and marital status

The sexual division of labour is fundamental to production in Sinasina, as it is elsewhere in the highland region. In the subsistence sphere men are primarily responsible for fencing and clearing land, house-building, the cultivation of certain special crops, and the daily routine of firewood collection, while women have charge of the bulk of sweet potato cultivation and household tasks (Tables 6.3, 6.4). Pig husbandry is more evenly distributed, with women carrying out most of their feeding, and men attending to other tasks. In coffee production, most of the maintenance and processing is done by men, more of the harvesting by women. The latter division,

TABLE 6.3 Division of labour by sex[1]

	Activity	Total hours	Percentage contribution
Activities carried out mainly by men[2]	Fencing	333.3	98
	Courting	198.4	96
	Nut pandanus cultivation	154.5	91
	House construction	981.0	88
	Clearing	512.6	83
	Local Government Council	375.6	84
	Firewood: collect/split	207.0	81
	Coffee: maintain and process	127.1	77
Activities carried out mainly by women[2]	Sweet potato garden: weed	292.6	95
	Sweet potato garden: plant	470.2	94
	Sweet potato garden: harvest	2020.9	91
	Household: cook/sweep/childcare etc.	2031.1	82
	School work	144.2	71
	Pig husbandry: feeding	326.6	67
	Coffee: pick	384.6	66
Activities carried out by both sexes (men's percentage contribution)	Ceremonies (various)	282.7	61
	Disputes	126.5	60
	Mourning	491.8	56
	Visiting/entertain visitors	391.1	54
	Pig husbandry: move, castrate etc.	388.4	54
	Vegetable garden: cultivation	206.8	53
	Tools/equipment/clothing	109.1	50
	Marketing and purchasing	383.6	47
	Church	297.5	44
	Gambling	372.2	43
	Bonagene	196.2	40

	Men (N=12)	Women (N=15)
[1] Total hours active	5278.0	7073.8
Total weeks present	106.0	150.3
Mean activity week	49.8	47.1

[2] Where one sex carried out more than two-thirds of the work and where the total amount exceeds 100 person-hours (or 0.8% of the total hours active for the whole sample).

TABLE 6.4 Mean time (hrs) spent per person-week on all activities, by sex (Koge sample, adults only)

Activity		Men	Women
Food production	Sweet potato (clear/fence)	7.1	0.8
	Sweet potato (plant/weed/ harvest)	2.2	18.0
	Other vegetable cultivation	1.0	0.7
	Nut Pandanus	1.3	0.1
	Pig husbandry	3.0	2.9
	Subtotal	14.6	22.4
House construction		8.1	0.9
Other subsistence tasks	Household	3.4	11.7
	Tools/equipment	0.5	0.5
	Firewood	1.6	0.3
	Gather/hunt	0.3	0.2
	Subtotal	5.8	12.6
Coffee production	Maintenance	0.4	-
	Pick	1.2	2.1
	Process	0.6	0.2
	Subtotal	2.1	2.3
Commercial	Marketing and purchasing	1.7	1.5
Modern Agencies	Council	3.0	0.5
	School work	0.4	0.7
	Government	0.3	0.1
	Church	1.2	1.3
	Subtotal	4.9	2.6
Health	Visit clinic	0.5	0.3
	Sick at home	0.5	1.7
	Care of sick	0.4	0.2
	Subtotal	1.4	2.2
Social/ceremonial	Pig festival	0.7	0.7
	Marriage	0.3	0.2
	Mourning	2.6	1.8
	Courting	1.8	0.1
	Disputes	0.7	0.4
	Other (1st menstruation etc.)	1.3	0.8
	Visiting/entertain visitors	2.0	1.3
	Gambling	1.5	1.6
	Subtotal	11.0	6.8
Totals	Travelling time only	8.7	7.9
	All activities: duration minus travel	41.1	43.4
	Total	49.8	51.3

however, was probably related to the absence of two men, working on coffee plantations, during the flush.

Patterned presumably on the traditional division of labour, most of the council work of road maintenance and some construction is undertaken by men, while the normally lighter tasks associated with school maintenance are mainly done by women. Participation in all other activities is relatively even.

Although the specialisation of labour by sex is established in childhood, full adult patterns of activity are not realised by either sex until marriage and the establishment of an independent household (Table 6.5). Casual observation suggested that children aged less than 10 years (of both sexes) contribute little labour to their households. Girls in this age-category are probably of more assistance than boys: they regularly accompany their mothers during the latters' daily routine, may have small garden sections nominally referred to as theirs, and generally lend a hand with such tasks as water-collection and the care of younger children. Boys of similar age are probably less involved in their fathers' routines, though they also occasionally assist with some tasks (and may nominally own pigs by the age of 10). As described earlier (pp. 190-1), Waula parents have recently tended to keep their daughters out of school, sending only their sons. Thus the three boys of primary school age in the sample were all attending school and their labour contribution was limited to tasks such as firewood collection and occasional pig-feeding in the late afternoons and at weekends. Four of their sisters, in the pre-adolescent age class of 11-14 years, were,

TABLE 6.5 Mean time (hrs) spent per person-week on all activities, by marital status (Koge sample

Activity		Married Men	Married Women	Unmarried Man	Unmarried Men	Unmarried Woman	Unmarried Girls
No. of individuals		9	10	1	2	1	4
Total hours active		3820.7	5242.5	473.2	984.2	518.8	1312.5
Total weeks present		75.1	100.7	12.0	18.9	11.6	38.1
Per cent survey time absent		21.8	11.1	0	21.4	3.6	15.6
Food production	Sweet potato (clear/fence)	8.8	0.9	3.5	2.7	–	0.1
	Sweet potato (plant/weed/harvest)	2.9	19.0	1.2	0.1	8.8	14.0
	Other vegetable cultivation	1.1	0.7	0.4	1.0	0.3	0.6
	Nut Pandanus	1.3	–	3.4	0.2	0.4	0.1
	Pig husbandry	3.7	2.9	1.0	1.3	3.2	1.8
	Subtotal	17.8	23.5	9.5	5.3	12.7	16.7
House construction		7.9	0.9	7.3	9.7	0.7	0.5
Other subsistence tasks	Household	3.3	12.3	4.4	3.0	6.1	9.5
	Tools/equipment	0.6	0.5	0.5	0.4	0.3	–
	Firewood	1.6	0.3	2.0	1.2	0.1	0.2
	Gather/hunt	0.2	0.2	0.1	1.0	–	0.6
	Subtotal	5.7	13.3	7.0	5.6	6.6	10.4
Coffee production	Maintenance	0.4	–	0.3	–	–	–
	Pick	1.2	2.2	2.4	0.5	0.7	0.6
	Process	0.5	0.2	1.4	0.2	0.1	0.1
	Subtotal	2.2	2.5	4.1	0.8	0.8	0.7
Commercial	Marketing and purchasing	1.5	1.4	2.0	2.4	2.0	0.9
Modern agencies	Council	3.0	0.5	1.5	3.9	0.3	0.1
	School work	0.4	0.7	0.7	0.3	0.8	0.7
	Government	0.4	0.1	0.2	0.1	–	–
	Church	1.2	1.3	1.7	1.3	1.2	0.5
	Subtotal	4.9	2.6	4.1	5.6	2.3	1.3
Health	Visit clinic	0.6	0.2	–	0.4	0.7	0.5
	Sick at home	0.5	1.9	–	0.6	–	0.1
	Care of sick	0.3	0.2	0.5	0.9	–	–
	Subtotal	1.5	2.4	0.5	1.9	0.7	0.5
Social/ceremonial	Pig festival	0.7	0.3	–	1.4	3.6	1.1
	Marriage	0.4	0.2	0.1	0.2	–	–
	Mourning	3.0	1.8	1.5	1.7	1.5	0.5
	Courting	0.1	–	–	9.7	0.6	–
	Disputes	0.7	0.3	–	1.1	1.1	0.1
	Other (1st menstruation etc.)	1.0	0.6	1.3	2.3	1.9	0.2
	Visiting/entertain visitors	1.2	0.9	1.0	2.2	5.3	0.7
	Gambling	1.5	1.3	–	2.4	4.8	0.7
	Subtotal	9.5	5.4	4.8	20.9	18.8	3.4
Totals	Travelling time only	9.1	7.4	6.5	8.3	12.1	6.3
	Duration: activities	41.7	44.6	32.9	43.8	32.6	28.2
	Total	50.9	52.1	39.4	52.1	44.7	34.4

however, at home and as Table 6.5 shows, their average activity pattern resembled a scaled-down version of that of married women. Not only do they regularly accompany their mothers during the day, but they also independently harvest from gardens and, when their mothers are temporarily unable to work (due to sickness or pregnancy), they may be called upon to take almost full responsibility for the day to day provisioning of a household.

A major change occurs at adolescence, which is followed by a period in which youths of both sexes, and girls in particular, are afforded considerable freedom from routine tasks. This does not seem to be a recent phenomenon since in the late 1930s, West noted that "(g)irls are the only privileged class in Mirani (near Kundiawa): men and women and boys must work, but girls need do nothing beyond strolling about displaying themselves and their ornaments and teasing the young men". (1939:18; parenthesis added).

Exchange Labour

All time expended by sample members on the four major categories of work associated with production and household maintenance (food production, house construction, other subsistence tasks and coffee production, hereafter referred to as 'productive' labour), which together accounted for 70 per cent of total activity time or an average of 33.7 hours/person week, was recorded by the household (sample or otherwise) for which it was carried out. In addition, assistance with these activities from members of both sample and non-sample households, was recorded.

Table 6.6 shows that almost 90 per cent of the total hours of productive labour engaged in by sample members was work performed

TABLE 6.6 Exchange labour in productive activities[(1)] (whole survey, Koge sample)

Exchange labour categories	Total sample (n=27)		Adults only (n=23)	
	Hours	%	Hours	%
'Pooled' labour	131	1.5	126	1.7
Inter-household exchange	805	9.3	750	9.9
Total:[(2)] productive labour	8626	100.0	7547	100.0

(1) Productive labour as defined here includes food production, house construction, other subsistence tasks and coffee production.

(2) Including non-exchange labour.

for their own households. Less than 2 per cent was 'pooled' for joint activities, and some 9 per cent (10 if only adults are considered) was undertaken for other households. The amount of exchange labour received by adult sample members balanced with the amount they gave (Table 6.7). However, the latter figure does not include labour performed for other households when sample members were temporarily absent, unlike the former figure which includes work done for the sample members by temporary visitors. Thus, the sample as a whole presumably helped others more than they were helped.

TABLE 6.7 Exchange labour given and received by adults (whole survey, Koge sample)

Households with which sample adults exchanged labour	To other households		From other households	
	Hours	%	Hours	%
Within sample	361	48.1	359	48.0
Outside sample	389	51.9	389	52.0
Totals	750	100.0	748	100.0

Some tasks attracted considerably more exchange labour than others (Table 6.8), notably house construction, the clearing, fencing, weeding and planting of sweet potato gardens, and the processing of coffee. Such variation by task is, as a consequence of the sexual division of labour, paralleled by varying participation by men and women : men, despite their fewer numbers, accounted for 60 per cent of the total labour exchanged. Phrased differently, while men exchanged nearly 15 per cent of all their productive labour, women exchanged only 6 per cent.

Variation by sex and marital status is summarized in Table 6.9. In general married men and women received more help than they gave, whereas unmarried persons of both sexes (excluding pre-adolescent girls) gave more assistance than they received. The amount of variation between individuals in any one category, however, indicates the need for a closer look at variation between households as the major units of production.

TABLE 6.8 Distribution of exchange labour performed by Koge sample, by task and sex (whole survey, adults only)

Task	Hours	Per cent	As per cent of each sex's exchange labour		As per cent of total time spent on tasks(1)		
			Men (N=483 hrs)	Women (N=322 hrs)	Total sample	Men	Women
Food production							
Clear	101.9	12.7	14.5	9.8	19.9	16.5	36.2
Fence	58.5	7.3	12.2	-	17.5	17.9	-
Plant	87.3	10.8	-	27.1	18.6	-	19.7
Weed	54.4	6.8	0.8	16.4	18.6	9.5	19.1
Harvest	41.5	5.1	0.9	11.5	2.0	2.3	2.0
Other vegetables	5.1	0.6	0.8	0.3	2.5	3.7	1.0
Pandanus	8.0	1.0	1.6	-	5.2	5.7	-
Pigs	32.7	4.1	3.5	4.8	3.5	5.4	3.9
Subtotal	389.4	48.4	33.9	70.1	7.9	10.5	7.1
House construction	258.4	32.1	49.6	5.8	26.3	27.8	15.6
Other subsistence tasks	105.6	13.1	12.7	13.8	4.3	9.9	2.4
Coffee production							
Maintenance	1.0	0.1	0.2	-	2.5	2.6	-
Pick	36.4	4.5	1.0	9.8	9.5	3.7	12.4
Process	14.3	1.8	2.6	0.5	16.4	21.0	6.3
Subtotal	51.7	6.4	3.8	10.4	10.1	8.0	11.7
Totals	805.1	100.0	100.0	100.0	9.9	14.8	6.0

(1) Total time refers here to the total time recorded for a task during the survey (i.e. irrespective of whether it was exchanged or pooled).

TABLE 6.9 Exchange labour by marital status and sex (Koge sample)

Status	n =	To other households (as % of prod. labour)		From other households (as % of prod. labour)	
		Mean	Range	Mean	Range
Married men	9	8.4	2.1-19.4	16.2	0.6-40.1
Bachelor	1	39.7	-	0.2	-
Young men	2	30.5	24.0-37.1	2.2	0 - 4.3
Men: subtotal	12	14.7	2.1-39.7	12.5	0 -40.1
Married women	10	5.4	0.9-14.8	8.4	0.1-24.9
Single girl	1	15.1	-	0.3	-
Young girls	4	4.8	2.5- 8.2	1.1	0.3- 2.0
Women: subtotal	15	5.9	0.9-15.1	5.9	0.1-34.9

In Table 6.10 I list sample households in descending order of balance in their exchange labour 'budget' (labour given minus labour received, each calculated as a percentage of the household's total hours of productive labour). The range is considerable: from household J with a 'credit' of nearly 40 per cent, to household A with a 17 per cent deficit. These two extreme cases are related: if J's contribution to A is excluded, the former's credit is reduced to 26.3 per cent, and the latter's deficit falls below that of household B, to minus 7.9 per cent. The overall distribution is however, relatively firm: three households (J, F, and D) gave considerably more help than they received, three (A, B, and H) received more than they gave, and four (I,C,E, and G) were in relative equilibrium.

There is no clearcut correlation between this distribution and the relative working capacities of the households, as measured by the ratio of 'consumers' to 'workers'[3]. The three households with the largest deficits included one with a low ratio and excluded another (G) with the highest ratio, while the three with the largest credits excluded two of theoretically greater working capacity. Two other measures, one an adjusted dependency ratio which includes the household pig herd as consumers, the other a measure of productive intensity (food crop area cultivated per worker) both of which assess

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[3]I later term this the 'human dependency ratio', in contrast to an adjusted one which includes pigs as consumers and which I term the 'total dependency ratio' (see p313). The values used to convert people of different age and sex to these measures are given in Appendix 6.

TABLE 6.10 Exchange labour by household (Koge sample)

Household	Exchange labour					
	To other households		From other households		Balance	
	As % of product. labour	No. of households	As % of product. labour	No. of households	Per cent	Hours
J	39.7	17	0.2	4	+ 39.5	+132.2
F	15.7	15	1.8	2	+ 13.9	+110.0
D	11.7	11	4.1	13	+ 7.6	+ 68.5
G	6.5	13	5.5	9	+ 1.0	+ 10.8
E	7.9	20	7.0	11	+ 0.9	+ 13.8
I	4.7	9	4.6	14	+ 0.1	+ 0.7
C	10.1	14	10.7	8	- 0.6	- 4.7
H	5.2	16	11.8	21	- 6.6	- 73.2
B	8.4	19	19.6	15	- 11.2	- 82.6
A	1.5	6	18.4	16	- 16.9	-127.6
Means	9.3	14	8.9	11	-	-

different aspects of the relative work burden faced or achieved by the sample households during the surveyed period, show better fits. The one obvious exception is that of household H, but this contained the two oldest members of the sample and its imbalance was largely a consequence of help received following the death of a son. Household D, which was only marginally advantaged in terms of the two measures, is also a special case: it was re-establishing itself after a 15 year absence.

One feature of exchange labour which might not be expected is the considerable number of other households with which a household engages in exchange labour (Table 6.10). This dispersal suggests a lack of close dependency relations as, for instance, might be found if strong patron-client type relationships between households were important, and warrants closer examination.

Table 6.11 shows that over the three months covered by the survey, the average household exchanged labour with some 11-14 other households. As would be expected, the number "falls off" quite abruptly with increasing social, and geographical, distance: the average household was involved with roughly half the other households of the sample, another five households attached to the same men's house, 2-3 in the rest of the clan, and 1-2 outside the clan. Overall, the 10 sample households assisted a total of 58 households, or 48 over and above those belonging to the sample. These figures allow calculation of hypothetical maximum and minimum fields of interacting households, providing a means to assess the extent of dispersal. If there was no

TABLE 6.11 Number and social range of households with which sample households exchanged labour

Households belonging to	Total households in category	Number of Households: To which sample households gave labour — Total	To which sample households gave labour — Mean per sample household	From which sample households received labour — Total	From which sample households received labour — Mean per sample household
Own clan					
within sample	10	10	4.8	10	4.7
same men's house	27	22	5.5	21	3.5
other men's house	34	13	2.6	7	1.3
subtotal	71	45	12.9	38	9.5
Other clan					
in Nimai	c.400	9	0.9	4	0.4
outside Nimai	c.5000	4(1)	0.7(1)	9	0.9
Totals		58	14.0	51	11.3

(1) Incomplete due to survey excluding temporary absences (one night or more) by sample members.

dispersal, the minimum field of households helped by those of the sample need have only included 15 households (since the average household assisted 14 others), each assisting all others. If, however, no relationships were reduplicated (i.e. none of the sample households assisted each other or shared a single partner with any other sample household), the maximum field would include a total of 150 households. The empirical figure of 58 lying between these limits of 15 and 150 therefore provides a rough measure of the extent to which exchange labour is dispersed.

It may be noted further that the amount of help given by the average household to its 14 partners was not equal. There was, in Schwimmer's terms (1973:129), a hierarchy of association, with a disproportionately large amount of labour exchanged between a few close partners, and a steadily declining proportion among the rest (Table 6.12). Following Schwimmer, the information on the exchange labour relationships between the 10 sample households shown in Table 6.12 may be plotted in the form of a sociograph (Fig. 6.1). According to the extent to which partners share a mutually preferential status, I distinguish three categories of relationship. A primary relationship is one in which either both partners are each other's first partner (B/D, E/G, and A/J), or the relationship includes one first partner and one second (C/B). A secondary relationship is one in which both households are each other's second, third, or fourth partners (E/C, A/B, F/J); and a tertiary relationship is one in which one household is a second, third, or fourth partner to the other, but the relationship is less close for the other (A/D, F/B, G/B, D/C,

TABLE 6.12 Exchange labour relationships between each sample household and its four most important partners (1,2)

Sample	1st partner		2nd partner		3rd partner		4th partner	
	Household	%	Household	%	Household	%	Household	%
J	A	33	(3.20)	15	F	10	(1.14)	9
F	(Z)	17	B	13	(Ta)	13	J	10
D	B	38	(Ta)	13	C	7	F	7
I	(2.23)	16	(Ke)	14	B	12	H	12
C	B	39	(Ke)	17	E	11	(Ta)	9
E	G	21	(3.6)	20	(Z)	13	C	11
G	E	26	B	15	(1.4)	12	(1.23)	10
H	(3.17)	20	(3.23)	10	(D)	8	(1.16)	7
B	D	21	C	15	(Do)	14	A	9
A	J	29	(1.6)	11	B	9	D	7
Mean		26		14		11		9
Cumulative		26		40		51		60

(1) Partnerships calculated by adding, for each partnership, hours given and received by sample household, and expressed as a percentage of the total hours of exchange labour given and received by the household.

(2) Household identification of partners: a capital letter alone indicates a sample household; (0.0 a non-sample household belonging to Waula clan; (Z=sister), (D=daughter) the household of a married sister or daughter (in all three cases these are households of the Nimai Bomai clan); (Ta=Tabari, Ke=Kere, Do=Dom) households of other tribes.

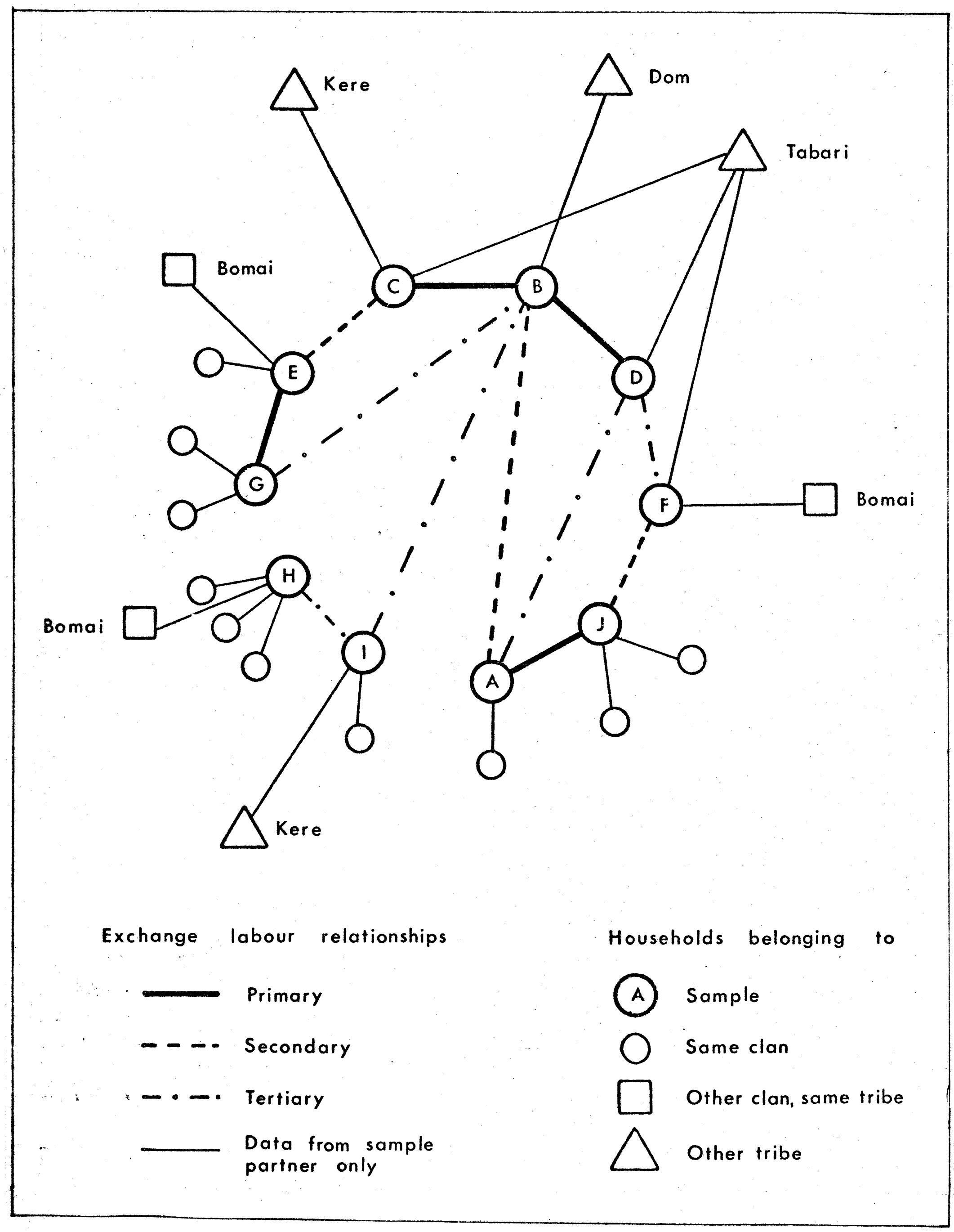

Fig.6.1 Major labour exchange relationships, Koge sample households

D/F, I/B, and I/H). Relationships between sample and non-sample households which appear in Table 6.12 cannot be classified in these categories since information is available from only one partner. They are plotted as a fourth residual class in Fig. 6.1. While the graph is therefore incomplete, and the sample obviously too small to be representative, the exercise is interesting in that it partially confirms Schwimmer's analysis of "circuits" of relationships in taro exchanges between Orokaiva households of the same settlement (ibid., 131-2), a pattern described as one in which no two households share the same closest mutual relationships. More formally,

> "A circuit of n households (H1, H2, H3 ...Hn) is defined as a set in which H2 has a 'closest mutual relationship' with H1 and H3; H3 with H2 and H4 and so on. Closure of the circuit is achieved if Hn has a 'closest mutual relationship' with H(n-1) and H1" (ibid., 131-2).

In this case Fig. 6.1 reveals no closed cluster of households linked by primary relationships. Nevertheless eight of the ten are linked by a thread of primary and secondary ones, with only households H and I excluded (though they are joined to the others by a single tertiary relationship). I would doubt, however, whether complete circuit closure would be expected in Sinasina, either with labour exchange or exchanges of food and other items, and it may be noted that in his analysis Schwimmer deliberately excluded gifts between members of different settlements. Perhaps a web-like pattern is a more exact description of this case, with settlements characterized by an increased density of primary relationships. The significance of household B's emergence as a node in Fig. 6.1 will be discussed later in relation to data on cultivation.

Kinship partly structures the pattern of labour exchange. Although all sample households were at least putative agnates, and all were fellow members of the same men's house grouping (at least for part of the year[4]), some were more closely related than others (Fig. 6.2). Extended family relationships, particularly between fathers and married sons, and reflecting shared interests in land and extra-clan relationships, were of obvious significance (i.e. households A, B, C, H, see Fig. 6.2 and Table 6.12). Relationships between married brothers appear to be more variable (i.e. H and 3.18, A and 1.21, I and 3.9, J and 3.14). Affinal relationships are important in all cases. In the case of A, however, they are hidden due to the fact that both his wife's relatives, and his married sister, lived at a considerable distance from Koge thus preventing visits of less than a day.

This brief account of the movement of labour between households concludes this section. I turn now to describe the characteristics of major sites to which productive activity is directed.

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[4]By March 1973, E, G, and C were residentially based on a new small men's house established 200 metres from the Koge one (see pp.348).

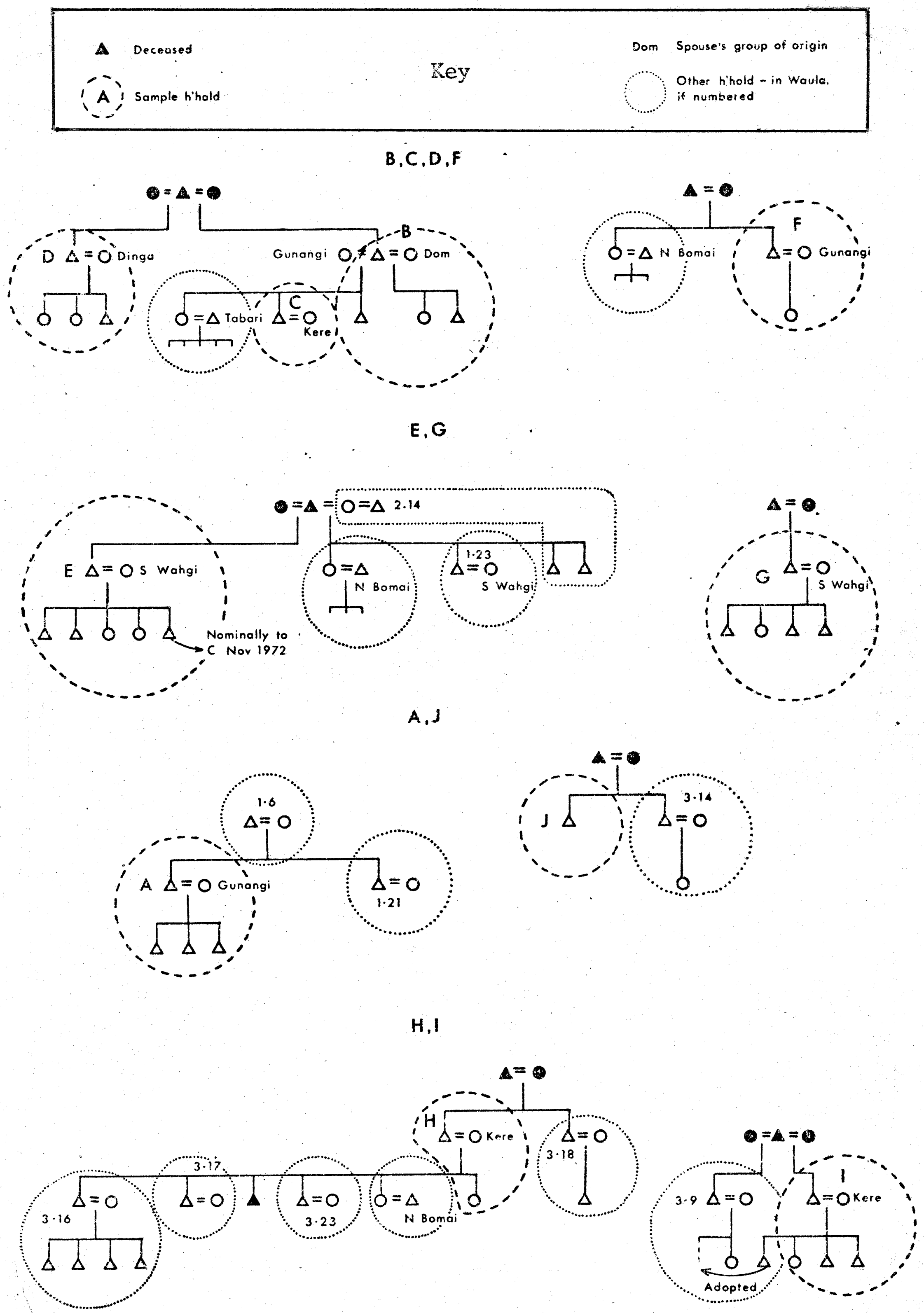

Fig.6.2 Koge sample : some genealogical relationships

LAND

Non-domesticated resources: hunting and collecting

Although cultivation and husbandry are the major components of the Sinasina production system and receive most attention here, the present role of non-domesticated resources in supplying some food and many other useful and essential materials can be briefly detailed[5].

Hunting, at least for those living below 1900 m is not part of the normal food procurement activities of adults. Up to the 1950s, game, from both forest and areas under secondary growth, undoubtedly featured more significantly in both the everyday and ceremonial diet. Birds, bats, marsupials, and rats were all, with few exceptions, hunted and eaten (subject to certain, usually temporary, food restrictions). Except for such occasions as feasts at first menstruation ceremonies, for which large quantities of grassland rats were hunted, hunting was however largely an individual affair and its yields, while perhaps nutritionally significant, could not have been great (cf. Dwyer 1974). Collecting, mostly by women and children, of insects, grubs, and frogs, probably provided more regular amounts of protein. During 1972-73, Waula men did not visit the forest or other areas specifically for the purpose of hunting, though the occasional bird or fruit bat was taken after a quick stalk in the course of other activities. Youths, however, occasionally scoured the grass-covered ridges around Koge in

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[5]Further information can be found in a separate checklist of some 500 plants (Hide *et al*. 1979).

search of quails and other birds. No one, it was said, ate rats any longer though those caught in traps in my house were sought by some for their pigs. Children, particularly girls, still search streambanks for frogs, but again usually as a secondary activity. The wood grub, or larvae, known as omune, which is frequently found in the stems of Ficus dammaropsis and other small Ficus spp. is regarded by some as a delicacy, and some trunks are protected to the point where omune might almost be regarded as a partially managed species.

Wild plants are important sources of food and other materials. Notable amongst the foods are wild nut pandanus, many different kinds of mushroom or fungi (mainly collected in the period September to December), and a number of leaves and ferns. In the vicinity of settlements and cultivation, an assortment of plants (escaped from cultivation, semi-domesticated, and wild) provide extra greens, and a number of grasses are regularly collected as pig-fodder. Beside such food and fodder supplies, collection also provides essential materials for building, fencing, firewood, cordage, tool-handles, weapons, and items of adornment. While wild species provide many of these, some of the major and more useful species are planted, or at least partially managed under varying degrees of human control. Major examples include the multi-purpose Casuarina oligodon, and the many species managed on, or near, settlement sites.

With the movement of Nimai population to lower altitudes (Chapter 5), it is likely that the impact of human exploitation on different zones has altered. Paralleling this change, moreover, have been changes in technology and materials. Notable amongst these is the shift, on established sites, to frame-houses (nailed rather than tied) with walls of woven Miscanthus stems, instead of slab planks cut from forest trees.

Cultivation

Nimai agricultural production is focused on three major sites, food-crop gardens primarily planted to annual or semi-annual tubers but including a wide variety of other crops, and separate groves devoted to the two major tree crops, the high altitude nut pandanus (karuka in pidgin, amil in Nimai), and the cash crop, coffee. Food-crop gardens occupy more land per capita than either of the other two sites, and receive larger and more sustained amounts of labour. They are made at all altitudes from 1650 to c.2500 m in Nimai territory and move on an irregular fallow cycle, the timing of which varies according to a range of social and ecological factors including altitude, soil type, land availability, and residence. Coffee and pandanus groves, by comparison, are stable over relatively long periods of time, are strictly zoned by altitude, and, due to their seasonal or irregular fruiting, show strongly seasonal patterns of labour (Table 6.2).

Pandanus groves

Before the 1950s karuka pandanus were the most important cultivated tree crop, grown in extensive groves in the 2100-2400 m zone fringing the forest. Wild pandanus (in Nimai the two main types are amil goril and kewa), the nuts of which are also collected, grow scattered throughout the remaining forest (planted, it is said, by a forest 'rat', dua nigil dagil)[6]. The red and yellow fruited pandanus (Pandanus conoideus; in Nimai, koba, in pidgin, marita), of lower altitudes, although not common in Nimai territory, is grown in small scattered clusters of a few palms in sheltered gullies up to 1800 m. They are, however, considered a marginal crop at this altitude and most marita fruit enters Nimai by gift, trade and exchange from people at lower altitudes.

The oily nuts of amil are highly valued as a food. They are also used as gifts, often elaborately packaged and decorated, in large ceremonial inter-group prestations (komina bire). Many less formal transfers are made between relatives and friends, and, in season, the nuts are marketed regularly. Both cultivated and wild varieties also provide valuable forage for pigs, which eat both nuts and mesocarp. Pigs are not excluded from the groves. In addition to windfalls, heads containing poor or empty nuts may be knocked down and broken open for them to feed on. Pandanus leaves were used extensively in the past for matting. They are also used, with those of Cordylines, for roofing houses built in or near the groves, unlike those at lower altitudes which are thatched with Imperata cylindrica.

Access to high altitude land suitable for karuka is unevenly distributed between tribes, and within them, between clans and lower

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[6]On one occasion in the forest one of my companions casually set fire to the dry crown of a wild pandanus in an abortive attempt to drive out any game it might be harbouring. Such an action would be unthinkable in the cultivated groves.

level units. Within Nimai, most karuka groves are concentrated in the south-eastern part of the territory, though some small isolated strands of trees occur in the south-west. Bomai and Waula clans therefore probably have larger holdings than Dugul and Ogole. Since no direct information on pandanus holdings was collected from clans other than Waula this statement is based only on impressions from forest visits, and on other indirect evidence (i.e. karuka sellers at the market and karuka gifts at an intra-Waula food exchange). Among Waula households, approximately half owned no karuka. While some present owners say they have established, or extended, their groves, most report that they were planted by men of at least their father's generation. As with other land, most owners inherited from their father though some have acquired their groves from less directly related clansmen, and a few from affines belonging to Nimai Bomai and the neighbouring Dom Nuku. These affinal grants were said to be permanent transfers. The Koge sample was a little unrepresentative in that only two of the ten households (D, I) claimed no direct rights to karuka groves.

Due to their high-altitude location in the south, Waula groves lie some 3 to 4 km from the Koge settlement. Although considerable, this distance does not greatly affect the general pattern of settlement or residence, mainly because fruiting is seasonal, or more exactly, irregular, and the groves receive little maintenance at other times. During a good fruiting season, however, some households do move into houses in or near the groves.

The precise periodicity of fruiting is unclear. Certainly they do not produce every year (Bergmann 1971, Vol. II: 105), but, in years that they do, fruiting seems to be concentrated in the period December to March (Table 6.13: Nilles 1943:121, 1944:8; though Bergmann, ibid., says June-July). Possibly there are differences between the ripening times of different varieties, and between the cultivated and wild kinds. Nutritionally, it would seem significant that if the December-March 'season' is correct, fruiting coincides with, or closely follows, the period during which sweet potato may be in short supply (cf. Lambert 1975:12-13; Hide 1980b)

The Nimai pandanus groves, with the exception of outliers, form an almost continuous block of managed silviculture. While karuka clearly dominates[7], they are interspersed with other trees. Undergrowth varies according to the age of the pandanus, the proximity of a harvest, and the care of the owner. Waula say that care is necessary if the palms are to grow well. During 1972, some men began clearing their groves as early as July or August. By late December, although the harvest did not promise to be a heavy one, at least two Waula houses were built or under construction in or near the groves. One of the sample households (G) took up temporary residence there during this month, and another (A) began construction in January. The first nuts of the season reached Waula at Koge in late January. Most new planting is said to be done during the fruiting period.

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[7]In one grove of 400 square metres at 2340 m, 18 mature and 9 immature pandanus were planted, i.e. a density of 676 trees/ha. This seemed low by comparison with others in the vicinity.

Table 6.13 Some records of nut pandanus fruiting, Sinasina and Chimbu

Year	Month(s)	Location	Source
1945	January	North Sinasina	Dennis (CPR 2, 1944/45
1947	March	South Sinasina (Gunangi)	Costelloe (CPR 7, 1946/47, p.1)
1950	December	Upper Chimbu	Heagney (CPR 4, 1950/51, p.5)
1952	February	Upper Chimbu	
1953	March	South Dinasina (Dom)	Fowler (CPR 14, 1952/53, p.4)
1968	April	North Sinasina (Nimai)	Hide, Field Notes 1967-68
1970	April	North Sinasina (Tabari)	Stott (CPR 14, 1969/70, p.3)
1972	No fruiting	North Sinasina (Nimai)	Hide, Field Notes, 1971-73
1973	January-March	North Sinasina (Nimai, Kere)	Hide, Field Notes, 1971-73
1975	January-March	North Sinasina (Tabari)	Lambert 1975:13

Maintenance is primarily restricted to clearing undergrowth, and, in some cases, supporting parts of the trees.

Coffee

The introduction and expansion of coffee growing was described in Chapter 5. According to tree counts conducted by DASF cited there, the Nimai had a total of some 103782 coffee trees in 1972. Of this total, 18365, or nearly 18 per cent, belonged to Waula clansmen. All Waula holdings (with the exception of plots belonging to one household for which data were inadequate) were surveyed in the first two months of 1972, yielding a total of 6.8 ha under coffee[8]. This 6.8 ha was owned by 67 households [9] or household groupings (Table 6.14),

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[8]A note on planting densities. While 1730 trees/ha is officially recommended (DASF 1971:41), even lower figures have been used for some estimates of area planted to coffee (i.e. 1534 trees/ha, Shand and Straatmans 1974:39, Table 3.2). Actual densities vary widely on the ground (on five plots ranging from 155-368 square metres, I observed a range of 1500-3400 trees/ha), but on average they are probably much higher than the former figures. Assuming the DASF tree count to be reasonably accurate for Waula (and it is probably an under-count since some isolated plots appear to have been missed), the 18365 trees on 6.79 ha convert to an overall density of approximately 2700 trees/ha. This may be compared with the 2204/ha recorded for a small, recently planted, Enga sample (Waddell 1972:60) and the 3226/ha obtained in south Sinasina (calculated from Table 9.2, in Hatanaka 1972:93). It is particularly close to the overall Chimbu figure of 2613 trees/ha given by Wilson and Evans (1975:13).

[9]These 67 households had a total population of 289 persons (resident in early 1972, 258 persons). Three were joint households; that is, married father and married son combinations with undivided coffee holdings. For other purposes, i.e. pig ownership, these three were enumerated separately as seven households. For the calculations of average holdings per household and per capita I have also excluded one household (D) recently returned from 15 years residence among the neighbouring Tabari since it had not planted coffee on Waula land. It had, however, left coffee on Tabari land when returning to Waula.

giving an average household holding of 0.1013 ha (0.0235 ha/*per capita*,

TABLE 6.14 Distribution of coffee holding ownership, Waula (1972)

Size of holding m^2	Households No.	Households %	Population No.	Population %	Total Area Ha	Total Area %	Area/person Ha
0 - 500	13	19	39	14	0.3682	5	0.0094
501 - 1000	24	36	98	34	1.8501	27	0.0188
1001 - 1500	17	25	67	23	2.0044	30	0.0299
1501 - 2000	7	10	52	18	1.1515	17	0.0221
2001 - 2500	4	6	20	7	0.8797	13	0.0440
2501 - 3000	2	3	13	4	0.5348	8	0.0411
Totals	67	100	289	100	6.7887	100	0.0235

Source: Field surveys, January-February 1972

or excluding absentees, 0.0250), figures which fall in the middle range of other Chimbu reports (see Table 5.0, Howlett *et al* 1976:107).

Although the amount of coffee planted per household varied considerably, from 0.0085 to 0.2568 ha, no holdings exceeded 0.3 ha, unlike central Chimbu where, as early as 1961, a few leading men had planted as much as one hectare (Brookfield 1968:102). This Waula distribution is, moreover, closely similar to that of a Gunangi clan in south Sinasina described by Hatanaka, where 64 'domestic groups' (with a population of 307) owned an average of 0.073 ha, with a range from 0.006 to 0.225 ha (1972:93, calculated from Table 9.2). Due to differences in the size of Waula households, the range of holding size per household tends to exaggerate the amount of per capita variation. Thus the 13 households which had planted more than 0.15 ha of coffee each, and together owned 38 per cent of all Waula coffee, included 29 per cent of the clan population, whereas the 13 households with less than 0.05 ha each, and a total of only 5 per cent of Waula coffee, had only 14 per cent of Waula's population (Table 6.14).

Per capita differences nonetheless remain in the order of four or five to one. Although the relative availability of land suitable for coffee may explain some of this variation it is unlikely that this is the only factor, as Hughes (1966) pointed out in his study of this question among the neighbouring Kere. Several means of acquiring land are available to persons whose direct patrilineal inheritance is inadequate (see also Brookfield and Brown 1963). A sample of 4.01 ha of Waula coffee showed that 29 per cent (by area) had been planted on land not inherited from the grower's father, suggesting that redistributive mechanisms do operate to soften the vagaries of demographic chance implicit in strict application of patrilineal inheritance. More significant, perhaps, are developmental factors in the growth and decline of household groupings, as signalled by the marked difference in household size at the lower and upper ends of the range in holdings. Seven of the 13 households with little coffee were headed by men over 55 years of age, and a further three by young men who had married only within the past two years.

Unlike the Raiapu Enga where, in 1966, coffee had only recently been planted and holdings had not yet become a "readily identifiable entity within the landscape" (Waddell 1972a:60), Waula coffee plots, and those of Nimai generally, occupied a definite position in the pattern of agricultural land use and settlement. Though planted from 1700 to nearly 2200 m, 98 per cent (by area) were below 2000 m, with most in the 1800-1900 zone (Table 6.15). Similarly, Hughes found 95 per cent below approximately 1900 m among the neighbouring Kere (1966:Appendix 8a, b). The Waula distribution contrasts, however, with that described by Brookfield for the Naregu at Mintima in central Chimbu: whereas 100 per cent of Waula coffee was planted over 1700 m, only 38 per cent of Mintima coffee was (1968:102). Just as coffee is far more restricted by altitude than food crop cultivation, so also is it generally located closer to settlements, with 50 per cent lying within 100 m of the major residences of Waula owners and 85 per cent within 1 km (Table 6.16; cf. Table 6.21).

Food-crop gardens

Garden types

The commonest terms applied by Nimai to food-crop gardens are *kwa gul* (sweet potato gardens), *me kon gul* (taro-yam gardens), and *ige mange komina gul* (literally, house-near-food-garden, hence kitchen or house-yard garden). In addition, the term *komina gul* (food garden) can be used to refer either generically to all food-crop gardens, or, more narrowly, to gardens containing mainly crops other than sweet potato. With the exception of taro-yam gardens, which have a special status, the other categories do not form a rigid classification, indicating unambiguously separate kinds of gardens distinguishable on

TABLE 6.15 Distribution of coffee holdings by altitude, Waula clan and Koge sample

	Waula clan				Koge sample			
	Area		Cumulative		Area		Cumulative	
Altitude m	ha	%	ha	%	ha	%	ha	%
1701-1800	1.74	25.6	1.74	25.6	0.014	1.5	0.014	1.5
1801-1900	3.75	55.2	5.49	80.8	0.741	81.6	0.755	83.1
1901-2000	1.18	17.4	6.67	98.2	0.153	16.9	0.908	100.0
2001-2100	0.08	1.2	6.75	99.4	-	-	-	-
2101-2200	0.04	0.6	6.79	100.0	-	-	-	-
	6.79	100.0			0.908	100.0		

TABLE 6.16 Distance between coffee holdings and major residences, Waula clan and Koge sample

Distance from house metres(1)	Waula clan				Koge sample			
	Area(2)		Cumulative		Area		Cumulative	
	ha	%	ha	%	ha	%	ha	%
0- 100	3.04	46.2	3.04	46.2	0.488	53.7	0.488	53.7
101- 250	0.64	9.8	3.68	46.0	0.019	2.1	0.507	55.8
251- 500	0.46	7.0	4.14	63.0	0.075	8.3	0.582	64.1
501-1000	1.46	22.3	5.61	95.3	0.242	26.6	0.824	90.7
1001-2000	0.81	12.4	6.42	97.6	0.084	9.2	0.908	100.0
2001-4000	0.15	2.4	6.57	100.0	-		-	
	6.57	100.0			0.908	100.0		

(1) Walking times may be converted at approx. 53 m/minute

(2) Reduced from the total of 6.79 ha due to the exclusion of a few plots belonging to absentees (i.e. no major residence in use).

the basis of crop or technique: some small gardens (or plots within them), surrounding, or near, houses may be mainly planted with sweet potato, while more distant, larger 'sweet potato gardens' may either be planted with a catch-crop of other vegetables, or have sections within them allocated mainly to sugar-cane or other crops. In the following account, therefore, I only partly separate those plots (either whole gardens or discrete sections of them), which are mainly planted with subsidiary crops from those primarily containing the staple tuber[10]. First, however, taro-yam gardens may be briefly described.

Taro-yam gardens are special cultivations, made at irregular periods explicitly for the purpose of producing large quantities of these two tubers, and a large variety of other crops, for both 'food

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[10]For this reason I hesitate to follow too closely Brookfield's dichotomization, (1973b:129-130) for central Chimbu, between 'open fields' (sweet potato), and 'mixed gardens' (subsidiary crops). Unlike Waddell (from whom Brookfield seems to have adopted the dichotomy), whose distinction was based on differences in Enga cultivation techniques and terrain, as well as crop types, Brookfield's use of it is based on crop type only. This being the case, the question arises whether the two types are distinct gardens, or successional stages. It is interesting that an early observer, Gitlow, contrasted the crop segregation found in the Hagen area, with the 'mixed' nature of Chimbu gardens where there is "great variety in each garden plot, with the sweet potato and other products mixed in the garden beds" (1947:65). In a recent paper, Komba (1978:12) describes successional planting (cf. Barrie 1956:46-7). A further question concerns Brookfield's later data source, air-photos. Is it possible, one wonders, to distinguish a garden primarily planted with sweet potato, but closely intercropped with corn, if it was photographed at a time when the corn was nearly mature? Further the basic units for his photo interpretation were grid-squares of 0.185 ha. Though he recognises that "(i)ndividual cultivated plots may on occasion be as small as 0.05 ha" (ibid., 133), Sinasina evidence would indicate that for both mixed vegetable sections and the majority of plots worked by individual households, the latter size is closer to reality than the former.

pile' (komina bire) prestations and for use on other major occasions. They are normally large, and involve considerable co-operation and coordination in clearing and fencing. Like large sweet potato gardens, however, they are internally subdivided into many small plots (ginibe), which are cultivated either by households or individuals. They are a garden of lower altitudes, or the ecological zone known as same, an area with which the Nimai consider themselves to be poorly endowed. Indeed, as far as Waula are concerned, Kuai, their most northerly, outlying block of territory which descends to 1650 m (Map 2.4) is the only land considered suitable for such gardens. It was last cultivated for such a garden in 1968 (cleared during May-August, completely planted by October), when a single bounding fence enclosed some 10-15 ha of mixed crops, taro-yam in particular, for use during the 1969 Nimai pig festival. The restricted size of Kuai, however, is highlighted by a comparison with the huge area cultivated in 1971-72 by Tabari groups from the Yobakogl and Emimau settlement areas in preparation for a komina bire in August 1972. This garden (at Dame) covered, at a rough estimate, 100 ha. Like Kuai, it is a north-facing ridgeside of medium slope, overlaying shale (clearly observable in the small streams cutting the ridge flank). Although the past history of taro-yam cultivation at Kuai is not clear (ownership having changed hands during warfare), the periodicity of such mixed gardens is not on a simple shifting cycle consisting of one planting followed by a lengthy fallow. By 1971, although much of the upper dryer, slopes were under grassy fallow, a large proportion of the lower part, within a shrunken fencing system, was under sweet potato (and, in some parts, other mixed crops). Some was still under cultivation as late as May 1973.

Sweet potato and other vegetable gardens: a general description

At any one time, a Nimai household has under cultivation a number of food-crop gardens, spanning a range of altitudes, which vary according to size, age (length of cultivation), tenure status, crop mixture and other characteristics. As studies in other parts of Chimbu show, restricted observations from short-term research are not sufficient for analysis of the complex long-term operation of such a system (Brookfield 1973b), and the following description is therefore only summary.

There is no sharply defined annual cycle of garden preparation. Some clearing and fencing was observed throughout the year. These tasks, both mainly carried out by men, vary according to the length of fallow, the type of secondary vegetation cover, and where the garden is located in relation to the larger enclosure system (Chapter 5). In the case of new gardens made after a lengthy fallow, both tasks may be undertaken by means of 'formal' work parties. In other cases they are more usually carried out by an individual and members of his household, often assisted less formally, by one or two other helpers. During 1972-73, none of the Koge sample households (and, to my knowledge, no Waula) cut new gardens in either forest or substantial woody secondgrowth. All sites were under either short grass, or *Miscanthus* swordgrass and *Casuarina*, or small woody shrubs. Preliminary clearing of shrubs, small trees, and *Miscanthus* is done with bushknives and axes, but the major work of clearing *Miscanthus* is undertaken with long-handled spades[11]. Cut trash is allowed to dry and then burnt. Timber is used for fencing, firewood (a number of Casuarina trees are usually only ringbarked, not felled), and other tasks, and Miscanthus may also be collected for construction work.

Several months may lapse between the initiation of work on a site, and the start of planting. The most extreme case observed was a large new garden at Araul (Map 6.1), where preliminary clearing and most fencing was carried out by a large work party of 18 Waula men and youths in December 1971, but no further work was done until October of the following year. Planting did not begin until February 1973. Final clearing, breaking of the ground, and planting may be carried out at the same time. In the past, ritual marked the 'opening' of a new garden to women for planting, but this has largely lapsed, or, when it occurs, is now a low-key, private, matter. When clearing is complete, the ground is broken to a depth of a few cms and small mounds, measuring approximately 20 cm high are made at densities ranging from 1.5 to 1.8 per m^2. This is primarily the task of women, who, as they till and make the mounds (with small spades and digging sticks), clear the remaining trash which they burn off in small fires between the newly made mounds. The mounds are usually planted immediately; either a digging stick or spade is thrust into the mound, four or five slips of sweet potato pushed in, and the mound patted down by hand or spade. Only in low altitude areas,

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[11]This tool, acquired by most men from the mid 1950s, now plays a vital part in Nimai cultivation. Before use, Nimai replace the short handle with a longer one, and, after heating, flatten the blade. The latter is then filed to a razor-sharp, carefully maintained, edge.

where the land is swampy or liable to waterlogging, do Nimai employ the gridiron ditching technique of land preparation common to the west (Brookfield and Brown 1963:43-6). Nimai say they ditch only for the purpose of drainage. This technique is therefore restricted to the flat watershed area from Yoba airstrip east to the Kere border (mainly Bomai and Ogole land), and to the north-facing slope bottoms of such areas as Kuai and Igai. Over the remainder of Nimai territory, complete tillage with small mounds is the dominant form of land preparation for sweet potato cultivation. Less patterned drainage, and small run-off, ditches, and soil-retention devices are employed in accordance with local soil and slope conditions.

This description has not considered the size of an area brought into cultivation. This is highly variable, depending on the number of households which either co-operate to clear and cultivate a particular area belonging to one person, or co-ordinate their activities in a general area in which their claims adjoin each other. Thus the range is from, at one extreme, a few hundred m^2 cultivated by a single household, to, at the other, a whole ridgeside of many hectares containing gardens belonging to many households.

Sweet potato is the major crop. Many different varieties are distinguished (Hide _et al_. 1979:23-5) with recognition taken of such qualities as yield, hardiness to varying conditions, taste and texture. Some are grown primarily for pig fodder, others regarded as prime human food. New varieties are sought, and distributed through personal networks of kin and neighbours. Most of the presently cultivated varieties are said to have been acquired during the colonial period. Despite the large total number of varieties currently recognised, the numbers appearing in any one plot range, on the basis of a small sample, from 5 to just over 20 (mean 11), with two or three predominating (Table 6.17)[12]. Maturation periods vary considerably, with altitude probably the major determinant: during 1972-73, 6 months at 1800 m, and 7-8 months at 2000 m were recorded.

Although the dominant impression of 'sweet potato' gardens is that of mono-culture, this can be deceptive since other subsidiary crops, their number and variety dependent on such factors as previous fallow length, garden age, time of cultivation, altitude and soil, are also interplanted with the tuber staple. Taking the degree to which other crops are segregated from sweet potato as the major criterion (cf. Waddell 1972a), three strategies of interplanting in sweet potato gardens can be recognised. Subsidiary crops may be planted as a non-segregated catch-crop interspersed widely throughout a garden; they may be partially segregated in discrete clumps, or they may be

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[12]These findings are similar (though the two main varieties are different, or at least differently named) to those of an earlier investigation by the nutritionist, K.V. Bailey, at Waiye (just west of Kundiawa), whose report (dated 9 July 1963), was seen by the kind permission of A.G. Kimber at the Highland Agricultural Experiment Station at Aiyura (see Hide _et al_. 1979:23-25). Whether Nimai gardens were previously dominated by a couple of varieties is a moot question. According to Meggitt (1960:104), the Mae Enga, who had cultivated 8-10 varieties in an average garden in the mid-1950s had, a few years later, reduced this to two or three and had given up many of their older varieties. Without quantitative backing this generalization is difficult to evaluate (cf. Table 6.17 showing an average plot to have 11 varieties, although marked by the predominance of two).

TABLE 6.17 Frequencies of mounds planted with five major sweet potato varieties in five garden plots(1)

	Plot A		Plot B		Plot C		Plot D		Plot E		Total plots	
No. of mounds in plot	120		169		111		87		132		619	
No. of varieties planted	21		12		10		7		5		28	
Varieties	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%
ogangi(2)	1	38.3	1	44.4	1	50.4	5	8.0	1	64.4	1	43.5
nilgi(2)	2	17.5	2=	10.6	-	-	1	44.8	2	29.5	2	18.9
nambawangi	5=	4.2	2=	10.6	2	10.8	2	21.8	-	-	3	8.7
wangi	5=	4.2	2=	10.6	10	0.9	3	11.5	-	-	4	5.5
konimagi	11=	1.7	-	-	6	6.3	4	10.3	-	-	5	2.9

(1) The plots ranged in size from c.54 m^2 to 140 m^2 (i.e. mound density was approximately 1·5 per m^2) The altitude range was narrow: Plots A, C, D, and E were all at 1840 m., Plot B at 1950 m. Variation in the planting frequency of different varieties by altitude, soil, and characteristics of gardener would be interesting to explore with a larger sample.

(2) Subtypes of both recognised (pege and gol in both cases), but not consistently so in this small survey. However, ogangi gol was definitely more numerous than ogangi pege (161 mounds and 99 respectively).

totally segregated in separate sections (ginibe) of a garden. When a new garden is planted during the dry months it is not uncommon for the gardener to schedule a catch-crop planting of corn (in particular), which is extensively planted throughout the garden between the sweet potato mounds. For example, one sweet potato plot of 111 m^2, at just over 2000 m, which contained, in early February 1972, some 169 sweet potato mounds had 27 plantings (each consisting of 2-3 plants) of corn scattered between the mounds. Although I lack specific information on this point, it is not, I think, usual to intercrop in this manner after the first planting of sweet potato. The commonest form of interplanting is to make use of the concentrated ashes left by the small heaps of trash burned off (mole gangwa) during the final clearing and planting of sweet potato by women. These small ash-beds, measuring approximately 0.6 to 1.2 m^2, may be interspersed among the sweet potato mounds at densities ranging from 2 to 7 per 100 m^2. Each ash-bed is usually planted with an assortment of vegetables, squashes, and legumes, and (although I am unsure on this point), it is possible that successional planting is practised in them. Taking the 111 m^2 garden section described above as an example, this contained, in addition to the sweet potato and interplanted corn, 3 ash-beds, each containing 2 or 3 cabbages, 5-14 peas, 5-6 Setaria palmifolia, the odd pumpkin, and some Amaranthus spp. I have also seen old ant, or termite, mounds used in the same way as ash-beds.

Total segregation of subsidiary crops probably occurs most frequently where significant variation of slope within a garden determines variable soil quality and depth. In such cases, small, but usually totally segregated sections of the garden on deeper, wetter, soils at the bottom of slopes, or in dips elsewhere in the garden, may be reserved for plantings of taro, sugar-cane, bananas, or a combination of these and other plants. In addition, but also in cases where no single section is reserved in this way, the edges of drainage ditches and other favourable locations are often used for smaller, more scattered plantings of the same crops.

Non-staples are also planted in house-, or kitchen-, gardens made in the immediate vicinity of a house (old house-sites, after a house has been moved or re-built, are a favoured location). These are generally very small plots, containing a large diversity of species. Where space is restricted, as in main settlement areas such as Koge or Iremil, sweet potato is noticeable by its absence, though in other locations it may outnumber mixed crops.

Between planting and harvesting, the main tasks are weeding in the case of sweet potato and other minor crops which are both mainly carried out by women, and, for men, the staking and supporting of sugar-cane and some other crops. The intensity of weeding varies according to soil and climatic conditions, peaking, it appears, during the wet season (and before the sweet potato vines have succeeded in providing a continuous ground cover). When cropping begins, weeding is carried out during the course of harvesting visits. When sweet potato vine growth is very heavy, they may be trained up short (1-1.5 m) stakes, giving the appearance of a stunted yam garden (this practice was seen in only parts of three gardens in 1972-73: it may increase productivity, see Hide _et al_. 1979:25). Some sweet potato weeding is very intensive, involving the opening of a small concavity in the top of mounds to expose the lower ends of the vines[13]. It may be that this is done when large tubers are sought for a prestation.

Sweet potato plants are harvested progressively. Thus special care is taken not to harm the growing plant and loud complaints were heard voiced by women on finding that an impatient or inexperienced daughter had 'ruined' a crop. Further tubers are also gained from old gardens in which running vines are allowed (and encouraged) to take root. Insufficient information was collected concerning the factors determining whether a garden (or a section of it) will be replanted, and the duration of very short (less than 1 year) fallows. Tenure is, however, important in this context. Where a garden owner has granted the use of a section (ginibe) to others, the right to use these appears to revert to the garden-owner when the first planting has been harvested.

Cultivations of the Koge sample

More detailed statements are possible for the cultivations of the Koge sample households between June 1972 and March 1973. As surveyed in June 1972, these households had a total of 4.4 ha under

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[13] Dr. D. Yen (pers. comm. 2 April 1974), noting that some New Guinea varieties of sweet potato are profusely rooted at the stem nodes close to the crown of the plant, suggested that the technique may disturb adventitious root development along stem nodes, thus allowing most of the energy of the plant to be directed toward tuber development at the main root.

cultivation, or 0.11 ha per person (Table 6.18), of which 79 per cent was planted to food crops, and 21 per cent to coffee. Similar figures were calculated nine months later (coffee was not re-surveyed and was assumed to be unchanged). The per capita amounts of 0.08-0.09 ha for food crops appear low by comparison with some other figures from the Chimbu Province (Table 6.19), but it is unlikely that researchers have used the same definitions of "cultivated area" (see Table 6.19, note 4; Appendix 6), and thus comparison is difficult.

As described above, the gardens of a Nimai household include cultivations on land to which the household head holds primary rights, as well as sections within gardens belonging to others. In the following analysis by household, I refer to both kinds of garden as 'plots', to give some measure of the fragmentation and dispersal of a household's agricultural activities. A 'plot' therefore means a spatially separate area under cultivation (if a household has two sections within the same garden of another household, they are counted here as one 'plot'). Initially, I am concerned only with plots in which the predominant crop was sweet potato, and thus exclude a small number of kitchen gardens.

Between June 1972 and March 1973, nine households of the Koge sample (F, the bachelor, had no sweet potato gardens) had a total of 71 sweet potato plots under cultivation from which they harvested sweet potato, and a further 8 which had been planted but were not yet producing by March 1973. Table 6.20 lists these plots, by household, detailing the frequency with which they were harvested

TABLE 6.18 Area under cultivation (Koge sample)[1]

	June 1972		March 1973	
	ha	%	ha	%
By major crop				
Sweet potato	3.3186	75.6	3.5529	77.4
Other vegetables	0.1617	3.7	0.1269	2.8
Subtotal	3.4803	79.3	3.6798	80.2
Nut pandanus	(no survey)		(no survey)	
Coffee	0.9078	20.7	0.9078	19.8
Total	4.3881	100.0	4.5876	100.0
Mean areas				
Per household				
Food crops[2]	0.3867	-	0.4089	-
Coffee[3]	0.1009	-	0.1009	-
Total	0.4876	-	0.5098	-
Per person				
Food crops[4]	0.0849	-	0.0876	-
Coffee[5]	0.0245	-	0.0239	-
Total	0.1094	-	0.1115	-

[1] See Appendix 6, section 4 for discussion of problems.

[2] Nine households only (J, the bachelor, excluded).

[3] Nine households only (D, recently returned from 15 year absence excluded).

[4] 41 in 1972, 42 in 1973 (J, the bachelor, excluded).

[5] 37 in 1972, 38 in 1973 (Household D excluded, see footnote 3).

TABLE 6.19 Areas under cultivation at four Chimbu locations

Region	Group and/ or location	Year	No. of persons	Under cultivation ha/person			
				Food crops	*karuka* pandanus	Cash crops[2]	Total
Sinasina	Kere Kui	1965-6	18	.073	.024	.049	.146
Sinasina	Kere Dege	1965-6	25	.166	.166	.020	.352
Sinasina	Gunangi A	1969	5	.110	n.a.	.019	.129
Sinasina	Gunangi B	1969	5[3]	.044	n.a.	.018	.062
Chimbu valley	Womkama	1964?	44	.232[4]	.016	n.a.	.248
Central Chimbu	Naregu	1958-9	68	.119	.008	.005	.132

[1] Sources: Kere, Hughes (1966, Table 8, Appendix 8); Gunangi, Hatanaka (1972:99); Womkama, Criper (1967:56, 59, 61, Tables 4, 5); Naregu, Brown and Brookfield (1959: 30, Table 8). For a larger sample of 93 landholders, Brown and Brookfield give a lower figure of 0.93 ha/food crops only/per capita (ibid., 26, 29, 31), but, in a recent publication, Brookfield gives a much higher figure of 0.18 ha/food crops/per capita for an estimated population of 870 (Brookfield 1973b: Table 6.4, p. 156). In all cases I have converted from the original figures which were in acres.

[2] Coffee only, with the exception of the Kere Dege figure which includes some pyrethrum.

[3] Part only of a polygynous family which may explain the very low food crop area.

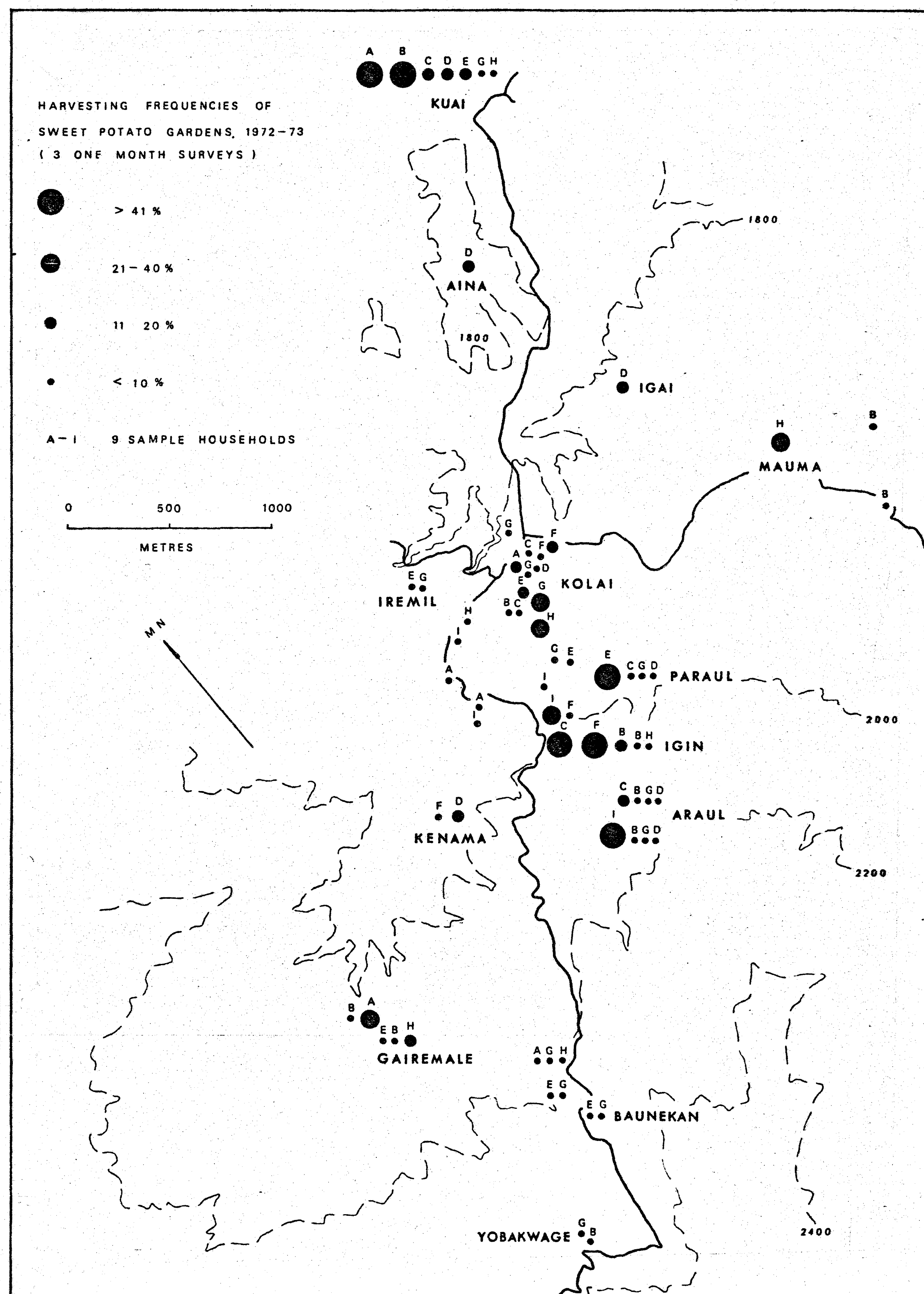
[4] Criper (ibid., 55-6) defines all "enclosed land" as cultivated.

TABLE 6.20 The number, and harvesting frequency, of sweet potato plots cultivated by 9 households (June 1972 - March 1973)

Households	Total number of times tubers harvested	Plots cultivated by households																	Other plots	
		Harvesting Frequencies														No. of plots				
				Older plots					Major plots			Newer plots				producing	Not producing	Total	Harvesting frequency	No. of plots
E	111	–	–	–	–	4.5	7.2	11.7	44.1	15.3	3.6	1.8	0.9	–	–	8	1	9	10.8	8
A	50	–	–	–	–	2.0	2.0	2.0	44.0	38.0	12.0	–	–	–	–	6	1	7	–	–
B	129	–	–	–	1.5	4.6	4.6	10.1	45.7	14.7	4.6	3.1	2.3	1.5	0.8	11	1	12	5.4	4
C	75	–	–	–	2.7	4.0	5.3	14.7	56.0	10.7	–	–	–	–	–	6	1	7	6.7	4
F	69	–	–	–	–	2.9	7.2	15.9	52.2	8.7	–	–	–	–	–	5	1	6	10.0	5
G	97	3.1	4.1	6.2	6.2	6.2	9.3	9.3	21.6	9.3	5.1	4.1	3.1	2.1	–	13	–	13	10.3	7
D	93	–	–	–	1.1	7.0	10.7	12.9	19.3	16.1	9.7	7.0	–	–	–	8	1	9	16.1	11
H	103	–	–	–	2.9	3.9	3.9	4.8	32.0	21.4	10.7	1.0	–	–	–	8	1	9	19.4	12
I	74	–	–	–	–	2.7	4.0	4.0	43.2	29.7	4.0	–	–	–	–	6	1	7	12.2	6
Average household		–	–	–	3	4	6	10	40	18	5	2	–	–	–	8	1	9	10	6

during the three surveyed months, and their relative age. Over 9 months the 'average' household harvested from 8 plots cultivated by its own members, had one more which was not yet producing, and, in addition, harvested on several occasions from plots cultivated by other households. Typically, the 8 producing plots were not equally significant: one was harvested on 40 per cent of all occasions, or rather more than twice as frequently as the next most important one, with the remaining 6 receiving only 30 per cent of all harvesting trips. Only three households (G, D, and H) did not have a single, major, plot which was harvested as frequently as 40 per cent.

The approximate locations of these plots (excluding one in the territory of the Kere to the east) within Nimai territory are plotted on Map 6.1. They were dispersed over an area stretching 6 km from north to south, and 4 km from east to west. Although spanning a wide altitudinal range (1650-2350 m), most plots fell within the 1800-2200 m zone (76 per cent, by area, in June; 87 per cent, in March: see Appendix 6, Table A6.11 for fuller details). Given the overall ruggedness of Nimai terrain, it is no surprise that nearly half this cultivated area was on slopes of over 20 degrees, just under a quarter on slopes over 30 degrees (Appendix 6, Table A6.12). Distance from major residence provides a different measure of dispersal. Table 6.21 shows that only one quarter of such cultivation (19-25 per cent) lay within 1 km of the residences of the sample households, and some 60-63 per cent within 2 km. In contrast, Brown and Brookfield found, for two central Chimbu samples in 1958 and 1965, that 50 per cent of food crop cultivation lay within 460 m of the cultivators' residence,



Map 6.1 Producing sweet potato gardens of Koge sample : locations and relative significance (June 1972 - March 1973)

TABLE 6.21 Percentage of sweet potato cultivation distant from major residences (Koge sample)

Distance from house (m)	At June 1972				Planted June '72-May '73				At May 1973			
			Cumulative				Cumulative				Cumulative	
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
0- 100	.06	1.8	.06	1.8	.16	10.7	.16	10.7	.20	5.6	.20	5.6
101- 250	.18	5.4	.24	7.2	.02	1.3	.18	12.1	.03	0.8	.23	6.5
251- 500	.09	2.7	.33	9.9	-	-	.18	12.1	-	-	.23	6.5
501-1000	.51	15.4	.84	25.3	.13	8.7	.31	20.8	.44	12.4	.67	18.9
1001-1500	.44	13.2	1.28	38.5	.34	22.8	.65	43.6	.82	23.1	1.49	42.0
1501-2000	.74	22.3	2.02	60.8	.31	20.8	.96	64.4	.75	21.1	2.24	63.1
2001-3000	.99	29.8	3.01	90.7	.38	25.5	1.34	89.9	.89	25.1	3.12	88.2
3001-4000	.23	6.9	3.24	97.6	.08	5.4	1.42	95.3	.26	7.3	3.39	95.5
4000-	.08	2.4	3.32	100.0	.07	4.7	1.49	100.0	.16	4.5	3.55	100.0
	3.32	100.0			1.49	100.0			3.55	100.0		

TABLE 6.22 Tenure status of currently cultivated food crop gardens

Primary rights to land held by member of husband's	Garden plots of 67 women[1]		Sweet potato gardens of 9 women[2]	
	No. of plots	Per cent	Area (ha)	Per cent
Own/extended family	255	65.4	2.20	66.5
Clan	66	16.9	0.75	22.7
Tribe	23	5.9	0.23	6.9
Other tribe	46	11.8	0.13	3.9
Total	390	100.0	3.31	100.0

(1) December 1971-January 1972

(2) June 1972

and 75 per cent or more within 1370 m (1967:133-4).

In June 1972 two thirds (by area) of the sweet potato cultivations of the sample were made on land which either belonged to each household head or was held jointly by him with his own father or brothers. As Table 6.22 shows, a similar proportion obtained for the plots cultivated by the majority of Waula women at the beginning of 1972. It might be expected, given the fragmentation and dispersal of holdings, that borrowing land provides a means of locating gardens closer to residences, as Chisholm (1967:71) has described for peasant Europe and Asia. This does not appear, however, to be the case at Koge: most of their borrowed land lay more than 1500 m from their major residences (Table 6.23).

Table 6.24 shows that the amounts of land under food crop cultivation by the sample households ranged from a low of .156 ha to a high of .764. Statistical investigation of such variation has been pioneered, in Melanesia, by Pospisil (1963:184-191). In his analysis of cultivation by the 16 households of the Kapauku community of Botukebo in the highlands of Irian Jaya, he found a significant, but not particularly strong, correlation (of 0.56) between the size of households (described as primarily units of consumption rather than production), and their cultivated areas. Pospisil further analysed, using both simple and multiple correlations, the unexplained variation, focusing on the composition of households in terms of specific categories of workers. This, however, still left some 29 per cent of the variability unexplained, which Pospisil related to

TABLE 6.23 Distance of borrowed land from major residence of borrowing household[1]

Distance from borrower's residence (m)	Area borrowed		No. of households which borrowed	Area borrowed (ha) per borrowing household
	Total ha	As % of land in distance class[2]		
501 - 1000	.0654	13.1	4	.0164
1001 - 1500	.0433	10.7	1	.0433
1501 - 2000	.2089	37.4	3	.0696
2001 - 3000	.3657	40.2	5	.0731
3001 - 4000	.0911	39.2	2	.0456
> 4000	.0763	100.0	2	.0382
Totals	.8507	28.4[3]	6	.1418

(1) N = 8 households of the Koge sample (excluded J, a bachelor with no sweet potato cultivation, and D, which had recently returned from a 15 year absence.

(2) Land cultivated by the 8 households (cf. Table 6.21)

(3) Percentage of all land cultivated by the 8 households.

TABLE 6.24 Koge sample households: actual and relative cultivated areas, household composition and size, and dependency ratios

Households	Area of (ha) food crop cultivation[1]		Household composition					Total household size		Dependency ratios	
			Humans			Pigs		Crude	Adjusted	Human	Total
	Per household	Per WU[2]	No.	HCU[3]	WU[2]	No.	PU[4]	Persons and pigs	HCU and PU	HCU/WU	HCU and PU/WU
B	.7635	.3181	5	3.8	2.4	11.0	5.7	16.0	9.5	1.58	3.96
E	.4826	.1508	6	4.5	3.2	6.3	2.8	12.3	7.3	1.41	2.28
G	.4820	.1928	6	4.0	2.5	4.0	2.8	10.0	6.8	1.60	2.72
A	.4091	.2046	5	3.1	2.0	7.3	3.8	12.3	6.9	1.55	3.45
I	.3671	.1468	5	3.3	2.5	2.6	2.3	7.6	5.6	1.32	2.24
D	.3483	.1393	5	3.4	2.5	1.7	1.8	6.7	5.7	1.36	2.08
C	.3077	.1539	2	1.8	2.0	6.7	3.9	8.7	5.2	0.90	2.85
H	.2638	.0879	4	3.2	3.0	4.0	1.8	8.0	5.0	1.07	1.67
F	.1563	.0781	3	2.2	2.0	2.0	1.3	5.0	3.5	1.10	1.76
Totals	3.5807	1.4723	41	29.3	22.1	45.6	26.2	86.6	55.5	-	-

(1) Mean, June 1972 and March 1973 (see Table A6.10, Appendix 6).
(2) WU= worker unit (see Appendix 6, pp. 603 ff).
(3) HCU = Human consumer unit (see Appendix 6, pp. 603 ff).
(4) PU=Pig unit (see Appendix 6, pp. 603 ff).

the "personal industry of individuals, different fertility of garden plots and so forth" (ibid., 190). Sahlins, in a comparative study (1971, 1972), combined Pospisil's finding that cultivated areas were more closely related to consumption needs than labour potential, with Chayanov's statement that "the greater the relative number of consumers, the more each producer will have to work to provide an acceptable per capita output for the household as a whole" (1971:30). Sahlins focused, however, not on correlations of actual cultivated areas with measures of actual household composition, but rather on the relationship between relative measures of household productive intensity (area cultivated, or crops produced, per worker) and the relative working capacity of households (the ratio of consumers to workers). I am not concerned here with his ingenious explorations of deviations from the Chayanov norm [14]. Instead, I wish to utilise both actual and relative measures of cultivated area and household composition in an attempt to understand the range of empirical variation shown by the Koge households. It is, however, worth noting that Sahlins' analyses of Melanesian materials (from Kapauku and Tsembaga Maring) show very weak correlations between the intensity of work and the working capacity of households (1971:43,46), and Sahlins devoted some effort to establishing "typical" patterns from his scattergram plots. The latter enterprise I regard as probably misplaced: examination of his materials indicates a very large range of variation in working intensity (nearly 8 fold in the case of

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[14] For further discussion, see Evans (1974). For application in Melanesia see Mackinnon (1976) and Boyd (1975). I acknowledge discussions with David Boyd on this subject in 1973-74, when we were both exploring the use of Sahlins' technique.

Kapauku, and 5 fold in the case of Tsembaga), and a very restricted range in working capacity (less than 2 to just over 2, respectively). In other words, the amount of difference between households' working capacities (as measured by the consumer/worker ratio) were slight and apparently not systematically related to working intensity.

The actual areas cultivated by the Koge households correlate poorly with either crude household size (where Y = area cultivated, and X = number of persons in household, $Y = 0.0599 + 0.0742X$, $r = 0.58$, $r^2 = 0.33$), or, when age and sex of household members are taken into consideration, with adjusted household size (where Y = area cultivated, and X = number of human consumer units in household, $Y = 0.1319X - 0.0316$, $r = 0.65$, $r^2 = 0.42$). Given the well-known fact that highlanders feed considerable quantities of cultivated sweet potato to their pigs (Rappaport 1968:61; Waddell 1972a:119), this is not unexpected. The only measure of the consumption requirements of households which is likely to relate closely to cultivated area is one which takes account of the numbers of pigs held. Their inclusion in the Koge data results in much stronger correlations. Crude household size, including pigs, provides a good predictor of cultivated area (where Y = cultivated area, and X = numbers of persons and pigs, $Y = 0.0471X - 0.0554$, $r = 0.93$, $r^2 = 0.87$), and adjusted household size (human consumer units and pig units)[15], an even

[15] See Appendix 6 (pp.603ff), for description of the method used to establish these equivalents.

better one (Fig. 6.3)[16]. That adjusted household size does not correlate better with the area planted between June 1972 and March 1973 (Fig. 6.4), is due, I think, to the inadequacies of the latter data (see p. 614).

Given these correlations, no close relationship would be expected, and none is found, between, following Sahlins, the consumer/worker ratio and the area cultivated per worker (Fig. 6.5). However, when pigs are included in the consumer category, the 'total dependency ratio' (human consumer units plus pig units/worker units) correlates well with the area cultivated per worker (Fig. 6.6).

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[16]This is of course a tiny sample and therefore extrapolation of this equation using these values to wider populations is not warranted.

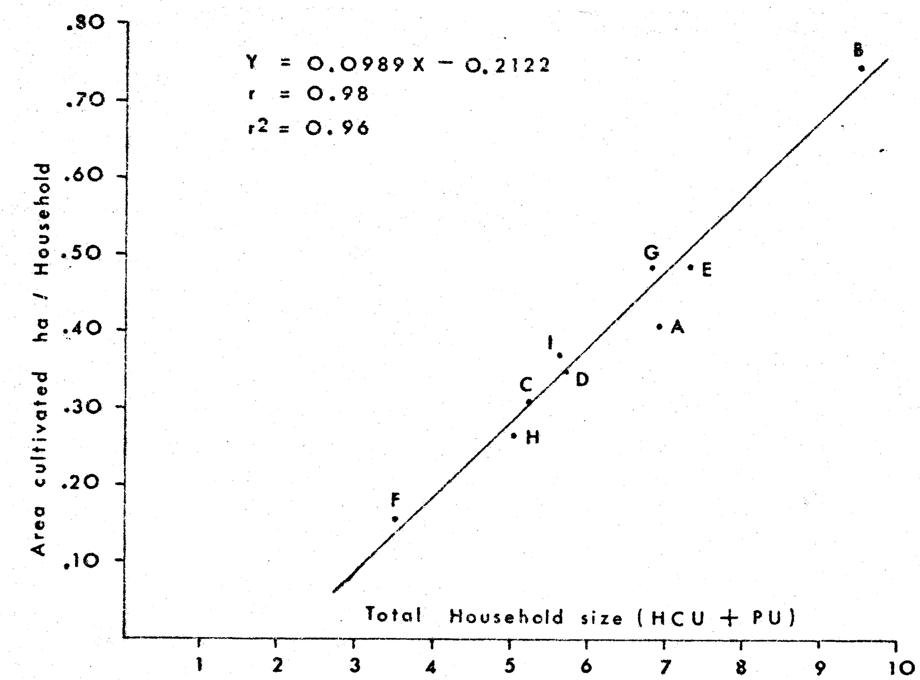

Fig.6.3 Relationship between foodcrop area cultivated and total household size

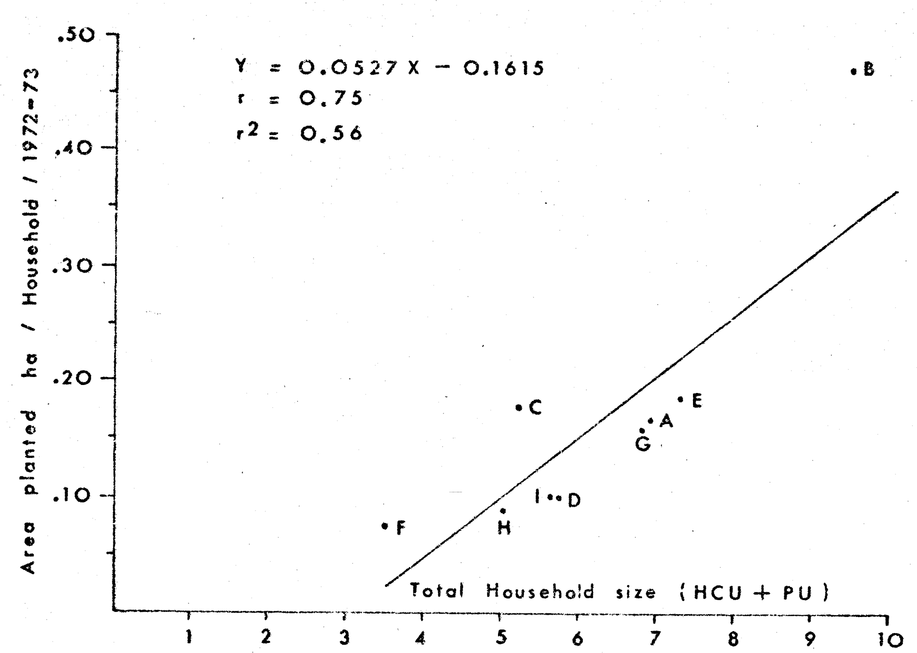

Fig.6.4 Relationship between foodcrop area planted and total household size

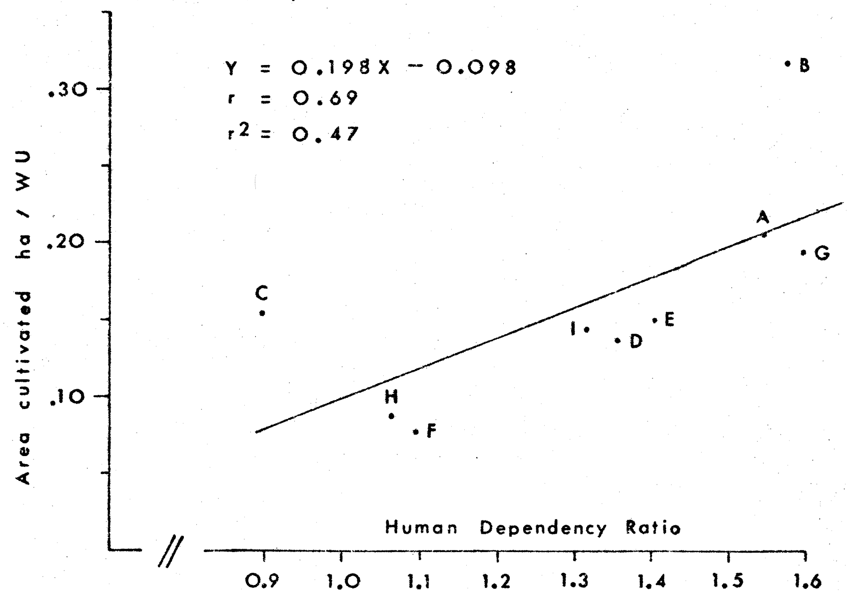

Fig.6.5 Relationship between foodcrop area cultivated and human dependency ratio (HCU : WU)

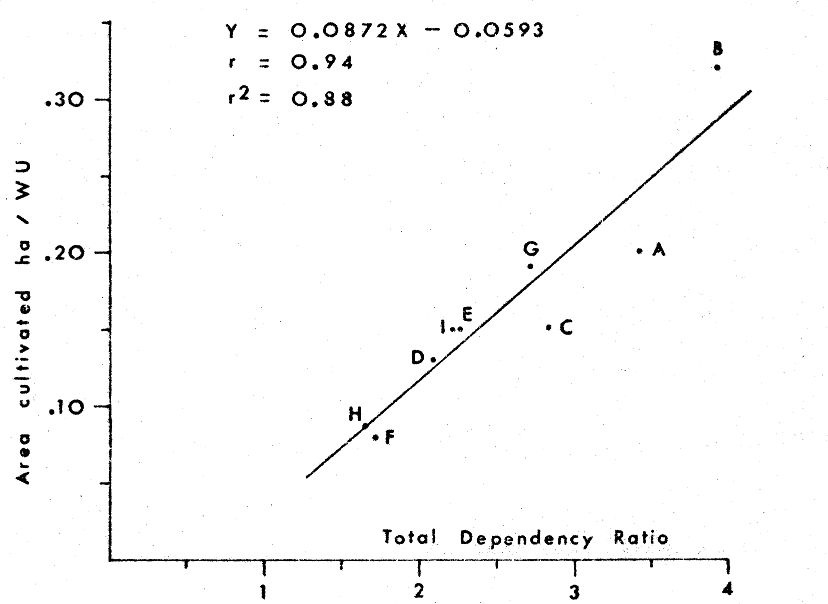

Fig.6.6 Relationship between foodcrop area cultivated and total dependency ratio (HCU + PU : WU)

LIVESTOCK

General

Before 1933 Sinasina tended domesticated pigs, dogs and chickens. Although all three were eaten, only pigs were primarily kept for slaughter. Dogs were useful for watch-keeping and hunting, and fowls provided feathers used for ornamentation. Wild, or feral, pigs, though known from areas to the south, were not present in Sinasina. A few tame cassowaries and sulphur-crested cockatoos, both of which were plucked for their feathers, and the occasional other bird and marsupial were also kept. These were not bred, but were all acquired by trade and prestation from other areas where they were captured when young.

By the early 1970s all of these animals and birds had been retained. The domesticates had been crossbred with introduced stock, and cats, cattle, goats, ducks, and a very small number of sheep, added, in approximate order of numerical importance, to the local inventory. Some fish ponds were built in the 1960s, but none survived into the 1970s. During 1972-73 no cattle were kept by any member of Nimai. No goats were held by Waula members, although a few were kept by other Nimai. Chickens were occasionally kept in small numbers by several households, but were constantly harried by dogs, of which Waula had approximately 30-40. Cats were not common (although a feral population has been established), being outnumbered several times by dogs. Cats, dogs, and, to a lesser extent, pigs, shared the same domestic quarters as people. Chickens were usually kept in small pens because of the dangers of theft and dogs. Cassowaries, cockatoos and parrots are rarer. In 1972-73, there was one of each kept by Waula at Koge. Cassowaries are kept in small firmly constructed pens. The wings of both parrots and cockatoos are clipped. While the Waula cockatoo roosted on rooftops or trees on the settlement site, the valuable parrot (a Pesquett's parrot, Psittrichas fulgidus)was enclosed at night in a small hutch built some 2 -3 m above the ground behind its owner's house. Both are the target of thieves and dogs, and neither of the Waula ones survived to May 1973. With the exception of pigs, then, the numbers of other domesticated and tame animals and birds are small. None receive special foods, all mainly sharing food prepared for humans, with the addition of peelings, and scraps. The bulk of their diet is sweet potato and what they forage for themselves (excluding the permanently penned cassowaries).

Culturally, and ecologically, pigs are by far the most significant domestic animal. They are necessary for the celebration of most important events, and, as items of wealth, they are used for trade and in many payments and prestations. As described in Chapter 4, their monetary value has persisted while that of most other wealth items has declined. They are owned or kept by most households, and their overall numbers, though varying according to pig festival cycles, approach or exceed those of the human population. Their management imposes major constraints on the organization of land use, not only because of the threat they pose, as mobile omnivores, to cultivations (Chapter 5), but also because they require rations of cultivated foods. I describe their feeding in Chapter 7, and aspects of their general production and use in Chapter 8. Here I am concerned with their management by households, particularly in relation to settlement and land use.

Pig ownership and management

Households are the major units of pig ownership and management[17]. The practice of agistment makes necessary a distinction between the pigs owned, and the pigs held, by household (i.e. not all the pigs held by a household may belong to it, nor, conversely, may all the pigs it owns by held by it). Although the number of pigs held and cared for by a household is the most relevant information for analysis of management strategies, both are necessary for initial description of the distribution of animals among households.

Censuses of Waula pigs during 1972-73 (Appendices 1, 6, 7) showed that only one of every ten households owned, and held, no pigs (Table 6.25). The average number of pigs owned per household was approximately 3.5, the average number held a little less at 3.3 Both distributions were similarly uneven. Fifty per cent of households

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[17]Nominally, some animals are sometimes spoken of as belonging to household members other than the household 'head' (usually the most senior man), i.e. even young children. A wife occasionally takes the initiative in acquiring a pig (see p.516). However, most rights of disposal are held by the household head, although it is unlikely that 'his' decisions are taken without close deliberation with his wife. Unattached, or 'semi-attached', widows are, I think, the only women who may regularly own and dispose of a few animals in their own right. It may also be noted that a household's right to dispose of its animals is not fully autonomous, but is circumscribed in some contexts by the claims of relatives and exchange partners, and by the policies of wider groupings to which the household belongs (Chapter 8).

TABLE 6.25 Size distributions of Waula household pig herds (owned and held) in May 1972 and April 1973

Herd size (no. of pigs)	May 1972						April 1973					
	Owned			Held			Owned			Held		
	Households		Pigs	Households		Pigs	Households		Pigs	Households		Pigs
	No.	Cumulative Per cent	Cumulative Per cent	No.	Cumulative Per cent	Cumulative Per cent	No.	Cumulative Per cent	Cumulative Per cent	No.	Cumulative Per cent	Cumulative Per cent
0	4	6.3	0	6	9.5	0	7	10.4	0	8	11.9	0
1	14	28.5	6.3	12	28.5	5.8	15	32.8	6.1	16	35.8	7.2
2	11	46.0	16.3	12	47.5	17.3	11	49.2	15.1	9	49.2	15.3
3	8	58.7	27.1	10	63.4	31.7	4	55.2	20.0	5	56.7	22.1
4	7	69.8	39.8	7	74.5	45.2	6	64.2	29.8	8	68.7	36.5
5	8	82.5	57.8	7	85.6	62.0	9	77.6	48.2	9	82.1	56.8
6	4	88.9	68.8	3	90.4	70.7	3	82.1	55.5	1	83.6	59.5
7	-	-	-	-	-	-	4	88.1	66.9	4	89.5	72.1
8	2	92.0	76.0	1	92.0	74.5	2	91.0	73.5	3	94.0	82.9
9	3	96.8	88.2	3	96.8	87.5	3	95.5	84.5	2	97.0	91.0
10	-	-	-	-	-	-	1	97.0	88.6	2	100.0	100.0
12	1	98.4	93.7	1	98.4	9.30	1	98.5	93.5	-	-	-
14	1	100.0	100.0	1	100.0	100.0	-	-	-	-	-	-
16	-	-	-	-	-	-	1	100.0	100.0	-	-	-
Totals	63	-	(n=221)	63	-	(n=208)	67	-	(n=245)	67	-	(n=222)

Source: Field censuses.

owned no more than 20 per cent of all Waula pigs, while the 10 per cent of largest pig owners owned 30 per cent[18]. Although these overall distributions remained stable throughout the year, the herd sizes of many households (both owned and held) altered considerably. As Table 6.26 shows, only about a quarter of 63 households maintained stable-sized herds during 12 months. Of the remainder, about equal numbers registered increases and decreases. The magnitude of some of the changes indicates that the number of animals owned or held at one moment in time is unlikely to be a reliable index of longterm differentials in wealth or status. As a rough indication of the amount of flux in the Waula herds during 1972-73, changes in the smallest and largest (owned) herds may be compared. Of the 18 households owning 0-1 pigs in May 1972, 13 still did so in April 1973. Replacing the five households whose herds had increased were seven whose herds declined (and an additional two, newly formed, households). At the other end of the scale, of the seven households owning 8 or more pigs in 1972, only three still did so a year later (the herds of the other four dropped to 5-7 pigs each). Five other households, whose herds ranged in size from 2-6 in 1972, increased theirs to top eight. In short, rather more change was evident among households with larger herds.

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[18] Comparison with distributions from other highland areas is difficult due to the use of different bases (i.e. individual owners rather than households), and in some cases, uncertainty whether reference is to animals held or owned. Nevertheless, it is interesting that rather similar patterns are shown by Bowers (1968:101), Cook (1967, Appendix 14), and Salisbury (1962:92). Hatanaka's Gunangi data, in contrast, show a considerably more even distribution (1972:96).

TABLE 6.26 Distribution of household pig herds (owned and held) by amount of change between May 1972 and April 1973

Change in size of herd (no. of pigs)	No. of households	
	Owned	Held
Increases		
+ 7	2	2
+ 5	1	1
+ 4	5	4
+ 3	3	2
+ 2	7	8
+ 1	6	5
subtotal: increases	24	22
No change	14	16
Decreases		
- 1	14	14
- 2	4	5
- 3	4	3
- 5	2	0
- 6	1	2
- 8	0	1
subtotal: decreases	25	25
Totals	63	63

Source: Field censuses

Although too much should not be made of the uneven distribution of ownership, given such relative flux and the approximate status of raw numbers as a measure, some possible sources of variation in herd size should be considered. Unlike the case of coffee holdings, greater equality is not found when allowance is made for variable household size. In May 1972, for instance, the 18 households owning 0-1 pigs comprised 28 per cent of the total 63 and included some 33 per cent of the resident population, whereas the 7 households owning 8 or more pigs comprised 11 per cent of all households and included 11 per cent of the population. Relative pig herd size (pigs per capita) was not related to household size[19].

A slight tendency for the average absolute size of household herds (owned) to rise with the age of household heads (up to 51-60 years) is suggested in Table 6.27, but the amount of variation is considerable[20]. Further, when household size is allowed for, per capita differences are slight, and seem to be mainly accounted for by the characteristically larger households, including more dependents, headed by men aged 31-50.

Given the need for pigs in marriage payments, it might be expected that herd size would correlate with some measure of a man's

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[19]Using average figures for household and pig herd size (three censuses), there was a slight, but statistically insignificant, tendency for larger households to own relatively (on a per capita basis) fewer pigs than smaller ones (where Y = pigs owned per capita, and X = household size, $Y = 1.42 - 0.11X$, $r = 0.23$; 66 households included in analysis.

[20]cf. Oliver's findings from Siuai (1949:14-15).

TABLE 6.27 Relationship between pig ownership and age of household head

Age of household head	No. of households	Number of pigs				Pigs per capita				No. of persons per household	
		Owned		Held		Owned		Held			
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
21 - 30	11	2.9	2.5	3.0	2.5	1.2	1.2	1.2	1.1	2.73	1.27
31 - 40	8	3.5	2.3	3.1	1.9	0.6	0.5	0.5	0.4	6.25	2.12
41 - 50	15	3.0	1.9	2.9	1.6	0.7	0.5	0.7	0.4	4.53	1.60
51 - 60	22	4.3	3.5	3.9	3.2	1.2	1.0	1.1	1.0	3.64	1.47
61 +	10	2.7	1.9	2.6	1.9	1.1	0.9	1.1	0.9	2.50	0.97
Total	66	3.4	2.7	3.2	2.5	0.99	0.89	0.95	0.86	3.86	1.84

future commitments to unmarried close relatives. This possible relationship can be crudely tested by dividing household heads into those with unmarried children or siblings aged 11 years or more, and those without such potential commitments (Table 6.28). Overall, households with commitments had an average of only one more pig per household than those with none, but, as the standard deviations indicate, the amount of variation was considerable. Breakdown of the two categories between households with more than the average 3.4 pigs and those with less, shows that a large majority of the former had commitments, whereas amongst the latter, households with and without commitments were equally represented.

In the light of accounts from other parts of Melanesia, (Allen 1968; Brookfield 1973b; Firth 1952; Potter nd.(a)), it would not be unexpected to find an uneven distribution of pig ownership (or of pigs held) related to differences in values and production goals. Decisions to pursue production for monetary incomes have resulted, very often, in conflicts between continued pig production and the new allocation of land and labour required for production of cash crops[21].

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[21] Firth's early account from Mailu on the Papuan coast is nicely succinct:

> "The position of the pig is an index of the conflict between traditional and modern cultural values....at Boru recently there has been discussion about the advisability of getting rid of their pigs. It is argued that they make the village untidy, and that they are uneconomic. When the people were persuaded by the Village Constable - a local Womong man - to

Continued at next page

TABLE 6.28 Number of pigs owned per household in relation to household head's commitment to unmarried children or siblings aged 11 or more years

	Households		Households with			
			3.4 or more pigs		3.4 or less pigs	
	with commitment	without commitment	with commitment	without commitment	with commitment	without commitment
No. of households	39	27	23	7	16	20
Mean pigs per household	3.7	2.7	5.6	6.2	1.6	1.4
Standard deviation	2.6	2.7	2.0	2.9	1.1	0.9

There is no evidence to suggest that pig production in Sinasina has faced effective direct opposition (at least in the short run) by 'modernists' of the kind described by Brookfield (1973b) for the central Chimbu, by Salisbury (1975) for the Siane, and Healy (1977) for the Maring, to cite three highland cases in which cycles associated with pig festivals have been halted - at least temporarily. Further, amongst Waula in 1972, no major division between 'modernists' devoting their land and labour mainly to coffee or other income-generating activity, and 'traditionalists' concentrating on pig production was evident, at least in the form of an inverse relationship between the size of coffee holdings and of pig herds. Of twenty six households with 'large' pig herds (3 or more pigs) approximately half had large (0.1 ha) coffee holdings; of the thirty households with 'small' coffee holdings (less than 0.1 ha), 14 had large, and 16 small (less than 3 pigs) pig herds. In brief review, then, pig husbandry persisted in 1972-73 as a significant, though variable part of the productive activity of most households.

Management strategies and the locational distribution of Waula pigs.

The wider pattern of enclosure (Chapter 5) is fundamental to an understanding of the management strategies followed by Waula pig-keepers, and hence the locational distribution of their pigs in 1972-

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Continued from previous page

put one coconut in the centre of the village for every nut given to the pigs it was discovered that each pig got about eight nuts a day. Considering the present high price of copra, it was concluded that this was waste. At a meeting of village councillors, opinion was divided between keeping the pigs in sties, and disposing of them altogether" (1952:67)

73. It will be recalled that this pattern consisted, ideally, of two zones: an "inside", central area of dense settlement (in pidgin, the haus lain, or kemp bilong man), and an "outside" area (the kemp pik) of fallow and separately fenced cultivated areas. The former included most modern facilities and some cultivation and was separated from the kemp pik by a combination of fences, ditches and natural barriers. Within it, no internal fencing was necessary and pigs were supposed to be prohibited. Outside, they were unrestricted except for fences protecting cultivation. In practice, considerable numbers of pigs were kept inside. Some of the tension between rules and practice has already been described.

In terms of this enclosure system, several management strategies, followed singly, in combination, or as part of a progression linked to seasonal and cyclical factors, are open to pig-keepers. Such strategies may be distinguished by the location of pig-houses, and the degree to which the day-time mobility of the animals is restricted. Pigs may be housed outside the settlement enclosure, or, which amounts to the same thing, adjacent to the barrier between the two zones. In both cases, unrestricted access to extensive, outside, foraging is possible. Alternatively, they may be housed well inside the enclosed zone, in which case they may be kept penned during the day or they may be led to, and tethered at, specific foraging sites. Less commonly, they may also be led to the perimeter of the enclosure and let out to forage freely.

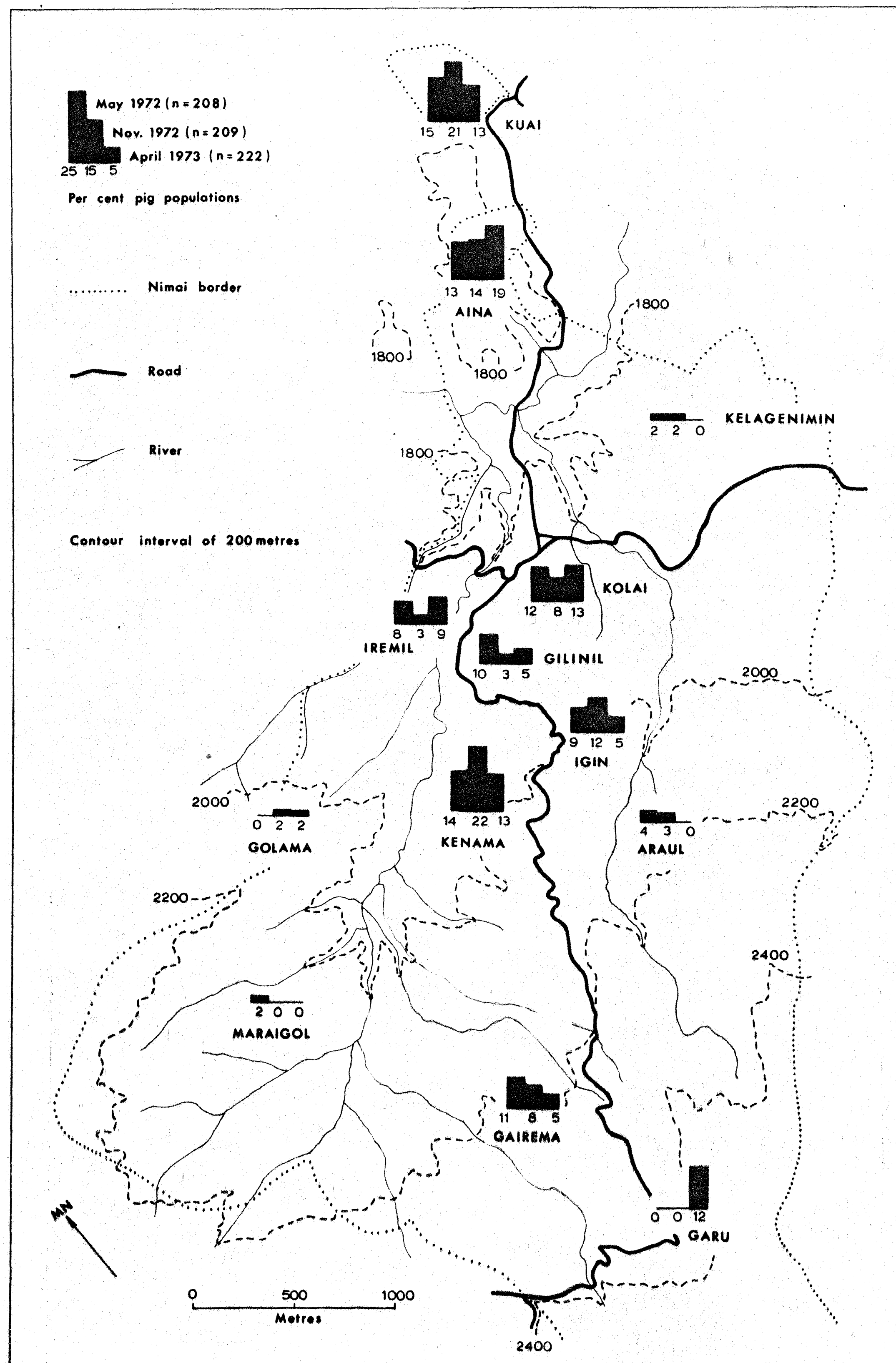
Although free-foraging is recognised as good for pigs, in that it enables them to root for the grubs, insects and small mammals which they require for health and growth, and as advantageous for their keepers since the amount of daily pig care is reduced, it is not without disadvantages. Even under the best of conditions it is risky. A free-foraging pig may be "lost" (in reality, probably stolen). It may also, in the course of its wanderings, suffer injury (limb fractures or breaks are not uncommon). Nimai also believe that pigs may be harmed by a variety of nature spirits or demons. Even more likely, it may break into a garden where, if caught in the act, it may be wounded or killed. At the very least, if the invader is identified (or impounded) by the garden owner, its owner will be forced to pay compensation for the crops it has damaged or consumed (payments noted during 1972-73 ranged from $1-8). Such risks probably increase in inverse proportion to the time an animal is under the watchful eye of its keeper. In brief, the free-range strategy may be good for one's pig, but too much freedom may mean no pig. Further, such an outside strategy requires that food for the pigs be transported to their house which, by definition is separate, and probably distant, from the major residence of the pig-keeper. Such disadvantages may be reduced by the keeper's household, or members of it, taking up residence at the pig-house site, though this runs counter to the council ruling and also reduces the benefits to be obtained from living within a settlement. Alternatively, pig-houses may be sited either close to a producing garden or to a route between garden(s) and major residence.

In contrast to the outside strategy of free-foraging, inside strategies offer pig-keepers the security of knowing that their animals are not at risk from thieves, demons, and the anger of arrow-happy garden-owners. Further, by centralizing the housing of both pigs and people, lengthy morning and evening detours or special trips to let out, feed, and shut-up animals at distant locations are avoided or reduced. Such advantages are offset by two disadvantages. Pigs kept inside require greater day-to-day individual supervision and care. If kept in pens (and only a small minority of Waula pigs during 1972-73 were, though the example of DASF supervised pig projects elsewhere - there were none in Waula - was considered by some worth copying), they require larger amounts of food and the provision of water. Pigs on tether also have to be shifted, or at least checked, several times during a day to ensure sufficient shade, water, and fresh rooting ground, and to prevent a fouled tether rope. Secondly, centralization of pig and human housing, although advantageous when a herd is small and gardens relatively close to the residence, imposes heavy transport costs with increases in herd size and distance to gardens.

The locations of all pigs held by Waula keepers in Nimai territory were recorded at three pig censuses. At the first and last censuses, just under half the animals were kept inside the enclosure system (Table 6.29). The increase in the number of pigs at outside locations in November was temporary, the result of an impending patrol empowered to enforce council regulations (p. 240). Map 6.2 plots the distribution of the pigs at 13 general locations, each of which includes any pig-houses within a radius of approximately 250 m. It

TABLE 6.29 General location of pigs kept by Waula at three censuses

General location	June 1972			November 1972			April 1973		
	Males % (n=87)	Females % (n=121)	Total % (n=208)	Males % (n=94)	Females % (n=115)	Total % (n=209)	Males % (n=100)	Females % (n=122)	Total % (n=222)
Outside	50.6	57.0	54.3	67.0	72.2	69.9	51.0	54.1	52.7
Inside	49.3	43.0	45.7	33.0	27.8	30.1	49.0	45.9	47.3
Totals	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0



Map 6.2 Waula pigs : locations at 3 censuses

may be pointed out that if the other Nimai clans had pig: human ratios similar to that of Waula, the total pig density within the mapped territory would have been six to seven times that shown, i.e. a total of approximately 1500 pigs[22]. Eight of the Waula locations (Kuai, Igin, Kenama, Golama, Araul, Maraigol, Gairema and Garu, see Map 6.2), lay outside the enclosure system, and five (Aina, Kelagenimin, Kolai, Gilinil and Iremil), within it. Besides showing the temporary movement of pigs outside in November, Map 6.2 indicates the relative stability of the overall distribution of Waula pigs over the twelve month period. The major exception was the movement of 15 per cent of the animals to the high altitude, southern, area of Garu by the latter date. This move was partly seasonal, in that it seemed to be triggered by the promise of a nut pandanus harvest towards the end of 1972. Other factors, however, were also involved, such as the opinion of some Waula that a period of dispersal away from the major settlement sites at lower altitudes would be beneficial for their pigs (p.242-3). The moves were accompanied, in some cases preceded, by the clearing of new, high altitude, sweet potato gardens, and the building of several substantial houses (some of which were still occupied in late 1975). Although the major

[22]Although no similarly detailed information on the numbers of pigs held by the other clans, and their locations, was collected, a summary count (conducted with informants at major men's houses) of current pig-houses indicated that those of Ogole were located mainly to the northeast, east and southeast of Koge, while those of Bomai and Dugul were distributed throughout the altitudinal range in the eastern and western parts, respectively, of Nimai territory.

locations at which pigs were kept, and the numbers of pigs at each location, remained relatively stable throughout the year, there was considerable movement of pigs between locations. Of a total of 102 animals held by Waula for the whole year (the number is considerably lower than the number held at any one time due to a high turnover), 44 were moved at least once[23]. Table 6.31 shows that such movements affected all animals, irrespective of their sex and of their location in May 1972. That pigs held outside originally were moved as frequently as those inside, indicates that the 'emergency' conditions under which moves were made in November were not wholly responsible for the high rate of mobility between locations.

Looking at such mobility in terms of individual animals, rather than households, the units of management, slightly underestimates the extent of relocation. The sample of 102 pigs were held by 45 households, 25 of which moved some of their animals during the year.

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[23]As shown in Table 6.30 these 102 pigs were, in terms of sex and location, representative of the total number of pigs held by Waula in May 1972, but less so by April 1973.

TABLE 6.30 Comparison between sample of 102 pigs held by Waula for 11 months and total pigs held by Waula in May 1972 and April 1973

Sex/location characteristics	May 1972		April 1973	
	Total (n=208)	Sample (n=102)	Total (n=222)	Sample (n-102)
Males (% of all pigs)	41.8	41.2	45.0	41.2
Males held inside (% of all M)	49.4	45.2	49.0	40.5
Females inside (% of all F)	43.0	40.0	45.9	35.0
Total pigs inside (% of all pigs)	45.7	42.2	47.3	37.2

TABLE 6.31 Number of pigs present between May 1972 and April 1973 which were moved at least once, by initial location and sex

Location/sex categories	No. of pigs in category	Pigs which were moved	
		No.	Per cent
By location (June 1972)			
Inside	43	19	44.1
Outside	59	25	42.4
By sex			
Males	42	17	40.5
Females	60	27	45.0
Total pigs	102	44	43.1

Three of these may be excluded on the basis that they moved only a minority of their pigs, while retaining the rest in their original location, and a further two on the grounds that they only relocated their pig-houses within the same general location as their original site (i.e. less than c.250 m). This leaves 20 (or 44 per cent) pig-house relocations by households. Bearing in mind that a number were made in conjunction with shifts in residence between settlement sites, it is possible to roughly distinguish between relocations which brought pigs closer to settlements (of which there were six), and those which dispersed pigs further away (of which there were 14). Foremost among the latter were seven households which, by April 1973, had moved their pigs southwards to the high altitude pandanus groves. There is some evidence, then, for concluding that the period of research covered the beginning of a slight trend toward dispersal.

Plotting of the overall distribution of Waula pigs, as in Map 6.2, reveals little of relationships between settlement (or residence) and the locations of pig-houses. This is explored in more detail in Table 6.32, which relates (at June 1972), the sub-populations of each of 8 settlement clusters to 11 general pig-house locations in terms of the number of households keeping pigs, and the percentage of each settlement's total pigs held, at the locations (for place names see Map 6.2; the settlements in Table 6.32 are listed in descending order from north to south on the map). Households at the three most central settlements, Koge, Gilinil, and Iremil, had approximately half their pigs (41 to 51 per cent) inside the enclosure system and usually in close proximity to their settlements, while households resident elsewhere, either outside the system (as at Kuai, Kenama, and Gairema) or close to its perimeter (Aina), kept either all or the majority of their animals outside. Thus choice of strategy is partly related to the location of residence relative to the perimeter of the enclosure. Where a substantial number of pigs were not kept in close proximity to a settlement, they were usually held at one other major location (i.e. Kuai in the case of both Koge and Aina; Igin and Araul in the case of Gilinil; and Kenama in the case of Iremil).

Where a household keeps its pigs however, is related to other factors than just settlement location. The size of herd is also important. As described earlier, each of the strategies offers

TABLE 6.32 Distribution of Waula households and pigs by settlement sites and pig-house locations in June 1972

(Pig percentages should be read horizontally)

Settlement details				Aina		Kelagenimin		Koge		Gilinil		Iremil		Kuai		Igin		Araul		Kenama		Maraigol		Gairema	
Location	No. of persons	No. of households	No. of pigs	No. of households	% pigs	No. of households	% pigs	No. of households	% pigs	No. of households	% pigs	No. of households	% pigs	No. of households	% pigs	No. of households	% pigs	No. of households	% pigs	No. of households	% pigs	No. of households	% pigs	No. of households	% pigs
Aina	54	12	38	11	71.0	2	7.9	-	-	-	-	-	-	3	21.0	-	-	-	-	-	-	-	-	-	-
Kelagenimin	5	1	1	-	-	1	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Koge	79	19.5	56.5	-	-	-	-	8.5	46.0	1	5.3	-	-	4.5	23.9	2	10.6	-	-	2	8.8	-	-	1	5.3
Gilinil	25	8	34	-	-	-	-	-	-	6	41.2	-	-	-	-	2	32.4	1	23.5	1	2.9	-	-	-	-
Iremil	66	20	47	-	-	-	-	-	-	1	8.5	8	36.2	-	-	1	2.1	-	-	5	44.7	1	8.5	-	-
Kuai	5	1.5	9.5	-	-	-	-	-	-	-	-	-	-	1.5	100.0	-	-	-	-	-	-	-	-	-	-
Kenama	2	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	100.0	-	-	-	-
Gairema	10	3	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	100.0
Totals	246	66	208	11	13.0	3	1.9	8.5	12.5	8	10.1	8	8.2	9	14.9	5	8.6	1	3.8	9	13.9	1	1.9	4	11.1

different advantages: pigs kept inside require more intensive management per pig, but are less at risk, while the outside strategy, although more extensive on a per pig basis is likely to be costly in terms of travel between settlement and pig-house. There is therefore a tendency for households with larger herds (measured in absolute or relative terms), to either keep their pigs outside, or, alternatively, to split their herds, leaving some outside and bringing others in (Table 6.33).

Another factor, cross-cutting both the location of settlement and pig herd size, is the location of producing gardens capable of providing regular supplies of tubers. To examine the inter-relationships between this and other factors, I turn to the nine households of the Koge sample, describing the changes in the location of their residences, pig-houses and major gardens between June 1972 and March 1973.

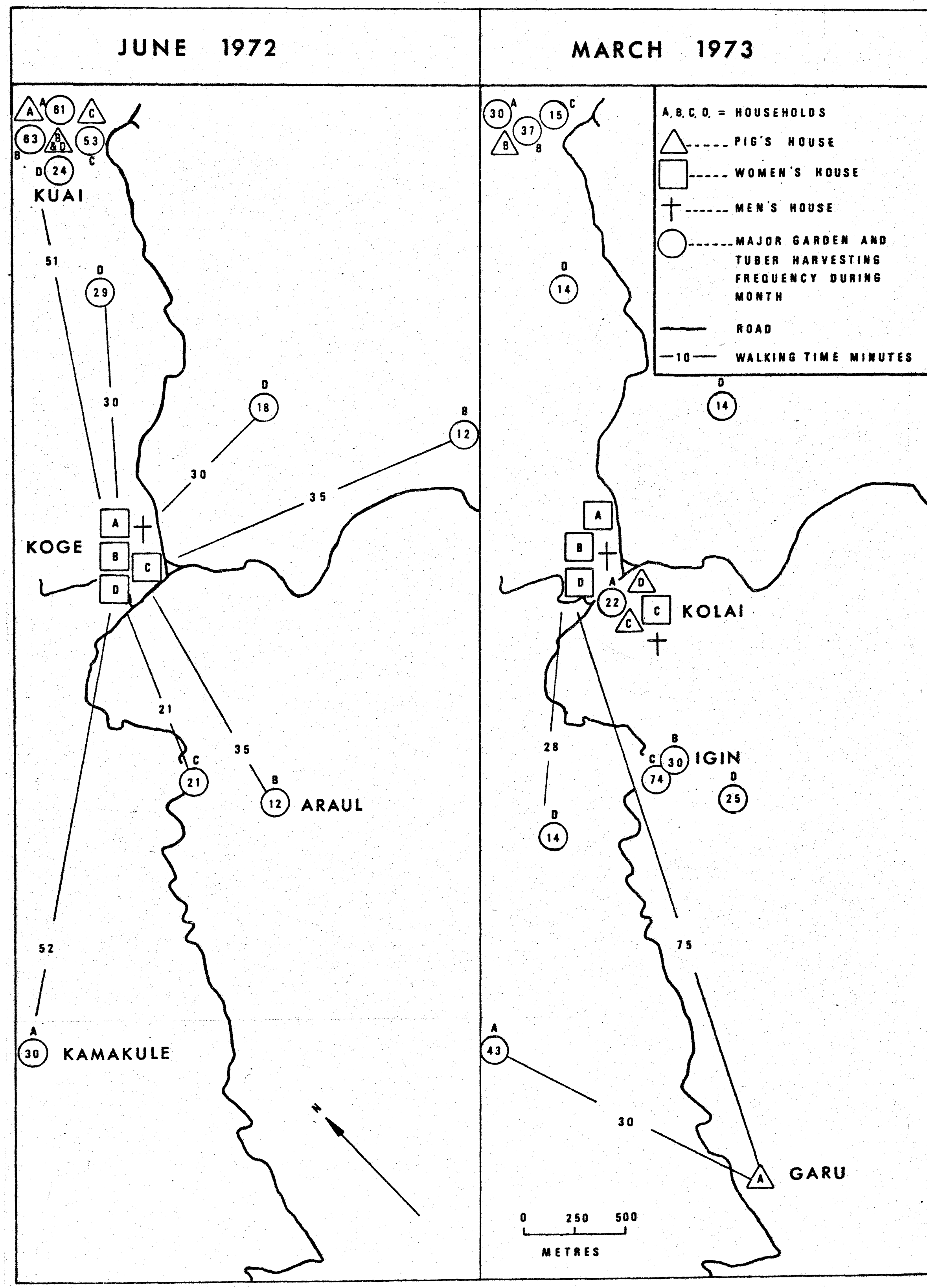
Case histories of management : the Koge sample

Partly for convenience, and partly reflecting on the ground differences, the nine households may be divided into two subgroups, one including households A, B, C, and D (Map 6.3), the other, households E, F, G, H and I (Map 6.4). I describe the former first.

In June 1972, households A, B, C, and D were based residentially on the central settlement site at Koge. All kept their pigs at Kuai, an 'outside' location some 2.7km, or 50 minutes walk, to the north at 1750 m. Their animals occupied three pig-houses (D shared with his half-brother, B), which were substantial buildings of customary design

TABLE 6.33 Relationships between household pig herd size and strategy of pig management (Waula)

Three measures of household pig herd size	No. of households	No. of households keeping pigs		
		Inside only	Outside only	Both
Pigs per household				
Households with few pigs (1-3)	34	20	13	1
Households with many pigs (4+)	23	7	6	10
Total households	57	27	19	11
(Mean pigs per household)	(3.65)	(2.48)	(3.74)	(6.36)
Pigs per humans				
Households with low ratio (<0.99)	29	16	11	2
Households with high ratio (>1.00)	28	11	8	9
Total households	57	27	19	11
(Mean ratios)	(1.11)	(0.70)	(1.14)	(2.15)
Pig units (PU per worker units (WU)				
Households with low ratios (<0199)	39	17	13	-
Households with high ratios (>1.00)	27	10	6	11
Total households	57	27	19	11
(Mean ratios)	(1.05)	(0.78)	(1.01)	(1.79)



Map 6.3 Households A, B, C, and D : residences, pig-houses, and major gardens

with separate sleeping quarters for people and pigs. They had been built between October 1971 and May 1972, replacing older structures at the same general location. Each was sited on the periphery of a single, large, cultivated area, in which all four households had significant garden sections. For households A, B, and C, these gardens were, in terms of sweet potato harvesting frequencies (61, 63, and 53 respectively) unmistakably their major producing areas at the time. Household D, which had only one pig, in contrast to the larger herds of the others, had a lower harvesting frequency (24) at this location, but was also harvesting significantly (29 HF) from a garden at Aina, midway between Koge and Kuai. With the pig-houses located on the fence surrounding the main cultivation at Kuai, the pigs of the four households were managed on a straightforward outside strategy: free-foraging by day, and returning by late afternoon for food and shelter at their houses. The only departure from this routine was that made by household C, which, after its pigs had broken into a neighbouring garden belonging to members of the Dinga in early June (causing damage for which C paid $8 in compensation) built a separate pig-sty, within the garden fence at Kuai, in which two of its pigs were occasionally penned by day. Households A, B, and C all had other gardens producing sweet potato during June-July, either to the east, or uphill to the south of Koge (Map 6.3). Household A was the most marked case of dispersal, with a major garden (30 HF) 52 minutes from Koge, in the opposite direction to Kuai, at Kamakule. In addition, all had other plots less frequently visited.

With their major gardens and pigs nearly 3 km distant from

Koge, it may be asked to what extent these households were 'based', in residential terms, on Koge. One measure is the number of nights the adult members slept away from their major residences, staying with their pigs at Kuai. As Table 6.34 shows, this varied considerably for individuals, but the average figures, for both men and women, were

TABLE 6.34 Nights slept in pig-houses: men and women of households A, B, C, and D(1)

Household	Men			Women		
	Nights surveyed	At pig-house		Nights surveyed	At pig-house	
		No.	Per cent		No.	Per cent
A	25	8	32	14	2	14
B	27	19	70	15	15	100
C	25	16	64	12	8	67
D	25	5	20	24	0	0
Totals	102	48	46	65	25	45

(1) June-July 1972.

similar at about 45 per cent. Although high, this figure should not be taken to mean that nearly half their total time was spent at Kuai. On most of the days that household members stayed the night at Kuai, they also visited or passed through Koge. It is unlikely then that their use of Kuai resulted in any major loss of communication with others at Koge.

Eight months later, in March 1973, only household B still maintained pigs at Kuai. Its Kuai garden, however, had diminished in significance (an HF of 37 instead of its previous 63), and both husband and wife spent fewer nights with their pigs (down to 68 and 50 per cent respectively). A new garden, some 20 minutes to the south of Koge at Igin, was increasingly important with an HF of 30. With their pigs moved away from Kuai (or, for A, in the process of moving), the harvesting frequencies of the other three households at this location had declined markedly: from 61 to 30 (A), 53 to 15 (C), and 24 to less than 5 (D).

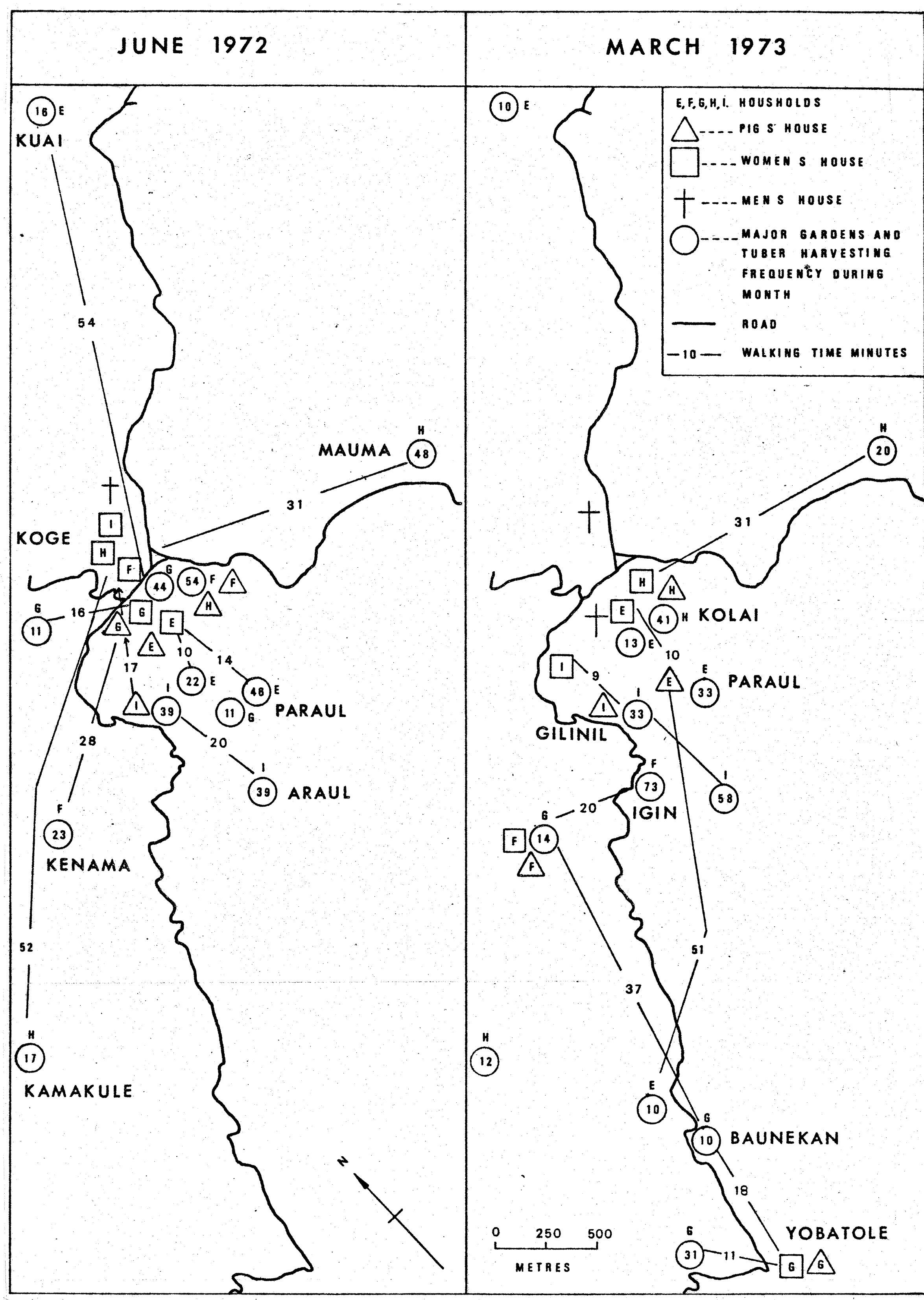
Household C's new major garden was now, like B, his father, at Igin, where the HF had risen to 74, from 21 in June. During October and November, C built a new woman's house, with a separate pig-sty, at Kolai, a few minutes out of Koge. C's pigs, however, had been brought from Kuai to Kolai in September, ostensibly because of the threat posed to them by the Dinga at Aina: there had been a Dinga-Nimai skirmish in late August. Though the location of their pigs at Kolai meant that household C had to transport food to them, the short run from Igin, at 2000 m, was all downhill. In moving to Kolai, the head of C attached himself firmly to the new men's house built there under the leadership of the head of household E. Relationships between the two families were further cemented in late November when E's wife gave birth to her seventh child, a son, which was 'given' (in name) to C's wife, then still childless after three years of marriage (see also Fig. 6.1).

Although household D also moved its pigs (having acquired an additional one to bring its total to two) to Kolai, and also built a separate sty for them beside that of C, the household remained at

Koge. The male head continued his affiliation with the older Koge men's house. Their new pig-house site was now central to their rather dispersed set of four primary gardens, two, each of 14 HF, and some 30 minutes away, to the north and northeast of Koge, one a similar distance (and also 14 HF) to the southwest, and another, of 25 HF, some 25 minutes to the south at Araul.

In contrast to these centralizing moves by C and D, household A moved its pigs from Kuai to Garu, some 75 minutes to the south of Koge at 2300 m. This location, although 30 minutes uphill from A's new major garden at Kamakule (43 HF, up from 30 in June), was in the midst of A's nut pandanus groves, which came into fruit in early 1973. Like C and D, A had also moved its pigs from Kuai in September, following the Nimai-Dinga skirmish, and had taken them for safety to Gairema, some 15-20 minutes from Kamakule. However, lacking a proper house and the necessary supervision, the pigs constantly attempted to return to their former base at Kuai over 5 km away by trekking across the enclosure system). In exasperation, A eventually took them back to Kuai at the end of October. Work began on the new house at Garu on January 8, and, on February 22 they were moved up there from Kuai. Thus for household A, the period from 4 February to 5 March was transitional, with the wife spending 12 per cent of her nights still at Kuai (down from June's 32 per cent), and the husband 18 per cent of his, at the new house at Garu.

The second group of households (E, F, G, H, and I, see Map 6.4), were all more centralized on the Koge-Kolai settlement complex in June. E and G provide a convenient starting point since they, like



Map 6.4 <u>Households E, F, G, H, and I : residences, pig houses, and major gardens</u>

the four previous households, had kept their pigs at Kuai earlier in 1971 (and both still had gardens there in June 1972). During 1971 they had moved their animals back to Kolai, both establishing new women's houses with separate pig-houses. For most of 1972 the head of household E slept regularly at the Koge men's house, while the head of G mainly stayed with his family at Kolai. During June-July the major gardens of both families lay conveniently within 15 minutes of Kolai. The activities of the other three households, F, H, and I, although a little more dispersed, were also primarily focused on Koge-Kolai. All the members of F and I slept at Koge, with their pigs housed separately. Household F's pigs were at Kolai, less than four minutes away beside their major producing garden (54 HF) with their next most important garden (23 HF), just under half an hour away at Kenama to the southwest. I's pigs were kept 17 minutes to the south at Gilinil, directly beside one of their two major gardens (39 HF), and on the homeward route from the other (also with 39 HF) at Araul. Household H's gardens were more scattered, the most frequently harvested one half an hour to the east at Mauma (48 HF), with another 50 minutes uphill to the south at Kamakule. Two houses, less than four minutes apart, were maintained at Koge and Kolai, with the wife spending 38 per cent of her nights with their pigs at Kolai, and the husband 78 per cent of his. The latter, an elderly man, did not use the Koge men's house for sleeping, unlike the heads of both F and I who regularly stayed there. In contrast to the first group of households with their pigs at Kuai, only one of this Koge-based group, H, regularly shared a roof with its pigs during June. Further, with the exception of I, all were located too far from the perimeter of the enclosure system for easy access to free-foraging. Tethering was therefore their main system of daily management.

Over the 8 months between June and March 1973, the movements of this group of households were similar to those of the first in that the general tendency was southward and uphill. Household G, preceding A by two months, built a new house in the high altitude pandanus groves in late November. Taking their pigs, the family moved into residence there in early December. The move was made possible by the maturation of two high altitude gardens both within 20 minutes of the new house site. In addition, use of a mature garden section at Kenama some 47 minutes away (downhill) was granted to G by a fellow clansman in return for caring for the latter's pigs which had also been moved (without a caretaker) to the pandanus groves. Although both husband and wife slept most nights (26 and 24, respectively, of 28) in the new house, both visited and passed through Koge regularly (11 and 10 times respectively, over and above the few nights also spent there), despite a round trip of almost 8 km. A young couple, the man a close agnate of G, who had recently returned from working in the Wahgi valley, moved into their old Kolai house.

Household F also moved as a family, not to the pandanus, but to the site of a replanted, but not yet producing, garden at Kenama just outside the pig enclosure system. During March they were heavily reliant on a single garden at Igin (73 HF) 20 minutes away from their new house. Though maintaining their main Koge house, neither husband or wife slept at Koge on more than three nights during the month.

In preparation for the 1972 rainy season the head of household E started, at the end of October, to build a more substantial pig-house close to his older one at Kolai. Hearing of the impending patrol to enforce the council rules, however, he decided to relocate instead nearer the perimeter of the pig enclosure and thus further away from the settlement. This resulted in a 10 minute southward move, and the construction of a substantial new house which his wife also used for sleeping on occasional nights. Although the move allowed access to free-foraging for the pigs, it was also handily placed within a few minutes walk of E's major productive garden (33 HF) at Paraul. As this garden started to decline in significance, new gardens at higher altitudes over 50 minutes away to the southwest came into production. In addition to relocating his pigs, the head of household E also led a small group of men in the construction of a small new men's house at Kolai (on the stated grounds that the one at Koge was too noisy). This was completed in November, and the heads of households C and G (the latter on his irregular visits from residence in the pandanus groves), used it as their residential centre. Other members of the sample continued to use the older Koge building.

The remaining two households, I and H, also built new women's houses: H on a new site at Kolai which had become their major productive garden (with 41 HF) replacing the older more distant one at Mauma, and I at Peramara, 10 minutes to the west of Koge. Following the death of an adult son in October, the members of household H moved into a closer relationship with the household of another, middle-aged, son. The latter's wife took charge of some of H's pigs, and moved them to Kuai where she occupied C's old house. H's wife spent the occasional night with her there after taking food to the pigs. The household's other pigs were looked after at Kolai. In moving their house to Peramara, household I reduced their distance from their pigs, which had not been moved, to less than 10 minutes walk. Due to the wife's temporary absence at Kundiawa hospital to care for a sick child in March, information on the relative significance of their gardens during this later period is lacking.

These case histories highlight, at the level of individual households, the relations between husbandry, and the patterns of cultivation, residence and settlement. Mobility, in particular, is emphasised, with this small group of households shown to be regularly positioning both themselves and their animals in relation to their current major food gardens. Their strategies are patterned by multiple constraints. In the longest term, these include a fundamental grid consisting of an individual's claims to land (inherited, acquired by other means, and temporarily borrowed), and the location of major settlements. Evidence in both this and the preceding chapter have indicated that this is not a permanent grid: settlements have moved, and access to land is extensively shuffled. Medium and shorter term factors include pig herd size (and thus a combination of age, personal ambition, responsibilities and commitments to others, and luck with one's stock), the wider pattern of enclosure, the state of inter-tribal relations, the council's ability and will to enforce its regulations, and the condition (health, pregnancy) of household members.

Neither these case histories, which cover only eight months in detail, nor the more synchronic, separate, accounts of labour, land, and livestock which preceded them provide a full perspective on the dynamic characteristics of this system of production. The following two chapters move further in this direction. In the next I examine the levels of output of the two major crops, sweet potato and coffee.

CHAPTER 7

Levels of production: sweet potato and coffee

Introduction

This chapter describes the levels of production of sweet potato and coffee by Koge sample households during three months of survey during 1972-73.[1] My main purpose is not to assess the extent to which production fulfilled nutritional requirements (no direct nutritional investigation was made), but rather to explore relations between production levels and the characteristics of households, their pig herds, and areas under cultivation. It is important however to recall, as described in Chapter 2, that 1972 saw Sinasina (and the highlands in general) suffering not only an unusually severe drought but also a longer term downturn in coffee prices. Although I cannot evaluate the influence of these climatic and market conditions due to the lack of longitudinal production data, their underlying presence must certainly be noted.

Food Crops

Lacking storage facilities, Sinasina food production requires continuous harvesting. Table 7.1 shows that sample households harvested some food on 90 per cent of a potential 709 days, and that the staple, sweet potato, was dug only slightly less frequently.

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[1]The three main survey periods in this chapter are the same as in Chapter 6: Period I, 19 June-16 July 1972; Period II, 23 October-19 November 1972; Period III, 5 February-4 March 1973.

TABLE 7.1 : Number of days on which foodcrops were harvested, and number of garden visits (Koge sample, by household)

	HOUSEHOLDS									
	E	A	B	C	F	G	D	H	I	Totals
1. Days										
Potential harvesting days (N=)	84	59	84	77	81	84	81	82	77	709
Harvesting days (as % of potential days)										
(a) all gardens	99	86	98	88	78	99	89	88	83	90
(b) sweet potato gardens only	94	80	98	87	76	93	86	85	79	87
2. Garden visits										
(a) to all gardens										
total visits (N=)	147	70	141	84	80	162	103	131	86	1004
visits to own gardens (as % of total visits)	86	100	91	89	86	93	83	83	83	88
(b) to sweet potato gardens only										
total visits (N=)	111	50	129	75	69	97	93	103	74	810
visits to own gardens (as % of total visits)	89	100	95	93	87	90	84	81	88	88

Source: Daily interviews, three months.

No household harvested on less than four of every five days.[2] Food was commonly taken from more than one garden on the same day: 1.6 gardens for all crops, and 1.2 for sweet potato alone. Households did not harvest exclusively from their own gardens: 12 per cent of the total harvesting visits were made to gardens belonging to others. Such sharing was not restricted to one or two closely related or neighbouring households, but involved, like labour exchange (p.270), each household in a web of relations with, on average, some nine others.

Although it was not possible to weigh accurately the total food crop production of sample households during the survey periods, the number of times they harvested different crops was recorded during evening interviews. These data provide overall crop harvesting frequencies, and an indirect measure of crop availability during each of the three survey months (Table 7.2). Following the obvious and complete dominance of sweet potato, Rungia klossii and Setaria palmifolia stand out as the two major subsidiary crops. Both were harvested with some regularity throughout the year (though the amounts may have varied). Only three other crops, onions, Oenanthe javanica, and bananas were also harvested regularly in each period. Eleven others (Brassica oleracea, Amaranthus spp., Ficus dammaropsis, Cucurbita sp., miscellaneous leafy greens, Saccharum edule, beans, bamboo shoots, corn, and nut pandanus) were harvested most frequently

[2]Compare Mitchell's account from Nagovisi (in Bougainville) where households only harvested 2-3 days out of 7 (1976:74,76).

TABLE 7.2 : Harvesting frequencies of all crops (A) by whole survey, (B) by periods (Koge sample)

Crops	Harvesting frequencies: A — Whole survey (sum of days on which each household harvested a crop)	B — By Period (percentage distribution of A): Period I	Period II	Period III
Tubers				
Sweet potato	629	34	33	33
Manioc	14	57	14	29
Taro (*Colocasia* & *Xanthosoma*)	13	85	15	0
Yams	4	100	0	0
Irish potato	2	50	0	50
Leafy greens				
Rungia klossii	96	24	36	40
Ficus copiosa	49	2	84	14
Brassica oleracea	33	3	36	61
Amaranthus spp. (*virides. hybridus, tricolor*)	32	31	9	59
Allium sp.	19	32	42	26
Ficus dammaropsis	18	5	22	72
Oenanthe javanica	13	15	38	46
Rorippa sp.	10	0	0	100
Cucurbita sp.	10	0	20	80
Misc.(1)	9	0	11	88
Other vegetables				
Setaria palmaefolia	65	31	38	31
Saccharum edule	17	12	6	82
Beans (*Dolichos lablab* and *Phaseolus sp.*)	17	12	12	76
Bamboo shoots	14	7	14	79
Corn	10	10	30	60
Misc.(2)	9	0	44	66
Fruits, nuts etc.				
Pandanus julianettii	51	0	0	100
Sugarcane	42	9	62	29
Bananas	26	23	50	27
Fungii	2	0	100	0
Ginger	1	100	0	0
Coffee	120	56	25	19

(1) Includes *Solanum nigrum*, watercress, *Trichosanthes sp.*, the leaves of beans, *Reidelia sp.* or *Hedychium sp.* and a fern.

(2) Includes pumpkins, cucumber, squash, chokos and tomatoes.

during the wet season, while only three, all minor tubers were mainly restricted to the dry first period of June-July. Sugar-cane and Ficus copiosa were the only two mainly harvested during October-November. These distributions are in general agreement with those suggested by data on food crops offered for sale at Koge market.

More information is available on the staple, sweet potato. An average of 29 harvests per household (range 12-43) were weighed, allowing estimates of each household's production. Table 7.3 shows that the average level of sweet potato production, kg/person (including visitors) per day, fluctuated from a low of 2.9-3.0 during October-November to a high of 3.2-3.3 in June-July, with an overall average of 3.0-3.2. That production was slightly higher in the dry season is confirmed by other evidence. Not only did the sample sell more sweet potato in the market in this period than in the other two (Appendix 6, pp. 624-6), but, as described in Chapter 2, it appears that the overall supply of sweet potato in the market was up at this time. Less directly, it will be shown later that Waula pigs gained weight more rapidly between May and November, than between December and April (Chapter 8).

Leaving aside differences due to region and year, comparison of this average of 3.0-3.2 kg/person (including visitors)/day (3.5 -3.6 kg if visitors are excluded), with other figures from elsewhere in the highlands, e.g. Waddell's 3.8 kg for a three household Raiapu Enga sample(1972a:114), is difficult without consideration of differences in the age-sex composition, and the pig:human ratios, of the samples. Waddell's sample was feeding more

TABLE 7.3 : Estimated average actual and relative levels of household sweet potato production (kg/day) (Koge sample, by survey periods)[1]

Households	Period I		Period II		Period III		Whole Survey		
	H'hold/ day	Person/ day	H'hold/ day	Person/ day	H'hold/ day	Person/ day	H'hold/ day	Person/ day	WU/day
B	31.7	6.3	23.3	3.0	25.0	4.1	26.7	4.2	11.1
A	22.4	5.1	11.1	2.2	15.9	3.0	20.0	3.7	9.0
E	17.6	3.2	11.7	2.4	14.2	2.1	14.5	2.5	4.5
G	12.9	2.7	15.9	2.5	14.5	2.5	14.4	2.6	5.8
D	13.7	2.7	10.8	2.7	8.6	2.0	11.0	2.5	4.4
C	5.6	2.5	13.5	6.3	12.6	6.3	10.7	5.0	5.4
I	10.0	1.9	10.7	2.1	-	-	10.4	2.0	4.2
H	11.3	2.6	7.5	2.5	12.1	3.1	10.3	2.8	3.5
F	4.2	1.4	7.3	2.3	7.8	2.5	6.4	2.0	3.2
Means[2]	14.4	3.2	12.4	2.9	13.8	3.2	13.8	3.0	5.7
Means[3]	14.9	3.3	12.9	3.0	13.8	3.2	14.2	3.2	5.9

(1) For data base from which estimates were made, see Tables A6.7, 16, and 17. N.B. Person includes visitors.

(2) All households included.

(3) Household I excluded.

pigs (their pig:human ratio was 1.7:1, ibid., 116, fn.1, compared to the 1:1 of the Koge sample), but their age-sex composition is not given. If, as seems likely, it was drawn from his wider land and labour sample of 10 households, and shared a similar age distribution, it was probably also characterised by a considerably lower child:adult ratio than the Koge sample (Appendix 6, p. 602). Both these characteristics would increase the likelihood of higher per capita sweet potato production figures.

Examination of the household figures in Table 7.3 shows a relatively limited,[3] but distinct, range of variation, or rather variations since several measures are possible. The most restricted range, from 2.0-5.0 kg/day/whole survey is that calculated on a per capita basis. Output per worker (WU) varies more, from 3.2 to 11.1 kg/day, and the greatest range, from 6.4 to 26.7 kg, is shown by the average daily figures of actual household production. Earlier analysis of variation of the actual and relative areas cultivated by households (pp. 313-6) showed the former to be most closely correlated with total household size (HCU + PU), and the latter with the total dependency ratio (HCU + PU: WU). Similarly strong correlations are found between actual household production (kg/sweet potato/day) and total household size, and between relative household

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[3]Limited, that is, by comparison with the nearly 8 fold range in household outputs per worker recorded by Pospisil amongst the Kapauku (Sahlins 1971: 41-42). This seems suspiciously large and is perhaps related to the fact that, as described by Pospisil (1963:187) these households were not major units of production, a point which Sahlins appears to overlook.

production (kg/WU/day) and the total dependency ratio (Figs. 7.1, 7.2). As in the case of cultivated areas, measures of household size and composition which exclude pigs result in weaker correlations.[4]

The correlation of actual household production with total household size (HCU + PU) shows the 'average' household of 6.17 HCU + PU producing 13.60 kg/day, with production increasing by 3.32 kg for each additional 'total' consumption unit (i.e. HCU + PU). The small size of the sample, in particular the relative lack of both large and small households, is to be noted, and may be responsible for the fact that production per total consumption unit, rather than diminishing with an increase in household size, as might be expected, in fact increases (e.g. from 1.60 kg per total consumption unit for a household of 4 HCU + PU, to 2.46 kg for a household of 8 HCU + PU). In terms of relative output, the 'average' household with a total dependency ratio of 2.55 produced 5.67 kg/WU/day, with production increasing by 3.38 kg/WU for each additional increase of 1 in the ratio. Again, diminishing returns are not apparent: with a total dependency ratio of 2, 1.89 kg/day would be available per total consumption unit; with a ratio of 4, this rises to 2.64 kg/day. (However, see Fig.7.5 below where diminishing returns are shown).

Due to continuous harvesting, and the difficulties of controlling for a large number of potentially significant variables, yields were not directly investigated. Production levels, do, however

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[4]Regression of actual household production (kg/sweet potato/day) on household size (HCU only) yielded $Y = 2.47 + 3.42$, , $r = 0.49$ $r^2 = 0.24$. Relative household production (kg/WU/day) on human dependency ratio (HCU:WU) gave $Y = 6.67X - 3.15$, $r = 0.62$, $r^2 = 0.38$.

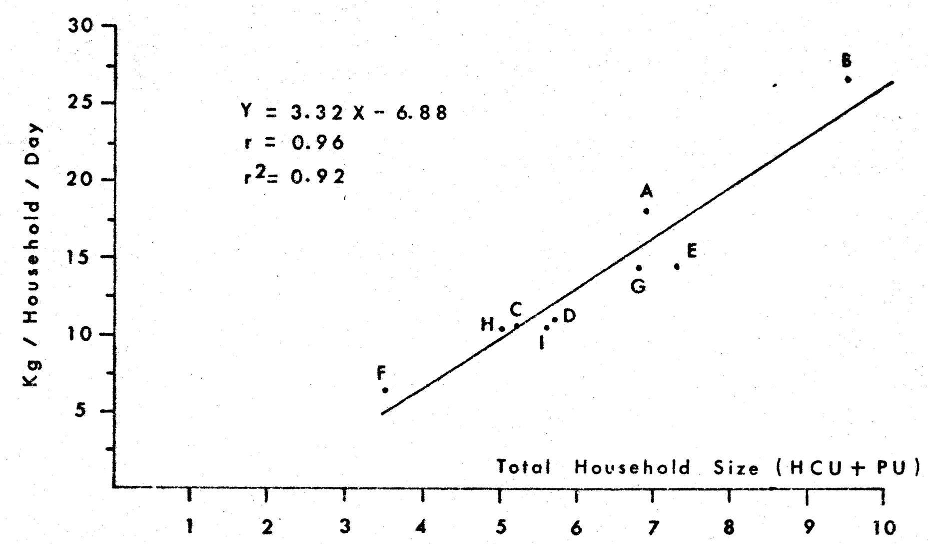

Fig.7.1 Relationship between sweet potato production (kg/household/day) and total household size (HCU + PU)

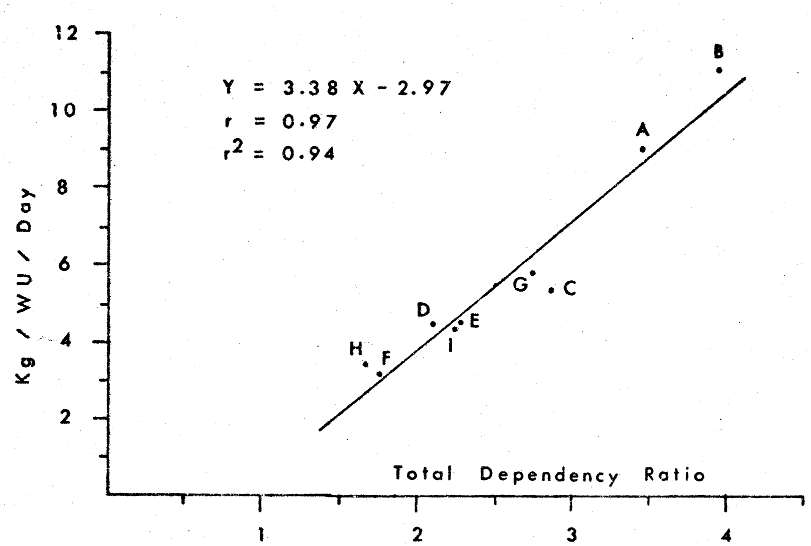

Fig.7.2 Relationship between relative sweet potato production (kg/WU/day) and total dependency ratio (HCU + PU : WU)

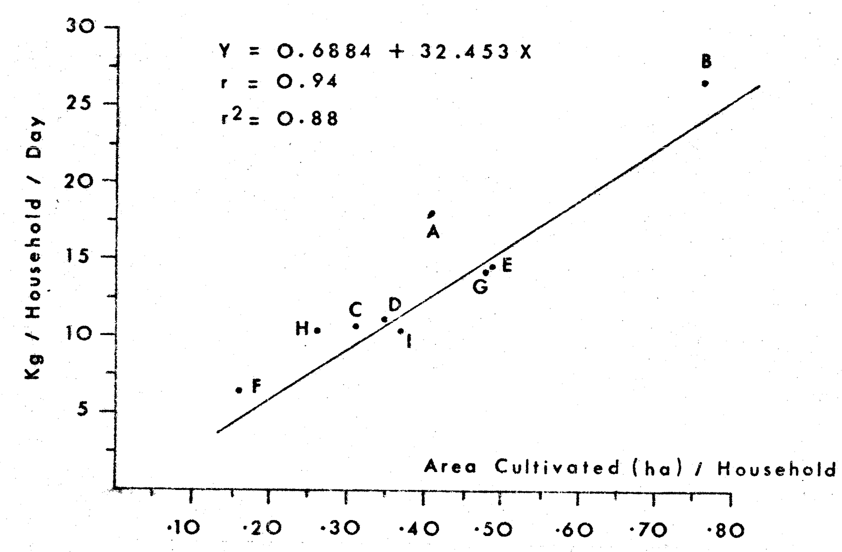

Fig.7.3 Relationship between sweet potato production and foodcrop area cultivated

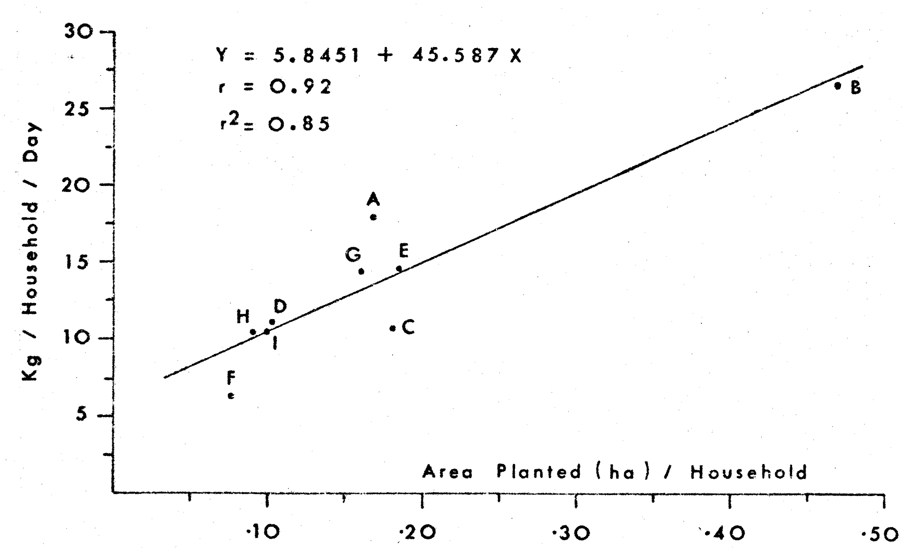

Fig.7.4 Relationship between sweet potato production and foodcrop area planted

correlate with areas under cultivation (Fig.7.3; see Appendix 6, section 4 for discussion of the latter). But since cultivated areas include gardens of different ages (Table 6.20), extrapolation from Fig.7.3 to annual yields per area (i.e. ranging from 14.3 t/ha/year for a household cultivating 0.1 ha, to 12.1 t/ha/year for a household with 1.0 ha) certainly underestimates actual yields. Conversely, since measurements of areas planted during 9 months of 1972-73 (Table A6.10) failed to include replantings, extrapolation from Fig.7.4 results in overestimates, at least for households with smaller areas (i.e. 28.5 t/ha/9 months for 0.1 ha, 15.7 t/ha/ 9 months for 0.5 ha).

Pig feeding

Both the preceding analysis and that of cultivated areas (Chapter 6) indicate that a significant proportion of tubers are produced for pigs. I now turn to consider the size of pig rations fed by some Waula to their pigs during 1972-73, and extrapolate these data to cover the range of pig production levels likely to occur during the course of a Sinasina pig cycle.

The regular daily ration of pig food consists of sweet potatoes, which may be raw or cooked, and some green fodder. Cooking of the sweet potatoes probably increases their nutritional value (Krider and Carroll 1971:336). Salt is also commonly sprinkled on cooked tubers, a practice which may depress the animal's appetite (Hafez and Signoret 1969:356). The green fodder component consists of the peelings (both raw and cooked) and leaves of Setaria palmifolia, sweet potato leaves (usually raw), and such introduced grasses (uncooked) as Pennisetum clandestinum and Setaria purpurea. Such rations are usually given to the pigs as a single meal in the late afternoon or evening at pig-houses, though some animals are also occasionally fed in the morning. Some owners use separate bowls or wooden troughs for feeding each animal, others put the food straight on the ground though portions are usually separated to prevent squabbling. Some pigs, especially weaned piglets which are being hand-raised, regularly receive titbits while people are eating, and additional household scraps such as sweet potato peelings. The latter are also thrown as mulch into coffee groves in and around settlements where, due to the council rule prohibiting free-range pigs, there may be no pigs to scavenge them. On particular occasions, such as castration, transfer to a new pig-house, and first acquisition, special meals, perhaps including some canned fish and rice, may be given to a pig. Rats caught in and around houses are also fed to pigs (those I trapped were sought eagerly), and oral accounts suggest that some zealous pig-keepers occasionally dig earthworms for their animals. Despite such special dietary additions, sweet potato is the major item of food which people provide for their pigs. Its recognised importance was nicely expressed in the following admonitory lecture, given by a classificatory mother to a new bride on her marriage eve in April 1973:

> "When you feed your pigs, don't just give them food scraps and peelings - they won't grow big on that. When you harvest large sweet potatoes, give them to the pigs - give them some cooked and some raw then they'll grow big ... They won't eat sweet potato peel and the leaves and ends of pitpit (Setaria palmifolia), if you only give them that stuff. They're not crazy! Give them large sweet potatoes - they won't gobble it up. First they'll sniff and snuffle at it, then they'll look up at your face thinking, "Oh, what large tubers she's given me", and only then will they break it and eat. That's

all I want to tell you. Keep my words in your head, and not behind you!" (T/CH/28B,29B).

To investigate pig feeding, a sample of seven households, varying in composition, husbandry strategy, and relative pig numbers, were surveyed for brief periods (Table 7.4). Four (A, C, D, and E) belonged to the Koge sample, with three others (X, Y, and Z) added. The surveys were conducted in November 1972 and March 1973 and thus unfortunately did not cover any of the dry months when sweet potato production appeared to be higher, and pigs gained weight more rapidly (pp. 473 ff).

Rations fed to individual pigs could be weighed for only three of the households (Table 7.5). Such rations ranged from 0.6 to 2.6 kg/pig/day, with the latter high figure restricted to household X which had a single (pregnant) pig. Only one household, C, was surveyed twice. In this case, the rations of the two larger pigs (Kiabe and Biremine) remained unchanged between November and March, those received by Pone, which farrowed in early February 1973 and was nursing four piglets during the second survey, increased by 34 per cent, and those of the two smallest animals both increased by just over 20 per cent. In general, the regularity in the daily amounts fed to the pigs was marked, as indicated by the low standard deviations. Of particular interest are the relatively large amounts fed to smaller animals, 0.6-0.9 kg for young pigs of 15-17 kg live weight.

Although the sample is small, and perhaps affected by such factors as the number of pigs per household (see p.371), analysis of

TABLE 7.4 Pig feeding survey: characteristics of households[1]

Households	Survey details		Household composition			Husbandry strategy[3]	Pigs		Dependency ratios	
	No. of days	Reliability[2]	No. of persons	Consumer units	Worker units		No.	Units	Pigs/ humans	HCU+PCU/ WU
B	5	B	4	2.9	1.7	F	19	9.0	4.75	7.00
Z	4	B	4	2.8	2.0	F	9	5.8	2.25	4.30
C(ii)	8	A	2	1.8	2.0	T,P	9	4.5	4.50	3.15
C(i)	7	A	2	1.8	2.0	T	6	4.2	3.00	3.00
Y	4	B	2	1.8	2.0	F	3	3.0	1.50	2.40
E	7	A	5	4.1	3.2	F,T	5	3.1	1.00	2.25
D	7	A	5	3.4	2.5	T	2	2.0	0.40	2.16
X	7	A	3	2.2	2.0	T	1	0.7	0.33	1.45

[1] Households C(for the first time) and E surveyed during November 1972; all others during March 1973.

[2] A = food observed fed to pigs; B = ration weighed only, not observed fed to pigs.

[3] F = free-range, T = tethered, P = penned.

TABLE 7.5 : Daily sweet potato rations fed to individual pigs by three households[1]

Household	Pig name	Number of days ration weighed	Pig weight (kg)	Sweet potato ration (kg/day) (i) Mean	(i) SD	(ii) Mean	(ii) SD
C	Kiabe	(i)7, (ii)8	96	1.81	0.47	1.82	0.16
	Biremine	(i)7, (ii)8	42	1.51	0.46	1.53	0.47
	Pone[2]	(i)7, (ii)8	38	1.15	0.28	1.54	0.31
	Nda	(i)7	21	0.96	0.12	-	-
	Kobemoge	(i)7, (ii)8	17	0.93	0.18	1.14	0.07
	Gaga	(i)7, (ii)8	16	0.86	0.11	1.07	0.20
E	Masul[3]	7	45	1.19	0.22		
	Mobale	7	32	1.41	0.22		
	Toru	7	23	0.92	0.11		
	Kolainin	7	15	0.58	0.10		
	Dibongwa	7	15	0.58	0.13		
X	Balgane[3]	8	45	2.56	0.53		

(1) Households C(i) and E weighed 6-12 November 1972; households C(ii) and X, 25 February-4 March 1973. For details of household composition see Table 7.4.

(2) In pig (first month of pregnancy) during first survey; nursing 4, three-week old, piglets during second survey.

(3) In pig at time of survey. Masul starting third month of pregnancy, Balgane in first month.

the data suggests a trend for rations, after rising quickly to about 1 kg/day for pigs weighing 25 kg, to climb more slowly thereafter to reach 2 kg/day for pigs of just over 80 kg (where Y = pig ration/day and X = pig weight, $Y = 1.73 \log X - 1.32$, $r = 0.77$, $r^2 = 0.59$). All these rations are, however, modest, particularly if compared with those recently recommended for improved husbandry (Table 7.6), which are many times larger.

TABLE 7.6 : Recommended pig rations[1]
(from Watt et al. 1975:29)

Type of Pig	Weight (kg)	Age (mths)	Energy food (kg)
Weaner	13.5	2	1.8
Grower	17-45	3-4	3.6
Fattener	45-72	4-6	6.8
Adult (still growing)	112-180	10-20	9.0
Adult (maintenance)	112-180	20-36	6.8
Lactating	112-180	20-36	9.0

(1) Using the Lehmann system of feeding, with all pigs receiving 0.45 kg of protein concentrate per day as well as the energy food (except lactating sows which receive 0.9 kg). Under this regime it is recommended that growers receive as much energy food as they can eat, but Watt *et al.* note that a 135 kg pig can consume up to 20 kg sweet potato/day if fed on such an *ad lib* basis (1975:34).

In Table 7.7 the results of the full feeding survey are shown at the level of households, the units of management, not that of individual pigs. Pig rations are related both to the total

TABLE 7.7 Pig rations by household[1]

Households[2]	Sweet potato production (kg): Household Total	Household Per day[3] Mean	Household Per day[3] SD	Per WU per day	Pig rations: All pigs (kg/day) Mean	All pigs (kg/day) SD	Per cent of total production	Mean/kg/day per pig	Mean/kg/day per PU	Human rations (kg/day): Household mean	Per person[4] mean	Per HCU mean
B (a)	109.77	21.95	7.05	12.91	14.06	2.45	64.0	0.74	1.56	7.89	1.97	2.72
(b)	122.92	24.58	7.34	14.46	-	-	57.2	-	-	10.52	2.63	3.63
Z	66.22	16.56	4.10	8.28	9.04	1.12	54.6	1.00	1.56	7.51	1.88	2.68
C(ii) (a)	105.24	13.16	NA	6.58	7.10	0.85	54.0	0.79	1.58	6.06	3.03	3.36
(b)	117.48	14.69	NA	7.35	-	-	48.3	-	-	7.59	3.80	4.22
C(i) (a)	84.14	12.02	NA	6.01	7.25	1.35	60.3	1.21	1.73	4.77	2.39	2.65
(b)	95.03	13.58	3.52	6.79	-	-	53.4	-	-	6.33	3.16	3.52
Y	56.13	14.03	0.52	7.01	9.61	1.77	68.5	3.20	3.20	4.42	2.21	2.45
E (a)	68.04	9.72	NA	3.04	4.69	0.33	48.3	0.94	1.51	5.03	1.01	1.23
(b)	98.88	14.13	4.91	4.42	-	-	33.2	-	-	9.44	1.89	2.30
D	81.53	11.65	NA	4.66	3.85	0.64	33.0	1.92	1.93	7.80	1.56	2.29
X	74.96	10.71	NA	5.36	2.65	0.51	24.8	2.65	3.79	8.05	2.68	3.66
Total (a)		96.64			51.15		52.9			45.47		
Total (b)		105.24					48.6			54.07		

(1) See Table 7.4 for household characteristics.

(2) (a) = sweet potato produced by own cultivation; (b) = (a) plus other sweet potato purchased from market or received from another household.

(3) Only applicable if sweet potato obtained daily.

(4) Household members only (visitors not included).

production of sweet potato (and to the total amount, including acquisitions from other sources, available to households), and to the proportion consumed by people.[5] If the 7 households are regarded as a single sample 'population' of 25 persons and 45 pigs (I exclude the second measurement of household C) with a pig:human ratio of 1.8:1, their average daily production of sweet potato was 96.6 kg, (i.e. 3.86 kg/person/day), of which 51.1 kg (53 per cent) was fed to pigs and the remainder consumed by people. If market and gift acquisitions of tubers are included, the total amount of sweet potato available rises to 105.2 kg/day, the pig ration remains unchanged (but falls to 48.6 per cent), and the human ration rises to 54 kg. The daily ration per person (not including visitors) was 1.82 kg from production alone (2.16 kg with other acquisitions included), and each pig received an average of 1.14 kg. In comparison,

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[5]Complete information on the size of green fodder rations was not collected, but Table 7.8 indicates the amounts given by three households.

TABLE 7.8 : Green fodder component of some pig rations (kg/pig/day)[(1)]

Household	Sweet potato leaves	Grasses	Veg.leaves/ peelings	Total	As per cent of tuber ration
X	0.40	0.12	-	0.52	20
Z	0.26	0.04	0.04	0.34	34
D	0.04	-	0.19	0.23	12

[(1)]Frequency: Households X and D each gave their pigs green fodder on 4 of 7 days, Household Z on 4 out of 4 days.

Waddell reports an average production of 3.79 kg sweet potato/person/day for an Enga sample of three households, of which 64 per cent was fed to pigs (1972: 114,118). Both people and pigs received an average 1.4 kg per head daily (ibid., calculated from Table 27 and p.119). It may be noted that the pig:human ratios of these two samples were similar (1.7:1 for the Enga, ibid., 116), but it is possible that the Enga sample's pigs were larger since a tee exchange ceremony was held a few months later (ibid., 119-120).

Aggregation of the Koge figures in this way, however, is of limited interest because of the marked differences between individual households. Further, their aggregate pig:human ratio is considerably higher than that of the Waula population during 1972-73. Earlier analysis, which showed correlations between production levels and measures of household size and composition which included household pig herds, was necessarily incomplete since, without information on the division of production between people and pigs, the extent to which production was related to pig holdings could not be isolated. This is now possible.

As with the full Koge sample, the actual and relative production levels of the present seven households correlate strongly with total household size,[6] and with the total dependency ratio (Fig. 7.5). The proportion of each household's production fed to

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[6] Where Y = actual household production (sweet potato kg/day) and X = total household size (HCU + PU), $Y = 5.84 + 1.19X$, $r = 0.82$, $r^2 = 0.67$.

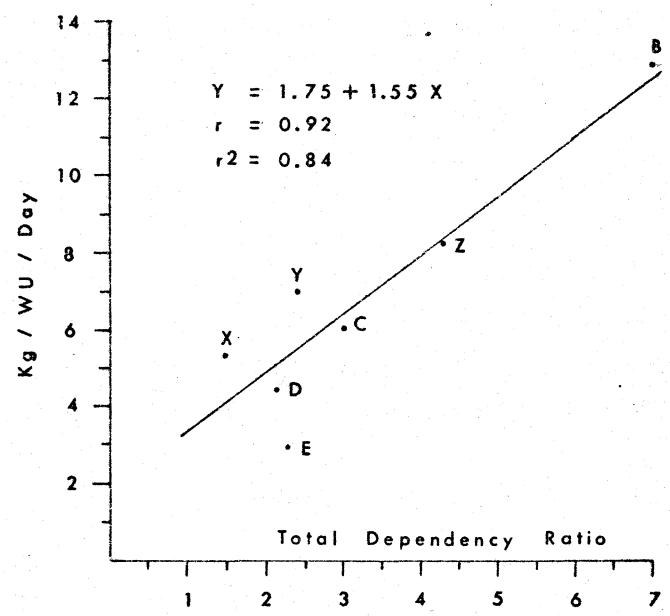

Fig.7.5 Relationship between relative sweet potato production (kg/WU/day) and total dependency ratio

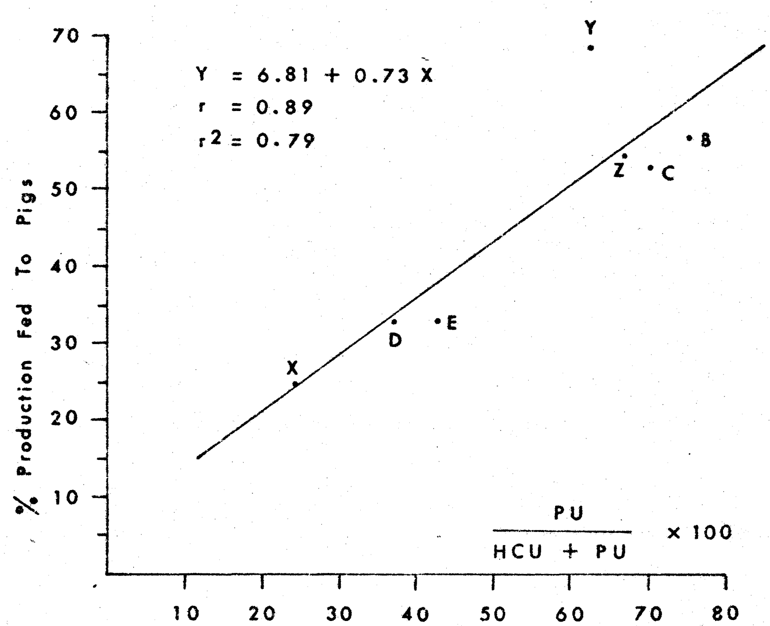

Fig.7.6 Relationship between proportion of sweet potato production fed to pigs/and relative size of household pig herd (PU as % of HCU + PU)

pigs ranged from 25 to 68 per cent, and it is reasonable to expect this to be related to a measure of the relative proportions of pigs and people within each household. Fig. 7.6 shows that the former variable is strongly correlated with PU as a percentage of HCU + PU.[7] Before exploring some of the implications of this relationship, variation in average pig rations requires brief consideration.

As Table 7.7 shows, the average sweet potato ration per pig given by the 7 households ranged from 0.8 to 3.2 kg/day, or, adjusted for pig size, from 1.5 to 3.8 kg/day per PU. Some of this variation appears to be related to the size, actual and relative, of household pig herds. The three households (D, X and Y) with three or less pigs fed their animals an average 2.59 kg (SD 0.64) per day per pig (or, per PU, an average 2.97 kg, SD 0.95), while the four households with five or more pigs fed theirs' an average of only 0.97 kg (SD 0.19) per pig (or, per PU, 1.59 kg, SD 0.10). None of the several possible measures of relative pig herd size (i.e. pigs:humans, PU:HCU, PU:WU) correlate strongly with average per pig rations, though the log of the ratio PU:WU provides a partial fit.[8] Due to the distribution of small and large herds in the sample (Table 7.4) it is unfortunately impossible

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[7]Any of the measures of pigs to people could serve as the basis for such a correlation (i.e. pigs as a percentage of people plus pigs, or the ratios, pigs:people and PU:HCU). Equations using these three variables for X gave the following: $Y = 14.04 + 0.58X$, $r = 0.81$, $r^2 = 0.66$ (where X = pigs as a percentage of people plus pigs); both of the ratios result in nonlinear relationships, where X = pigs:people (multiplied by 100 to facilitate use of logarithms, $Y = 29.32 \log X - 15.64$, $r = 80$, $r^2 = 0.63$; and where X = PU:HCU (also multiplied by 100), $Y = 39.09 \log X - 34.92$, $r = 0.88$, $r^2 = 0.78$.

[8]Where Y = average ration per pig (kg/PU/day) and X = the log of the ratio PU:WU (multiplied by 100), $Y = 5.60 - 1.58 \log X$, $r = 0.66$, $r^2 = 0.44$.

to test whether households which kept their pigs outside the enclosure system, and thus allowed their pigs to forage freely, provided their animals with smaller rations than those keeping their pigs tethered or penned inside the enclosure system.

The results of the inter-household analysis, which indicate the increasing proportion of sweet potato production fed to pigs as the number of pigs relative to people rises, can be extrapolated, with caution, to explore the range of variation which may be expected during the course of a pig cycle. Values for the relevant variables, PU and HCU, are available for Waula, 2½ years after their previous festival and, by their estimates, some four or more years before their next one (Chapter 8, pp. 502-3), and for the Dom subclan of Kumgau Barikane, both immediately before, and seven months after, their 1972 festival. These are shown in Table 7.9 with estimates of the proportion of sweet potato production fed to pigs at these three cyclical stages.

Substandard tubers

Knowing the proportion of sweet potato production fed to pigs is not, however, the same as knowing how much land, over and above that required for the production of human food, is cultivated especially to provide tubers for pigs. This is because a proportion of any sweet potato crop is composed of small tubers which are either unfit for human consumption, or disliked by people. Although I did not investigate in the field the extent of this normal by-product of sweet potato production, a working estimate can be obtained from a review of the scattered, but now reasonable, literature on this question.

TABLE 7.9 Estimated variations in proportion of sweet potato production fed to pigs during cycle

	Early cycle	Mid cycle	Late cycle
	Dom Barikane April 1973	Nimai Waula 1972/73	Dom Barikane July 1972
(A) Data Base			
Resident human population	83	248	97
HCU	61.2	183.4	71.8
Pigs held	26	213	75
PU	17.8	133.6	74.7
PU : HCU	0.29:1	0.73:1	1.04:1
(B) $\frac{PU}{HCU + PU} \times 100$	22	42	51
(C) Proportion of sweet potato production fed to pigs (estimate)[1]	23	38	44

[1] Calculated by means of the equation in Fig.7.6.

For Chimbu, Brookfield and Brown report that a DASF yield trial at Kundiawa found that "...15-25 per cent of the harvest of a garden in full production...(was) of the small size that would be fed to pigs....In old gardens a much higher proportion of the total crop is used in this way" (1963:58). Are such small tubers qualitatively unfit for human consumption, or only disliked when large tubers are available? If they are inedible, how small is small? Further, what are "old gardens"? Those with an old crop in late stages of harvesting, or those which have been replanted several times and hence presumably with depleted soils? Rappaport provides some information for the Maring. Their pig rations consisted of "garbage and substandard tubers, mainly sweet potatoes" (1968:58). The latter, he estimated, accounted for 83 per cent of all tubers fed to pigs (ibid., 60). Such substandard tubers weighed less than 113 g (oz in original), and "while edible, are considered unpalatable, being mostly skin" (ibid., 260, see also, 59, 67). According to Rappaport some 30 to 50 per cent of the sweet potato harvest was of this size (ibid., 260). Since Maring apparently plant mainly in the period June-September, and Rappaport weighed production between March and May (ibid., 43), it is possible that this estimate refers to the earlier stages of harvesting. Waddell gives no estimates for the Raiapu Enga, but notes that "(m)ost of the tubers (fed to pigs) are of inferior quality removed in the later harvestings of the sweet potato mounds, but, as the pig population increases, their owners are obliged to feed them ones of better quality" (1972:62; parenthesis added).

Further insight into the size and extent of inferior tubers comes from an experiment made by Jamieson (1968) in New Britain under coastal conditions. From three plots, which were cultivated under three different rotation regimes, he harvested tubers eight times from roughly four to nine months after planting, weighing a sample of approximately 50 tubers from each plot at each harvest. From two of the plots on better quality soils, tubers weighing less than 57g (oz in original) ranged from 14 to 29 per cent and 8 to 21 per cent of the eight harvests; from the third plot on soil of lower fertility, they constituted 33-72 per cent (ibid., 22-24). While the poorer soil was associated with a greater proportion of small tubers, Jamieson did not find that the proportion of small tubers increased with the ageing of the crop. On the good soils the size distrubtion of tubers remained stable, while on the poor soil the proportion of small tubers in fact declined (ibid., 17, 23-4).

To determine the relationship between palatability and tuber size Jamieson conducted an ingenious test. A panel of six New Guinean fieldworkers independently judged the eating qualities of boiled tuber samples in respect to such characteristics as roughness, fibre, sweetness and tang. Their judgements were then summed to give a palatability index by which the different-sized tubers could be rated. The resulting scores, summarised in Table 7.10, show vividly how unpalatable the under 57 g tubers were rated. This is a significant finding since it suggests that the widespread avoidance of such small tubers rests upon a genuine difference in palatability rather than cultural evaluations of the proper size of tuber fit for adult consumption (cf. Mitchell 1976:73).[9]

TABLE 7.10 : The palatability of sweet potatoes by tuber size[(1)]

Weight classes (g)	Palatability Index Score
0 - 57	6
58 - 227	22
228 - 510	32
511 - 567	22
568 +	34

[(1)]Adapted from Jamieson (1968:22, Table 5), whose original tabulation included 13 classes of 2 oz increments. I have grouped only those classes sharing the same index score.

It may be concluded then that very small tubers are distinctly unpalatable, and that their proportion of a crop increases with a decline in soil quality, but not necessarily with the age of a crop.[10]

As indicated by the cited reports, there is a very wide range of variation in the proportion of tubers which might be deemed to be of

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[9]However, it is of interest that Jamieson's panel enjoyed tubers weighing more than 0.5 kg, which Mitchell reports the Nagovisi also considered unfit for human consumption (ibid.) Perhaps age of tuber, as well as size, is important?

[10]Different field results relating to this latter variable would be expected, given differing harvesting strategies, i.e. the Nagovisi usually harvest an entire plant at one time (Mitchell 1976: 58, 73), whereas the more common New Guinean technique (I think) is selective harvesting over a period of time, as is done in Sinasina.

unpalatable size. As a working estimate an average 20 per cent would seem to be reasonable.[11]

This figure is useful for defining a theoretical minimum level of pig production which might be maintained without extra cultivation solely for pig fodder. This can be calculated from the equation shown earlier in Fig. 7.6 (p. 370), as PU at 18 per cent of HCU + PU, or a PU:HCU ratio of 0.22:1. In other words, the cultivated area necessary for the support of one 'reference person' can also provide, theoretically, sufficient substandard tubers for the support of 0.22 PU. Since pigs can consume 100 per cent of a crop, the amount of extra cultivation necessary for each increase of 1 PU in the ratio PU:HCU is 80 per cent of the amount needed for the support of one reference person. The empirical variation in the PU:HCU ratios of Barikane shown earlier (Table 7.9) therefore suggest that during the course of a cycle the amount of sweet potato cultivation might increase by approximately 66 per cent (calculated as : the Barikane pre-festival ratio of 1.04 PU per HCU represented an increase of 0.82 PU over the 'minimum' 0.22 figure; 80 per cent of 0.82 is 0.66). Increases within this range are also suggested by Brookfield's analysis of land use changes among the Mintima Naregu between 1958-67 : i.e. an increase of 54 per cent in the area under open field cultivation per capita (1973b: 140, Table 6.1).

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[11] Watt et al. (1975:34) mention that 40 per cent of a harvest is usually not suitable "for sale", but market quality is presumably of a higher standard than that tolerated for home consumption.

Coffee production

Data on coffee production were also obtained from Koge sample households during the three four-week periods when their activities were surveyed, and are more complete than figures for subsistence production.[12] Period I (19 June - 16 July) coincided with part of the coffee flush (May-August), Periods II (23 October - 19 November) and III (5 February - 4 March) with the off-season. As Table 7.11 shows, production was markedly seasonal, with 68 per cent of the total cherry harvested picked in Period I, 13 per cent in Period II, and 19 per cent in Period III. Labour expended in coffee (all tasks, n=530.3 hours) was similarly distributed, with respective Period percentages of 64, 15 and 20. In terms of harvesting frequency, the average household picked coffee every fourth day during the flush, every ninth day in November, and only once every 12 days during February. This pattern of seasonality matches relatively well that shown by average monthly purchasing records from the Kundiawa Coffee Society for the period 1971-74: June, November and February had, respectively, 18, 3.7 and 2.4 mean monthly percentages of total annual purchases (Howlett et al. 1976:231).

Harvesting is not heavy work, and is done by men, women and children. During 1972-73 harvesting rarely occupied a full day, even during the flush, as witnessed by the small average quantities of

[12] All production was weighed, in most cases as freshly picked cherry. When, as occasionally occurred, coffee was pulped before weighing, weights were converted to cherry equivalents. All sales were recorded by price, and only a minority were also weighed before sale.

TABLE 7.11 Seasonality and frequency of coffee harvesting (Koge sample)

Period	Week	Total Cherry harvested		No. of days[1] households harvested	No. of times[2] adults harvested	No. of times children harvested	Average weight (kg) Cherry harvested	
		kg	%				per harvesting day	per harvesting day[3]
I	1	169	18	21	22	2	8.1	7.4
	2	153	16	14	16	6	10.9	8.1
	3	213	23	19	30	9	11.2	6.2
	4	101	11	13	13	1	7.8	7.4
sub-total		636	68	67	81	18	9.5	7.1
II	5	25	3	8	9	1	3.1	2.6
	6	15	2	4	4	0	3.6	3.6
	7	15	2	3	3	0	4.9	4.9
	8	64	7	15	10	6	4.3	4.9
sub-total		119	13	30	26	7	4.0	4.0
III	9	58	6	7	8	2	8.2	6.4
	10	14	1	4	4	0	3.6	3.6
	11	70	8	7	7	0	10.0	10.0
	12	33	3	5	5	1	6.6	6.0
sub-total		175	19	23	24	3	7.6	6.9
Survey Total		930	100	120	131	28	7.7	6.4
Mean household		93		12	13	2.8	8.0	

[1] This column totals the number of days per week each household harvested coffee, i.e. the potential maximum per week is 10 households x 7 days = 70.

[2] An adult is defined as anyone 18 years or over. Of the 131 times adults harvested, 83 (63%) were by women. Non-household members participated on only 6 (5%) of the 120 household harvesting-days, but accounted for 12 (9%) of the times adults harvested.

[3] An adult is counted as one person harvesting, a child one-half "person harvesting".

cherry picked per harvesting (Table 7.11; cf. Anderson 1977:24-6). Adult women picked more than adult men, but the overall contribution of the sexes to coffee production was roughly equal if the distribution of labour among all coffee tasks, and absences, are taken into consideration. One of the reasons for absences by adult men during the flush season was the demand for labour by coffee plantations in the Wahgi valley to the West. Throughout Period I two of the male members of the sample (the head of household G, and B's son) were thus employed. Lack of pruning means that some trees are heavily overgrown, necessitating the occasional use of ladders (usually by men), but normal picking equipment is only a bucket or tin-can to hold the cherry.

Although most harvesting, and other coffee tasks, was done by household members on their own holdings, there were exceptions. These included occasional, usually informal, help with picking by kin or neighbours, and the extension of harvesting rights to others. The relative amounts of coffee-related labour which the households either expended in helping, or received from, others is shown in Table 7.12. Three households (D, E and I) stand out in terms of help received. D, (excluded from Table 7.12 because it had no coffee of its own in Waula having recently returned after a 15 year residence amongst the Tabari), was helped by two small work parties of women to harvest from a fellow clansman's coffee during the flush. E also mobilised joint labour but in a rather different form. On two days during the flush, the household head, exploiting a temporary craze for marbles amongst children, succeeded in persuading two groups of six and nine

TABLE 7.12 : Exchange labour in coffee production (Koge sample)

Households	Exchange labour as percentage of total hours spent by household members on coffee production	
	Labour from	Labour to
G	2.2	3.7
J	1.7	13.9
F	-	18.9
H	7.1	9.1
E	24.2	15.4
I	17.4	-
A	3.3	8.4
B	-	2.8
C	8.1	-

children to help him pick coffee in return for marbles. No other household used, or participated in, any other 'formal' work grouping for coffee production like these, nor did any give or receive money or other goods in direct payment for labour related to coffee. The fairly substantial assistance received by household I came from a female relative of I's wife, whose extended visit during Period I was probably related to the fact that I's wife was then nursing a baby born less than one month before. It may be noted that in E's case also, his wife was five months pregnant during the flush. Of the three households (E, J, and F) which contributed significant labour to others, E's situation is explained by the fact that its head managed, and nominally owned, a coffee pulper. To ensure the careful use of the machine he frequently processed other's coffee for them.

J, the bachelor, helped a number of other households, both with harvesting, and particularly with drying, a task requiring the presence of someone in the settlement ready, in the event of rain, to move the beans under shelter. Household F, as described earlier (p. 359) was struggling to keep its head above water for subsistence purposes, and helped D, in particular, with picking, probably in return for rights to harvest subsistence food from the latter's gardens.

In several cases harvesting rights were extended to others. Table 7.13 shows that 13 per cent of the total 930 kg of cherry coffee picked by the sample was harvested from coffee trees belonging to others. The majority of this was accounted for by D, the one household with no coffee of its own in Waula. Two of the other four cases could also be interpreted as cases of need: neither of households C or I had much coffee of their own. In the case of C, 26 per cent of its production was picked from coffee belonging to a young fellow-subclan member. The latter's household moved, in 1972, from the small outlying hamlet of Aina to join, like C, the new hamlet at Kolai. During the following months close ties of assistance developed between the two households. These ties included daily food sharing and some labour exchange, and C granted the use of a food crop plot to his new neighbour. Significantly the latter had far more coffee planted than C (0.24 ha compared to 0.04). In the case of household I, 25 per cent of its total was picked from the holdings of a full brother who not only had more than twice as much coffee planted (0.12 ha compared to 0.05), but who also received wages as a general assistant at a nearby foreign-owned store. This brother had also

TABLE 7.13 : Coffee production by household: cherry coffee harvested, parchment produced, parchment sold, and yields per area (Koge sample, 3 months)[1]

Household	Coffee area ha	Cherry harvested (kg/3 months) Own coffee	Others	Total	Parchment produced est.[2] kg/3 mth	value $[3]	Parchment sales $/3 months	Estimated yields (tonnes/ha/yr)[5] Cherry	Parchment[2]
D	-	-	69	69	13.8	3.04	3.30	-	-
C	.04	25	9	34	6.8	1.50	4.90	2.50	0.50
I	.05	52	17	69	13.8	3.04	5.30	4.16	0.83
A	.07	38	-	38	7.6	1.67	2.70	2.17	0.43
E	.10	119	3	122	24.4	5.37	2.40	4.76	0.95
F	.11	93	-	93	18.6	4.09	0.80	3.39	0.68
B	.12	70	-	70	14.0	3.08	2.30	2.47	0.49
J	.13	72	-	72	14.4	3.17	2.90	2.22	0.44
G	.13	198	21	219	43.8	9.64	2.90	6.09	1.22
H	.16	145	-	145	29.0	6.38	13.90	3.63	0.73
Sample total	.92	812	119	931	186.2	40.98	41.40	3.53	0.71
Mean household[4]	.10	90	6	96	19.1	4.20	4.23	3.49	0.70

(1) No allowances made for absences.

(2) Parchment converted from cherry weights, using a cherry:parchment ratio of 100:20. The latter is an estimate based upon a small number of field measurements. Brookfield (1968:108) uses 100:18, as does DASF (1971:51). The latter, however, gives a 100:70 ratio for indigenous parchment: green bean, as compared with a 100:83 ratio (for plantation coffee?), i.e. peasant parchment is not as well dried as that from plantations.

(3) Value calculated at a low price of 22 cents/kg.

(4) Excluding Household D, which had no coffee planted in Waula territory, having recently returned from a 15 year absence.

(5) Calculated from figures in columns one and two with one exception: an additional 4 kg of cherry was harvested from B's holding.

adopted two of I's children since neither of his own had survived. The one case which does not fit this general pattern of assistance in need is that of household G which, despite the fact that it produced more than twice the average amount of coffee during the survey, also harvested 10 per cent of its total from the holding of a clan 'sister' married into the neighbouring Nimai Bomai clan. It may be noted that G was the only household known to have suffered a major theft of accumulated parchment beans during the year: approximately 20 kg during July.

The average household in the sample produced approximately 90 kg of cherry during the three month survey (Table 7.13), which extrapolates to 360 kg/year (or 72 kg parchment/year, converted at a cherry:parchment ratio of 100 : 20). Assuming a low overall price during 1972 and early 1973 of 22 cents/kg (for parchment), the average household income from coffee was therefore only $15.80/year. With household coffee holdings averaging 0.10 ha, the average yield was 0.7 t (parchment)/ha/year (Table 7.13).

This low income figure raises questions about the reliability of the data. How reasonable are they? Hatanaka, for instance, estimated coffee income for Gunangi domestic groups in South Sinasina, whose holdings averaged only 0.07 ha each, at a possible $83-120 in 1969 when prices were comparably low (she used a figure of 27.6 cents/kg). This large discrepancy is explained, I think, by her apparent failure to distinguish between cherry and parchment. Her estimate is based on annual yields of 2.75 kg/mature tree and 0.76 kg/immature tree, which figures, although she does not say so, must refer to cherry not parchment. Without converting them to parchment, Hatanaka directly derives from them income estimates of 62.4 cents/mature tree/year and 20.8 cents per immature tree, and then multiplies these by her total tree counts (8589 mature, 6572 immature), to give a total clan income figure, from which her domestic group average was obtained. Her error is revealed when total production is related to land area (4.68 ha), giving an impossibly high parchment yield of 5.2 t/ha. The average Waula yield of 0.7 t/ha, however, is similar to Brookfield's 0.7 estimate[13] for Naregu, which he compares with plantation averages of 1.1-1.2 (1968:103-4; see also Emmery 1970:278). A more recent study by Wilson and Evans, using gross figures on Chimbu growers, tree numbers and production estimates (all of which are subject to debate), obtained an estimate of 1.3 t/ha (1975:8), which, if their Chimbu figures are combined with those for the Western and Eastern Highlands, is lowered to 1.1 (ibid., 11-12). The latter figure has been used by subsequent studies (e.g. Anderson 1977).

It is possible, then, that my average of 0.7 t/ha for the Koge sample, which is considerably lower than these figures, is an

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[13]Brookfield's definition of "dry factory beans" could mean either parchment or the product, green bean, after factory drying and polishing. If the latter, his estimate would convert to approximately 0.9-1.0 t/parchment/ha according to the amount of drying (cf. DASF 1971:51).

underestimate.[14] If this is the case, my coffee income estimate is also too low. I note with interest, however, that a recent study estimates yields at between 500-700 kg/ha which it describes as less than half previous estimates (Economic Consultants 1979: Vol.3, p.41; apparently they did not consult Howlett et al. 1976:226). Be that as it may, my figures may be used to indicate estimates of labour inputs and cash returns for the average sized holding of 0.10 ha.[15] Table 7.14 shows such a holding to have received some 205 hours/year, indicating, if 70 per cent was invested during the four

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[14]Assuming complete weighing of coffee harvested by the sample households during the three months (of which I am reasonably confident), possible sources of distortion include: an unusually large proportion of immature and other non-bearing trees; that Period I did not properly sample the main flush season at Koge during 1972; that some harvesting from sample households' plots by non-sample members was not recorded (a possibility in the case of households J and H); and that some households, as a result of other sources of cash, or in response to the low price levels, did not harvest intensively. Alternatively, given the altitude range of the sample's plots (100 per cent planted over 1700 m, in contrast to only 38 per cent amongst the Naregu at Mintima, p. 288), it is possible the average correctly reflects a decline due to increased altitude (cf. Barrie, 1956a:3, who suggests a decline in growth rate and vigour over 1980 m).

[15]In summary form, the differences between my data and those of Anderson (1977: Table 24) are (for a base of 0.19 ha/year):

		Hide	Anderson
Input:	hours	388	416
	days (8 hours)	52	48.5
Production:	kg parchment	135	215[(1)]
Productivity:	kg parchment/hour	0.35	0.52

[(1)]based on assumed 1.1 t/ha/yr.

TABLE 7.14 : Estimated labour inputs in coffee production for average holding of 0.10 ha (based on Koge sample)[1]

Input	Labour input per 0.10 ha/year	
	Hours	Days[2]
Maintenance	17.3	2.2
Harvest	148.7	18.6
Pulp	22.5	2.8
Wash/dry	9.0	1.1
Market	7.5	0.9
Total	205.0	25.6

[1] Based on sum of 9 households' (D excluded due to no area base) labour inputs during 3 months: children (under 17 years) counted as 0.5 adult, exchange labour added and subtracted where relevant, and no allowance made for absences.

[2] 8 hours assumed.

TABLE 7.15 : Estimated cash returns to land and labour in coffee production (for average holding of 0.10 ha, assuming parchment yield of 0.71 t/ha/yr

Price of parchment ($/kg)	Cash returns		
	To land	To labour	
	$/0.10 ha/yr	$ hour	$/day[1]
0.22	15.60	0.07	0.56
0.33	23.40	0.11	0.88
0.44	31.20	0.14	1.12
0.55	39.00	0.19	1.54

[1] 8 hours.

flush months (p. 378), a peak input of 8.7 hours/week between May and August. Table 7.15 shows some estimates of returns to land and labour for various price levels.

Attention can now be turned to consider the extent of variation between households. Although the size of their coffee holdings differed considerably (and this largely determined total coffee income available to them), holding size does not fully account for the range in yields by area (0.4-1.2 t/ha, Table 7.13). The latter are, as would be expected, closely related to labour inputs (Table 7.16, Fig. 7.7). Four households (A, C, J, B) all expended less than 1500 hours/ha/year in coffee (this includes all work connected with coffee), and obtained yields of only 0.43-0.50 t/ha. Four others (E, F, H, I) which invested between 2000 and 3000 hours/ha had yields of 0.68-0.95 t/ha, and one, (G), wrung 1.22 t/ha from an investment of nearly 3300 hours/ha. In short, the nine households spanned an almost three-fold range of inputs and yields per area.

The age of coffee trees, and the availability of household labour, are two factors which, without inquiring into motivation, help to explain some of this variation. The reduced labour requirement of immature trees (non-bearing or only partly bearing), probably accounts for the lower inputs of households A and C, which were headed by the youngest members of the sample. Both had only recently established coffee. Households B and J, the other two households showing low inputs per area, however, both reveal the effects of labour shortage. Analytically, labour for coffee can be said to be short either absolutely (i.e. when a household lacks sufficient labour for all

TABLE 7.16 : Varying intensities of household coffee production (A) per worker,[1] (B) per hectare (Koge sample)

Household	A. Per Worker			B. Per Hectare		
	Labour[2]	Production[3]		Labour[4]	Production[5]	
	Hours/week	Kg/week	Kg/hour	Hours/year	Tonnes/year	Kg/hour
G	4.8	1.78	0.37	3283	1.22	0.37
J	3.7	1.20	0.32	1366	0.44	0.32
F	3.1	0.82	0.26	2570	0.68	0.26
H	2.1	0.74	0.35	2062	0.73	0.35
E	1.7	0.72	0.42	2224	0.95	0.43
I	1.6	0.46	0.29	2976	0.83	0.28
A	1.4	0.62	0.44	971	0.43	0.44
B	1.4	0.50	0.36	1460	0.49	0.34
C	0.7	0.24	0.34	1340	0.50	0.37

(1) In this analysis, adults (18 years plus) of both sexes equal 1.0 worker, and children (c.11-17 years) 0.5 workers.

(2) These figures are corrected for absences, and for age (see Note 1); i.e. the total number of hours spent on coffee production by surveyed members of a household (minus labour exchange to other households, plus labour exchange from other households), divided by their combined total of weeks present.

(3) Parchment coffee, calculated as one-fifth the weight of cherry coffee harvested. Corrected for absences, i.e. total kg. produced divided by the combined total of weeks present.

(4) These figures are not corrected for absences, but are corrected for age. They represent the sum of hours spent by household members on coffee production on the household's own holding plus hours received in labour exchange from other households extrapolated to one year.

(5) Parchment coffee; survey production figures extrapolated to one year. No allowance made for absences.

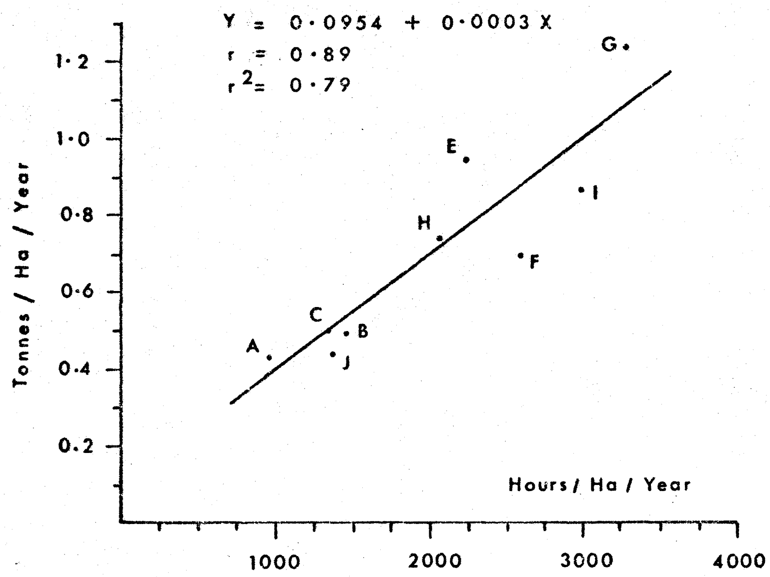

Fig.7.7 Relationship between coffee yields (parchment tonnes/ha/household/year) and labour inputs (hours/ha/household/year)

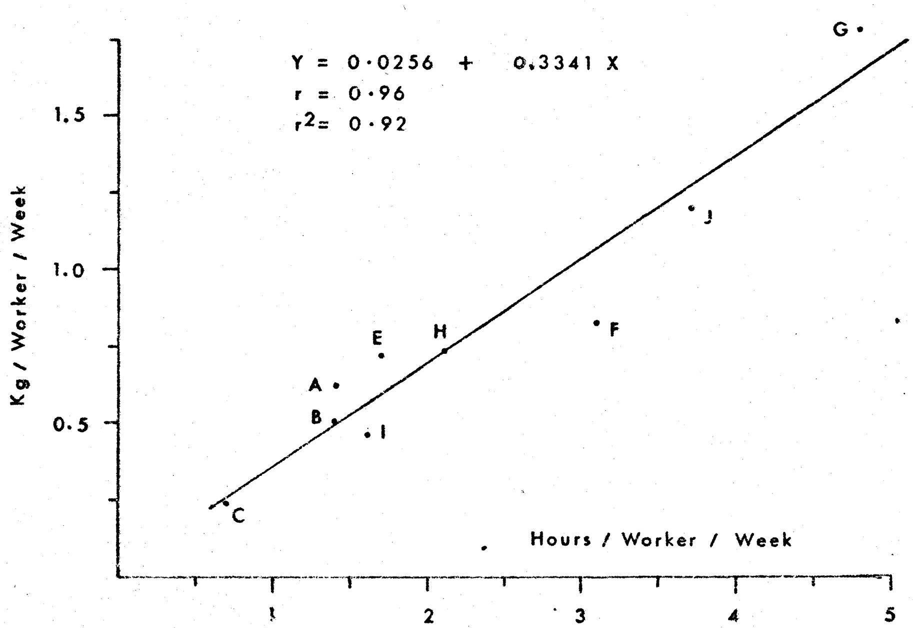

Fig.7.8 Relationship between relative coffee production (parchment kg/Worker/household/week) and labour inputs (hours/Worker/household/week)

tasks), or relatively (i.e. when it directs a disproportional amount of labour into tasks other than coffee at the expense of the latter). Household J, consisting solely of an elderly bachelor who achieved only low yields from his restricted inputs into a large (0.13ha) holding is an example of absolute shortage. Yet, to view his activities from the perspective of area alone hides his relative weekly input of 3.7 hours which brought him an average return per week of 1.2 kg parchment, a level second only to that of the members of household G (Fig. 7.8). In contrast, household B, while not generally lacking labour, was stretched to its limits in 1972-73 as a result of concentrating sharply on food crop production and pig raising. As shown earlier (pp.311, 315-6) it had several times the average subsistence area under cultivation, and kept the highest number of pigs.

Coffee sales were listed by household in Table 7.13. Although the total value of the sample's sales ($41.50) agreed closely with the estimated value of the total production of parchment ($40.98), there was no such agreement between production and sales at the level of individual households, probably as a result of accumulation (i.e. the survey periods caught some sales of previous production, and missed sales of surveyed production). Table 7.17 analyses sales by size and Period. More than three-quarters of the transactions, accounting for 27 per cent of their total value, were for amounts of less than $1.00. Although the percentage (by value) of sales made during the flush (68 per cent) was similar to the percentage (68) of coffee produced in the same period, the two off-season periods show no such relationship

TABLE 7.17 : Number and size of coffee sales (Koge sample)

Value of Sales ($)	Number of Sales			Survey Totals			
	Period I	Period II	Period III	Number of Sales	%	Value $	%
.10- .50	7	4	12	23	58	5.10	12.3
.50- 1.00	1	-	7	8	20	6.10	14.7
1.00- 2.00	4	-	1	5	12	9.30	22.4
2.00- 5.00	2	-	1	3	8	10.00	24.1
5.00-10.00	-	-	-	-	-		
10.00 +	1	-	-	1	2	11.00	26.5
Total no. sales	15	4	21	40	100	41.50	100.0
Total value	28.20	0.90	12.40	41.50			
No. of households which made sales	9	4	7	10			

between sales and production. Further, examination of the weekly distributions of harvested coffee and sales (Table 7.18), indicates that the Period I correlation was fortuitous, the result of a single large sale in week I, and that sales were not closely related to production (i.e. either in the same, or, as might perhaps be expected, succeeding week).

TABLE 7.18 : Distribution of coffee harvesting and sales by week and period (Koge sample)

Period	Week	Coffee harvesting (n=930 kg)	Coffee sales (n=$41.50)
I	1	18.2	47.2
	2	16.4	8.2
	3	22.9	1.4
	4	10.9	8.7
	subtotal	68.4	68.0
II	5	2.7	1.0
	6	1.6	-
	7	1.6	1.0
	8	6.9	0.2
	subtotal	12.8	2.2
III	9	6.2	10.4
	10	1.5	8.4
	11	7.5	6.5
	12	3.5	4.6
	subtotal	18.8	29.9
	Total	100.0	100.0

With one exception all recorded sales were made to coffee buyers on market days at the Koge market place. Although my information on the identity of all buyers is incomplete, the following indicates the wide range operating at the time: 12 sales were made to Nimai buyers (three belonging to Dugul clan, and two to Bomai), three to buyers from Dinga, two each to Collins and Leahy Ltd. and a Kundiawa store, and one each to buyers belonging to Namasu (a company), the Kundiawa Coffee Society, and to buyers recognised only as "from" Banz, Elimbari, Golun, and Koroka. It is probable that a number of the latter buyers, as well as some of those identified as Nimai and Dinga were either working officially for the Coffee Society or buying on their own account and reselling to the Society. No regular relationships between sellers and buyers were apparent. Sellers usually shopped around for the best price, frequently choosing to defer a sale when the price was considered insufficient. Discrimination was usually worthwhile since, on a single day prices often varied considerably between buyers. In June 1972, for instance, four recorded prices on a single market day ranged from 24 to 31 cents/kg.

Food purchases: substitute or supplement?

To what extent is money, derived from coffee sales and other sources, used to purchase foods? Further, do such purchased items substitute for, or supplement, a household's own production? Some partial answers to these questions are provided by information on the Koge sample's use of markets (primarily that at Koge), and retail stores (see Appendix 6, Section 8, for details).

By value, food accounted for 85 per cent of the sample's market purchases, and 96 per cent of sales. Sweet potato was the single most important item accounting for 55 per cent of purchases and 87 per cent of sales. Extrapolated to a year, I estimate that the sample sold, on average, 16 kg sweet potato/person and bought 32 kg/person. By comparison with the average production estimate of approximately 1100 kg/person/year (Table 7.3), these are small amounts, and are not suggestive of a significant dependence on the market for the purchase of the staple.

Analysis of the sample's retail purchases indicates an average expenditure on food of 14 cents/person/week, of which 6 cents was spent on protein and fat rich foods (tinned fish and meat, dripping etc.), 7 cents on largely starchy items (rice, bread, biscuits etc.), and the remainder on condiments and snacks. If the protein and starch figures are converted[16] to amounts of tinned fish and rice, their major components, they imply average intakes (per person/week) of 109 g of fish and 212 g of rice which, in energy terms, would total some 955 calories/person/week.[17] Allowing for visitors,[18] an average 866 calories/person/week from retail purchases is probably not far off the mark. It should be noted, however, that not only was there a wide variation between households around the average expenditure (i.e. 2-46 cents/person/week, Table A6.25, but also that the sample average varied between the Periods (19, 17 and 8 cents respectively; Table A6.24). In

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[16]During research, the price of fish (mackerel, pike) was approximately 55 cents/kg, and that of white rice, 33 cents/kg.

[17]Converting fish at 182 kilocalories/100 g, and rice at 357 (Thomas and Corden 1970).

[18]Who accounted for nine per cent of the total 'person days' during the three months of the survey, (Appendix 6, Table A6.7).

the absence of nutritional data this average for purchased calories cannot be assessed precisely relative to the average intake of other, non-purchased, foods. Very approximately, I estimate that it was about 7 per cent of the average energy available for consumption, after subtraction of pig rations, in the form of sweet potato.[19]

These limited materials therefore do not indicate a major reliance on the purchase of energy foods, at least at this time of low coffee prices. However, an over-emphasis on energy is perhaps misplaced, given the generally very low intakes of animal protein and fats recorded by nutritional studies throughout the central highlands (Oomen 1971:12,14). The purchases of such items as canned fish and dripping are more usefully seen in the context of locally produced sources of protein and fats, pork in particular, but also some vegetable sources.

The major protein and fat-rich foods can be divided into two categories: those obtained from locally produced animals (pigs, chickens, dogs, and cassowaries) and plants (nut and oil pandanus, and _Aleurites_ sp. nuts), and those which are mainly imported commercially (fish, meat, and dripping - all in canned form -, and various frozen meats - chicken, mutton and beef). While the majority of items in the former category which are consumed in Sinasina are also produced there, they are not of course necessarily consumed by their producers. All such

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[19]Calculated as follows. The sample produced an estimated 21 kg of sweet potato/person (including visitors)/week (Table 7.3). Using the equation shown in Fig. 7.6, with values for X from Tables A6.3 and A6.4, I estimate that 46 per cent of this was fed to pigs, leaving 11.2 kg sweet potato available for human consumption. Assuming 10 per cent waste, and converting at 116 calories/100 g, this gives 11,724 calories of sweet potato/person/week.

items circulate widely through formal and informal exchange relationships, as well as through market transactions. Conversely, items from the second category (especially frozen meats), though entering Sinasina through commercial channels, are commonly later distributed through non-commercial relationships. The frequency with which foods in both categories are consumed thus depends upon the interplay of four factors: their availability, which ranges from strongly seasonal, in the case of some local products, to regular, in the case of some imports; the production opportunities and performance of individual households; access to money, since all items can be purchased; and participation in exchange relations, since almost all items are also regularly distributed by this means. The relative importance of these factors is indicated by data on the average 'frequency of consumption' of the various foods both by the Koge sample considered as a whole (Table 7.19), and by its member households individually (Table 7.20). Two caveats must be entered concerning this particular measure. In the first place, although used here in the absence of intake figures, it can in no way substitute for them. Secondly, some inflation results from the use of households as the base unit, when the data were collected from individuals, i.e. a 'household' was credited with a fish 'day' if one member consumed that item. It is therefore a rough measure only, and, in the case of fish for instance, should be compared with figures on expenditure (Table A6.24).

Canned fish was the most commonly consumed item, eaten, on average, three times per fortnight. It was the cheapest, most regularly available, protein source in Sinasina, sold in two sizes of can (15 ozs and 5 ozs

TABLE 7.19 Average frequency of consumption (mean days/household/week)(1) of protein-, and fat-, rich foods: Koge sample, by week and by Period

Period(2)	Week	Canned fish	Pork	Other meats(3)	Dripping	Marita pandanus	Nuts(4)
I	1	1.4	0.1	0.3	-	-	-
	2	3.2	0.7	0.1	-	-	-
	3	1.4	0.1	0.1	-	0.1	-
	4	2.6	1.5	0.5	-	-	-
	Period means	2.2	0.6	0.2	-	-	-
II	5	1.3	0.9	0.2	0.1	-	-
	6	1.9	-	-	0.1	-	0.3
	7	0.9	1.0	-	0.5	-	0.2
	8	0.7	-	0.5	0.2	-	0.1
	Period means	1.2	0.5	0.2	0.2	-	0.2
III	9	1.1	1.7	0.1	-	1.0	3.4
	10	1.3	0.2	-	0.3	1.3	3.2
	11	1.7	0.1	0.1	0.3	1.0	4.2
	12	0.7	0.3	-	0.2	1.4	3.8
	Period means	1.2	0.6	-	0.2	1.2	3.6
Survey means		1.5	0.6	0.2	0.1	0.4	1.3

(1) Calculated by summing for each week all days each household (see text) consumed particular items and dividing by number of households present during week (10 households present during weeks, 1, 2, 3 and 5; 9.5 households during week 4, and 9 during the remaining weeks).

(2) Period I (19 June-16 July 1972), Period II (23 October-19 November 1972), and Period III (5 February-4 March 1973).

(3) Tinned meat, frozen meat, chickens, dog and cassowary.

(4) *Aleurites* sp. during Period II, *karuka* pandanus in Period III.

TABLE 7.20 Frequency of consumption (mean days/household/week) of protein-, and fat-, rich foods: by household for whole survey

Households	Weeks present	Canned fish	Pork	Other meats[1]	Dripping	Marita pandanus	Nuts[1]
E	12	1.2	0.8	0.3	0.2	0.6	1.2
A	8.5	2.2	0.9	0.1	0.2	0.6[2]	1.7[2]
B	12	2.4	0.5	0.2	0.2	0.3	1.4
C	11	2.4	1.0	0.3	0.1	0.6	1.2
F	12	0.5	0.2	0.1	0.1	0.2	0.7
J	12	1.6	0.2	-	0.1	0.7	1.4
G	12	1.1	0.6	0.2	0.4	0.2	1.8
D	12	1.1	0.7	0.1	-	0.7	1.2
H	12	1.5	0.3	-	0.1	0.4	1.2
I	8	1.8	0.2	0.4	0.1	NA[3]	NA[3]

[1] See Table 7.19 for definition.

[2] Weighted, due to household's absence in Period II.

[3] Household absent during Period III.

for approximately 30 and 10 cents) by the majority of trade stores. Table 7.19 shows that fish was consumed about twice as frequently during Period I than in either of the other two Periods, presumably as a result of cash received from seasonal coffee sales.[20] The frequency range for individual households (Table 7.20) was not wide, with only one household, F (cf. Fig. 7.), dropping well below once per week. The category "nuts", the only other item consumed on average more than once per week, includes two kinds which differ by season and place of origin. Small quantities of *Aleurites* sp. (*kawi*) were received, during Period II, as gifts and through trade from lower altitude areas in the south of Sinasina (Dom and Gunangi). This pattern of seasonality is matched by market records, where they only appeared for sale between September and December, peaking in November. Nut pandanus, which were grown by some of the sample, and also received in trade and exchange, were fruiting in Period III, when they were regularly eaten on three or more days per week.

Pork, socially the most important of the locally produced meats,[21]

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[20] However, variations between all three periods may well be more complex: i.e. some of the heavy expenditure during Period II (Table A6.24), was probably related to mourning, rather than immediate coffee income which was apparently very low at this time (Table 7.18). Further, Table A6.24 suggests that expenditure on protein foods during Period III was considerably lower than in Period II, though this is not indicated by the frequency figures in Table 7.19. Was this due to high intakes of *karuka* and *marita* pandanus (Table 7.19), or to a major reduction in the number of visitors (Table A6.7)?

[21] Cassowaries are too rare to seriously compete with pigs, and cattle in the early 1970s were also very infrequent. Later reports indicate that cattle have become increasingly important. For instance, while only two or three were killed at the Dom pig festival in 1972, visitors and participants suggest a figure of approximately 100 at the

Continued at next page

was eaten on average once per fortnight. Though this frequency was similar in each Period, the irregularity of consumption is shown by the weekly distribution. The frequency range of individual households varied five-fold, partly as a result of chance (scheduling of slaughter by kin or exchange partners in other groups), and partly as a result of some households buying small quantities of pork more frequently than others. The pork consumed by the sample originated from 18 separate sources:[22] 12 of which were exchange partners (six belonging to other tribes, two to other Nimai clans, and four to Waula); 3 were sales (two in the market, and one from a stall at the opening of the Koge Vocational School); and 3 involved pigs owned by sample members. Other meats, amongst which chicken was most significant but which also included tinned and frozen meat, and, on three occasions only, small quantities of dog (twice) and cassowary (once), were eaten more rarely. Not included in this category were a few occasions when such items as a (?)snipe (bilgari), and the wood grub or larvae (omune), were caught or collected.

Continued from previous page

Nimai festival in late 1978. This increase was presumably due to the exceptional returns from coffee during 1975-78 rather than a commensurate rise in Sinasina cattle production.

[22]Sources are defined here as separate occasions, i.e. the unit of analysis is the sample as a whole, not individual households. Thus pork received at a marriage by five of the sample households is counted as a single source, as are small market purchases by two households on the same market day from the same seller. In the case of the pork received through exchange, it may be noted that classification of a source as a member of, for instance, another Nimai clan, does not necessarily imply that this source was the ultimate origin of the pork.

Though dripping, or lard, is a canned, imported item, and therefore might be expected to be purchased more frequently during the coffee season, its more frequent consumption during Periods II and III is related to the Nimai preference for eating it with greens, especially the leaves of the strongly seasonal akola (Ficus copiosa) (cf. Whiteman 1965:310), which are consumed in considerable quantity in the period September to November. It is also eaten with other greens, which are prominent during the early months of the year (pp. 353-5). As noted earlier, the fruit of the marita pandanus, which yields an oil used similarly to dripping, is not produced in quantity by Nimai, and is mostly obtained by them through exchange relations with lower altitude areas and, to a lesser extent, from the market. On the evidence of this survey it is also seasonal, restricted with one minor exception, to Period III. Market records qualify this picture. Small amounts of marita, usually single fruit, were offered for sale at Koge market, mostly by non-Nimai sellers, in November of 1971, and in May, June, August and September of 1972. However, more appeared during late December, and markets from January through April each contained several dollars worth of the fruit.

CHAPTER 8

Pig production and use: cyclical characteristics

Introduction

My perspective changes in this chapter. Unlike the previous two, which referred almost entirely to Nimai Waula clan or a handful of its members and could only explore variation at the level of households within this single group, this chapter is based significantly on a comparison between information from Waula and from Barikane, a subclan or segment of the Kumgau clan from the neighbouring Dom tribe. In contrast to Waula members, who, with the rest of Nimai, had last celebrated a pig festival in late 1969 and were not planning another for some four or five years, Barikane participated in the Dom festival which culminated in September 1972. Since these two groups were therefore at different stages of their respective ceremonial cycles, a comparison between the characteristics of the pigs held by their members, and of the ways in which they were used, provides a means of overcoming some of the synchronic bias of a short-term study at one location.

My reasoning about cyclical features of pig production and use in this chapter is therefore based on several assumptions: in particular that these two small groups were broadly representative of the wider ceremonial groups to which they belong, and that completion of a cycle involves the achievement of certain goals, shared throughout Sinasina, within the context of constraints whose effects are relatively constant in the Sinasina social and natural environments. Thorough documentation of the material, nevertheless, allows scrutiny of the basis of my inferences.

Though long, the form of the chapter is straightforward. Following a brief discussion of the two groups and some features of the pig information, I look first at the aggregated composition of their members' pig herds, comparing not only their numbers but other demographic features. After examining agistment practices, I use information on how Waula and Barikane had originally acquired their animals to explore longer-term trends than were observable in the few months covered by research. I then move on to consider how the two groups managed and used their pigs during the research period, describing in turn reproduction, growth, mortality and other involuntary losses, and slaughter. An account of inter-group transfers of live animals is followed by a concluding summary of the major findings.

The data base

The pigs held by members of Waula and Barikane were censused three times during 1972-73. The three Waula censuses were conducted in May and November 1972, and April 1973; those of Barikane in July and September 1972, and April 1973. The Waula data therefore cover a period 2½-3½ years after a festival (October 1969). During 1972 discussions within the clan favoured 1977 for their next one. Following research, however, the Nimai were involved in several serious fights between 1973 and 1977, and their festival was eventually held in late 1978. Thus at the time of research the next festival lay some four to six years in the future. The Barikane censuses straddled their festival, taking place two months before the final slaughter, during the final week, and some seven months afterwards.

The censuses involved visits to all pig-houses (except in the case of the second Barikane census when most pigs had been moved into central settlement sites), the recording of basic information on animals present and follow-up on those held at previous censuses (Appendix 1), and, where possible, girth measurements for estimating weight (Appendix 7). Some topics, such as growth and pork transfers, were investigated with separate surveys, restricted in the main to Waula.

The quality of the information from the two groups is obviously different. Extended residence and continuous contact among Waula undoubtedly helped to increase reliability. The data from Barikane was collected during short visits, totalling ten days, and could not be checked and updated in the same way. To a limited extent this disadvantage may have been reduced by the common central focus of their husbandry on the festival, resulting in a far greater clustering in time and circumstance of slaughter and transfer than was the case with Waula.

Pig numbers

Accurate counts of the number of pigs owned by highlanders are difficult to achieve mainly because of the practice of agistment (Brookfield and Brown 1963:58-9; Feachem 1973:28; Hughes 1966:64). Here I distinguish between the number of pigs claimed as owned by the members of a group, which I term the 'sociological' population,[1] and the number actually present within a group's territory at a particular time (and thus excluding those owned but agisted out, and including those belonging to other groups agisted in), which I term

[1]The sociological population figures given here include only those pigs whose ownership status could be determined as unambiguously as possible, i.e. only pigs present for all censuses, or killed or transferred by their claimant(s) between censuses; pigs which returned to their claimant at some point during research, or pigs which were personally viewed at their place of agistment.

the 'ecological' population.[2] Table 8.1 shows the number of pigs in the Waula and Barikane sociological and ecological populations, and their respective total live weights, at each of three censuses. The number of pigs per capita, and the average weight of a pig in each population allow ready comparison.

The Waula figures show that in May 1972, two and a half years after their last festival slaughter, Waula had rebuilt their pig population to reach a ratio of 0.88 pigs per capita. If the Barikane ratio of 0.28 pigs owned per capita seven months after their festival is taken as representative of the relative size of a pig population within the first six months of a cycle, we may estimate that Waula had increased their pig population in approximately 2 years by 151 pigs or by a total of 216 per cent. Although this increase in raw pig numbers seems rapid other, earlier, surveys in Sinasina suggest it is not unusually so. Hughes reports ratios of 1.5 and 0.8 in two small Kere subclans (17 and 12 households respectively) only nine months after their December 1965 festival (1966:95-96).[3] Hatanaka, in a survey of

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[2]Evaluation of many published figures from the highlands is problematic due to the common failure to indicate which figure is meant. The distinction is not a case of hair-splitting. Feachem's Table 1 (1973:29), for instance, shows that 5 Enga clans had from 17 to 35 per cent of their pigs agisted out. He does not indicate how many were agisted in. Few workers indicate whether they viewed individual pigs, or whether the information was obtained from interviews. If by means of the latter, one wonders whether the (I suspect) conflicting claims of fathers, sons and brothers (in particular) were reconciled by collecting sufficient details (name, sex, origin, at least) for each pig. Published figures also tend to fail to relate pig counts to the total population of whole groups, thus making comparison of pig:human ratios in different areas difficult.

[3]Information collected by interview. Hughes cites (1966:64,fn.1) Salisbury on the likelihood of claims exceeding actual animals. He suggests that 66 per cent were 'adult' pigs (ibid., 103).

TABLE 8.1 Waula and Barikane pig populations at 3 censuses: number of pigs, pigs per capita, estimated total live weights (LW), and average pig sizes [1]

A. Nimai Waula

Census date	Pigs present - Waula territory				Pigs owned by Waula			
	No. of pigs	Pigs per capita	Total LW kg	Average pig LW kg	No. of pigs	Pigs per capita	Total LW kg	Average pig LW kg
May 1972	208	.83	6600	32	221	.88	6750	30
Nov.1972	209	.84	8010	38	204	.82	7860	38
Apr.1973	222	.89	7140	32	245	.98	7460	30

B. Dom Barikane

Census date	Pigs present - Barikane territory				Pigs owned by Barikane			
	No. of pigs	Pigs per capita	Total LW kg	Average pig LW kg	No. of pigs	Pigs per capita	Total LW kg	Average pig LW kg
July 1972	75	.77	5280	70	81	.83	5670	70
Sept.1972	70	.72	5120	73	72	.74	5290	73
Apr. 1973	26	.27	860	33	27	.28	1020	38

(1) The method for estimating pig weights is described in Appendix 7.

the Gunangi Kauva subclan approximately one year after their 1968 festival, reports 1.18 pigs per capita (1972:96).[4]

Fig. 8.1, which plots all these pig:human ratios in relation to a cycle with an assumed length of eight years, shows that while all point to a rapid recovery of pig numbers following a festival, there is clearly considerable variation in the timespan of this recovery (compare Barikane's 0.3 pigs per capita after seven months with the Kere figures of 0.8-1.5 after nine), and in the level achieved. The latter point will be discussed further below. Of interest in this context is the rate of increase shown by Waula over the 12 months of 1972-73. This seems low, at least by comparison with that estimated for the previous two years. The number of pigs owned rose only from 0.88 to 0.98, an 11 per cent increase. This suggests that Waula after a period of initially fast post-festival recovery, indicated by the tentative extrapolation from the Barikane post-festival ratio in Fig. 8.1, had entered a 'levelling-off' phase. The apparently low pre-festival Barikane figure of 0.83 (my earlier warning concerning undue reliance on these as absolute figures bears repeating), which is also joined by tentative extrapolation with the Waula ratios in Fig. 8.1, needs to be seen in the perspective of this suggested curve of relative pig numbers during a cycle. If my inferences are correct Sinasina pig cycles are characterised by brief periods during which pig numbers are low, and relatively long periods during which they remain in about equal

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[4] Survey details not indicated. 48 per cent were 'adults'.

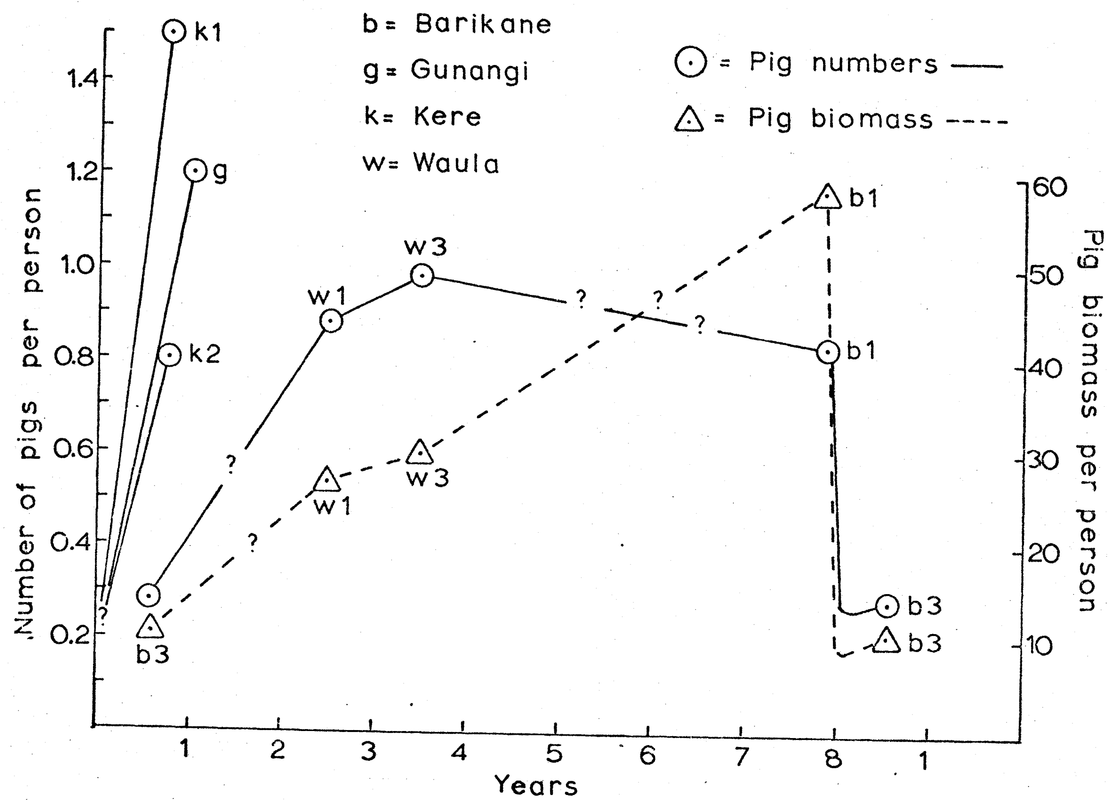

Fig.8.1 <u>The relative size of some Sinasina pig populations</u> (pig numbers, and in some cases pig biomass, per person plotted by years since last pig festival : 8 year cycle assumed, and trends interpolated)

numbers with people. While this sounds unremarkable, it contrasts strongly with curves drawn or inferred for other regions of the highlands, and with the suggested slope of increase in live weight, or biomass, per capita in Sinasina (Fig. 8.1). The latter, as extrapolated between the relevant four Waula and Barikane census dates, shows a relatively straight line increase from 10 kg to 58 kg per capita. The curves of pig numbers drawn by Meggitt (1974:191 for the Te cycle of the Enga, and by Shantzis and Behrens in their computer simulation of Maring cycle dynamics (1973:275), both invert the suggested shape of the Sinasina curve of pig numbers with ones of almost exponential growth up to the point of a cycle climax. This significant difference will be discussed later.

The differences between the Kere, Gunangi and Waula figures of 0.8-1.5 pigs per person within 9 to 30 months after a festival are open to various interpretations. While they may represent the kind of variation to be expected in such small surveys of groups subject to a range of seasonal and social factors, they could be taken as suggesting (assuming their reliability), a slight decrease in the intensity of pig production between 1965 and 1972, perhaps related to the expansion of coffee plantings (see p. 169 above; cf. Strathern 1969:52). Alternatively, they may reflect the inappropriateness of gross pig numbers, without knowledge of the size or age of animals, as a measure of differences in the intensity of pig husbandry. This point is clearly made by consideration of the fact that Barikane owned fewer pigs per capita (0.83) two months before their final slaughter than did Waula (0.88) who had slaughtered two and a half years before.

Comparison of the average weight of animals (or the pig units per capita, p.373) in the two populations (Table 8.1), however, quickly reverses their ranking and provides a more realistic comparison of the relative intensity of pig husbandry in the two groups.

Although the tentative nature of these suggestions must be emphasised, and obviously the smooth extrapolations in Fig. 8.1 should be visualized as subject to year by year fluctuations, particularly in small groups, they are not contradicted by the available data from other parts of Chimbu. Brookfield and Brown based a 'rough estimation' of the total pig population per Chimbu tribe on three sources: a government survey of 1958, which found two to three pigs per man about 18 months after the 1956 Naregu festival; an estimate of 4.5 pigs per family among the Kamanegu and Endugwa about one year before their 1960 ceremony; and on their own observation of no more than one pig killed per capita by the Endugwa and Siku in 1959-60 (1963:59). Reckoning that at least 90 per cent of adult pigs would be slaughtered at a festival they considered that a maximum pig population at the level of a Chimbu tribe would be unlikely to greatly exceed "one grown pig per head: allowing for piglets, we might assume 1.5 adult pigs per head as a maximum" (1963:59). While I later suggest that their qualification concerning piglets may be unnecessary the point to be made here is the general agreement between these figures and those from Sinasina, allowing for the difficulties of comparing per man, per family and per capita figures. If a Naregu man is the head of a household with about four members, and Kamanegu and Endugwa families are similarly sized, then Naregu had approximately 0.75 pigs per capita one to two years after their festival, the latter groups 1.1 just before theirs. Rough figures admittedly, but reasonably close to those from Sinasina.[5]

Population composition: size and sex

The significant differences in the demographic structure of the pig populations at different cyclical stages signalled by the widely varying average weights shown in Table 8.1 demand a closer look at population composition. Here a useful assumption is that "...any exploitation (of an animal population) for the basic animal product on a rational basis gives rise to specific age and sex structures..." (Chaplin 1969:235; parenthesis added). In brief, unless the population under observation has been the victim of extraordinary circumstances, its structure ought to reflect a compromise between the demands entailed by the goals of the herders and the potentials of the animals. However, while sexing of pigs was no problem, ageing, in the absence of reliable owners' estimates and/or an established pattern of tooth eruption for New Guinea highland pigs (Barrett 1973; Silver 1970), was unfortunately impossible.[6]

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[5]See also Venkatachalam's figure of 0.74 pigs per capita, for a population of 1,842 about six weeks before a "large-scale 'sing-sing'" in 1956-7 (1962:4-5). Unfortunately, it is not clear in which part of Chimbu this group was located, though the upper Chimbu valley seems possible (cf. Hipsley and Kirk 1965:89). In 1957, Montgomery estimated, also for the upper Chimbu valley, a total of 24,000 pigs held by a population of c.19,000 (1960:8-9), giving 1.26 pigs per capita. One of the constituent groups, at least, was two years away from a planned festival (ibid., 8). However, Barrie, writing of the Kamanegu Pagaku subclan in 1957 (central Chimbu, see Brookfield and Brown 1963:90), mentions a figure of 5 pigs per head of male population (i.e. if all males are intended, 2.5 pigs per capita), which, he was told, was much lower than usual (1956:48).

[6]R. Barrett, who collected some pigs' teeth from Chimbu in 1972,

Continued at next page

This is a major deficiency, particularly serious in that it rules out any exact examination of some of the demographic variables critical for a fuller understanding of the relationship between the biological potentials of the pig and cycle periodicity. It also renders any evaluation of the energetic costs of pork production difficult. As a substitute, I use instead size, supported by some information on growth rates.

Fig 8.2 shows the size and sex structures of the Waula pig population at three censuses. Similar information for Barikane is shown in Fig. 8.3. As expected from the comparison of average weights, the pre-festival Barikane population has a radically different size structure to that of Waula. Most significant is the lack of small Barikane pigs. Whereas approximately 50 per cent of the pigs in the Waula (May and April censuses), and also in the post-festival Barikane, populations weighed under 25 kg, less than 10 per cent of the pre-festival Barikane pigs did. Conversely, while nearly 40 per cent of the latter population weighed over 75 kg, less than 10 per cent of the Waula population did. The rather higher proportion (19 per cent) of the post-festival Barikane pigs weighing more than 75 kg may be explained by the very small total population at this stage, and by the fact that some of the remaining larger pigs were scheduled for late festival-associated slaughter which had been delayed due to absences.

Continued from previous page

suggests that "use could be made of growth ring analysis of tooth cementum lines which I did find...", and that "it may be possible to detect the number of lactations by a sow from the additional cementum rings in sow's teeth that I suspect are caused by slowed growth during lactation" (Pers. comm. 6 March 1975).

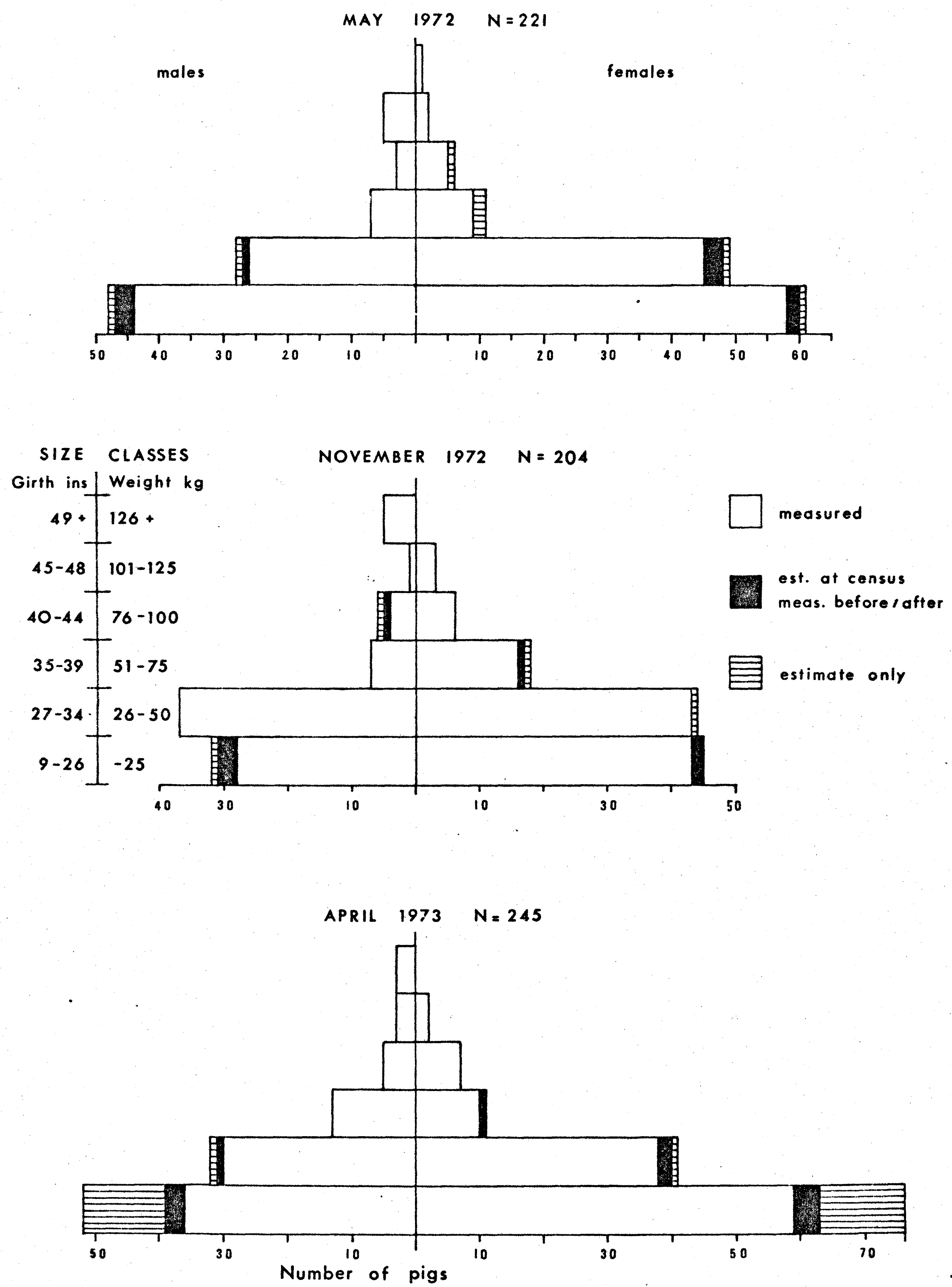

Fig.8.2 Number, size, and sex of pigs owned by Waula at three censuses

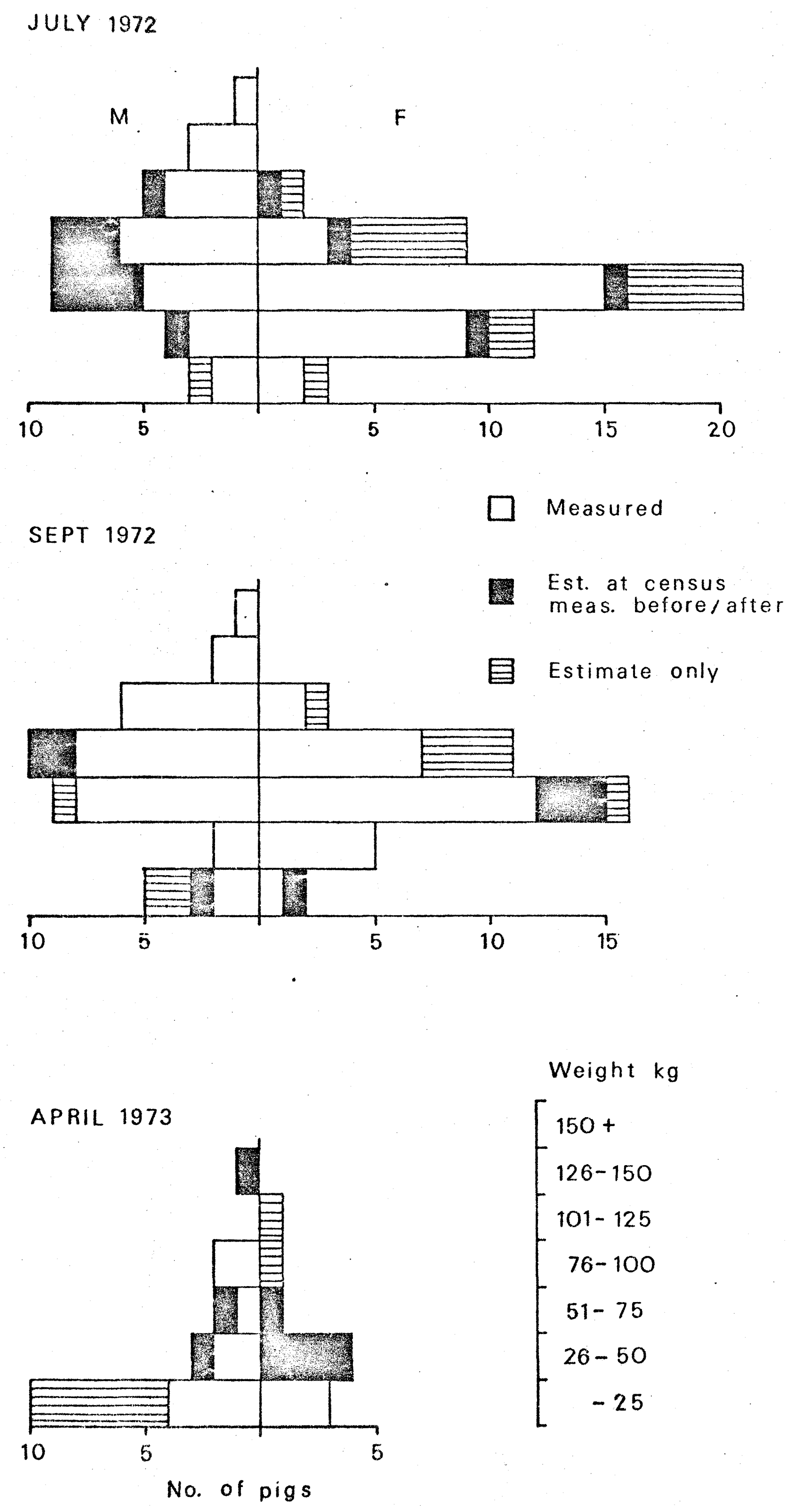

Fig.8.3 Number, size, and sex of pigs owned by Barikane at three censuses

The very small proportion of small pigs in the pre-festival Barikane population is further emphasised by noting that the smallest piglet which had been bred within the group's territory weighed 17 kg, and was therefore probably at least nine months old (p. 474 below).

At first regard, there are two possible explanations for the oddly top-heavy structure of the pre-festival population. Either Barikane piglets were dying, or being disposed of, faster than they were being reproduced, for which there is no evidence, or reproduction had almost halted during at least the 12 months prior to the final slaughter, which is supported by additional evidence. Further, since the 26-50 kg class was considerably smaller than the 51-75 kg class (Fig. 8.3), we may infer that the strategy resulting in this structure had been implemented before the final year.

That reproduction is restricted prior to a festival is not of course surprising. The major husbandry goal prior to a festival is the production of large pigs for slaughter. Continuation of normal reproduction, implying numbers of small animals and thin sows (p. 453), and the deflection of fodder for their growth to sizes still well below that sought, would hinder the achievement of this goal. Somewhat similarly, Bowers has described how, in the Kaugel valley in the Western Highlands, "for nearly a year many people had avoided pregnancies in their female pigs lest the mass pig killing be scheduled so quickly that they would have to kill a pregnant or lactating pig" (1968:95). In Sinasina, however, the sudden occurrence of the slaughter is not usually problematic, for the approximate time of the major festival slaughter within the final year is predictable with some certainty. This is because festivals are usually restricted to only a few possible months (generally August to December), due mainly, it seems, to the relative availability of sweet potato, and also the patterns of pig growth and condition (p.473 ; also Bergmann 1971, Vol.4, pp.97-8; Bowers 1968:Table 3, p.28). Rather than aimed at avoiding the slaughter of pregnant or lactating sows then, the restriction of reproduction in Sinasina is probably better interpreted as a strategy primarily undertaken in order to concentrate upon the production of the large pigs required for a festival slaughter. I return to this question later, turning for the moment to examine the patterns of agistment revealed at the censuses.

Agistment

Agistment, the farming out of pigs from owners to keepers in either one's own or another group, has been widely reported in the highlands' literature. Discussion has been focused on several possible advantages of the practice, including concealment of herd size (Meggitt 1958: ; Salisbury 1962:92), insurance against, or, in the event of an outbreak, response to, disease epidemics (Salisbury 1962:91-2; Waddell 1972a:62), and adjustment to, or exploitation of, local variations in the relative availability of grazing, cultivated fodder, and labour. Assessment of the extent to which the two former considerations influence agistment decisions is clearly difficult, if not impossible on a wide scale in the case of the first. Further, unless certain pig diseases are locality-specific both may be assumed to affect owners irrespective of their group membership; in other words, neither over time should result in differential inter-group movements of pigs. However, agistment as a means of coping with, or gaining from, uneven resource distributions is a different matter. Before turning to the Sinasina material, a brief review of earlier suggestions may help to clarify the issues.

Two main points have been raised, one emphasising the differential distribution of suitable pig foraging terrain and vegetation, or, to resurrect a useful medieval term, pannage, the other the differential ownership of pigs. It would be misleading, however, to oppose these two points since at least one author relates them, and it is unlikely that they are independent. For the sake of exposition I treat the former first. If the territories of social groups, or sections of them, differ in their endowment of pannage, it has been suggested that pigs are likely to be agisted from poorly-endowed to well-endowed groups. Such arrangements have been briefly but somewhat ambiguously described for the Raiapu Enga by both Waddell and Feachem.

Waddell suggests that agistment is "...frequently carried out by large owners, is partly motivated by a need to overcome the problem of food supply by placing pigs with kinsmen who have few animals of their own or who live near good foraging areas...it is also a matter of risk-spreading, designed to protect the pigs from sickness and other types of disaster" (1972a:62). "Good foraging areas", he indicates, are river flats, which, while characteristic of other parts of the Lai valley (ibid., 14), were almost absent at Sabakamada, his research location (ibid., 62). Nevertheless, clansmen resident on the steep main-range slopes (which rise above the terrace sections), who "...own large numbers of pigs prefer to agist them with kinsmen resident on the terrace sections because foraging is poor on the slopes; but this in turn often involves carrying large quantities of tubers down to help sustain the animals" (ibid., 181). Feachem, less cautiously, considers the risk-spreading motivation, as described by Westermann (1968:151), unlikely, and suggests "...that it is primarily men with a shortage of good foraging ground who allow others to raise their pigs" (1973:29). He supports his argument by showing that, of five clans surveyed, the one (Tombeakini) with the highest proportion of pigs agisted out, has a very high population density and lacks forest. The latter is important since "...the regions around the treeline, and in the lower forest, are prized as pig foraging country" (ibid., 30). His argument is nevertheless weak on several points. If it is primarily men with a shortage of forage who agist their pigs, why in his case do the other clans, with far lower population densities, also have high proportions of their herds agisted elsewhere (17-22 per cent, by comparison with Tombeakini's 35 per cent)? Secondly, Tombeakini may lack forest but it is "...particularly fortunate in having 0.09 sq km (or 16 per cent of clan territory) of river flats which are excellent for pig foraging..." (ibid., 27). Since this is the type of pannage which Waddell regards as most significant in Raiapu husbandry clearly more information is needed. Finally, neither Waddell or Feachem explain why persons well-endowed with pannage accept agisted pigs. It may be noted that participation in the Enga Te exchange system is competitive and that all groups, at least within a given vicinity, approach peak pig production at approximately the same time.[7] While Waddell's suggestion that agistment is frequently from pig owners with many, to those with few, pigs makes obvious sense at the household level, it would seem unlikely that groups well-endowed with pannage regularly have higher proportions of owners with few pigs. Given the labour and responsibility involved in pig husbandry one wonders also if keepers in well-endowed groups, following Feachem, regard themselves as being "allowed" to raise the pigs of their less fortunate agistment partners?

Present information is insufficient to answer these questions about Enga agistment.[8] My reason for the extended discussion is to point to some of the difficulties preventing simple statements about differential movements of pigs between groups through agistment. The Enga "case" is also useful since the general synchronisation of pig production over a very wide area required by the Te is a feature which is not characteristic of either Chimbu or Sinasina. In central Chimbu, Brookfield and Brown have described "...something like an alternating system" (1963:58), with the tribes and subtribes of an area divided into two groups, those of one group holding their pig festivals within

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[7]Elsewhere Waddell indicates, however, that the group among which he worked had recently split: some participated in a Te event before his arrival, others were preparing for a later one (ibid., 62).

[8]One possibility is described by Meggitt. Not all Enga clans participate as corporate units in the Te, rather their members "...are connected with men of the participating groups by filaments of individual, personal exchanges" which include a form of agistment with definite returns to keepers (1974:173-4 and fn.14).

one two-year period, those of the other in another two-year period some three years later. They suggest that one of the advantages of such alternation in the timing of festivals is that it allows neighbouring groups to use each other's pannage, through agistment, thus balancing "...the most extensive use of grazing grounds" (ibid., 58).[9]

In that their description emphasises reciprocal movements of agisted pigs between groups in accordance with the timing of peak production, absolute differentials in the distribution of pannage between groups is not their chief concern. Instead of viewing agistment as advantageous for poorly endowed groups, and hence raising the question of what well endowed groups gain from the relationship, their focus on alternation allows agistment to be seen as advantageous to all parties in sequence. Hence it also benefits the overall environment they share in that the impact of many pigs, instead of being restricted to the pannage of a single group, is spread over a wider area. In other words, if pre-festival accumulations of pigs are regarded as sufficiently numerous to constitute a threat to the environment by their "percussive influence" (Darling 1956:784), agistment is one means by which the high points of such cyclical fluctuations are reduced.

Discussion then has moved from the differential distribution of resources, to, in the latter case, the sequential differential

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[9]It also, they suggest "...serves to distribute pork consumption to some extent, (and) to make easier the rebuilding of herds by purchase from other tribes..." (ibid., 58).

distribution of pig numbers at the group level. Strathern has emphasised a different aspect of this latter point, viewing agistment as a means by which the inherent limitations of the restricted amount of labour available to single households can be transcended and the home production base extended (1969:43). His focus is directed to individuals, explicitly to competitors for big-man status in exchange relations, and to the strategies available to, and employed by, them. In this perspective the pattern of agistment observed at any moment, rather than reflecting inter-group access to pannage, may be the result of the aggregated management decisions taken by the participating owners and keepers in the light of their perception of both long-, and short-term advantages.

In terms of this discussion, several questions can be asked of Sinasina agistment. At the aggregate level of agistment movements between groups, what, if any, are the relationships between such flows and

(1) long term differences between groups in basic resource endowment,

(2) relatively predictable differences between groups in pig husbandry intensities due to the pig cycle, and

(3) short term, unpredictable occurrences (at worst, catastrophes), such as drought, harvest failure, and disease?

Further, at the level of individual households, is the movement of pigs regularly from those with many, to those with few pigs?

The inter-census movements of agisted pigs into and out of Waula and Barikane are shown in Fig. 8.4. The size and sex of the animals are shown on Table 8.2, and Tables 8.3A and 8.3B describe the directions

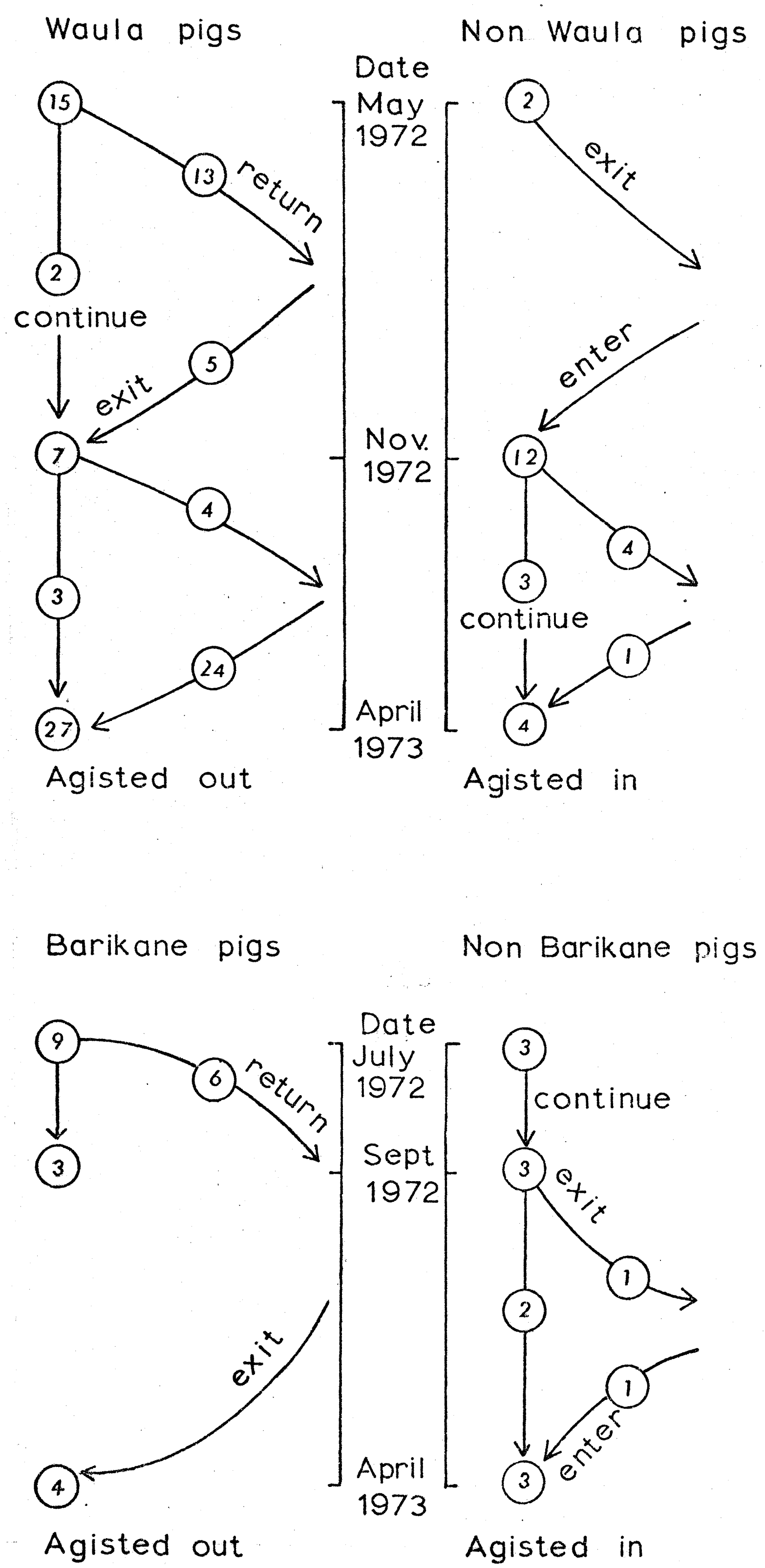

Fig.8.4 <u>Waula and Barikane agistment flows</u>

TABLE 8.2 Number and sizes of pigs agisted into and out of Waula and Barikane at three censuses

	Size classes Live weight kg	PIGS AGISTED OUT						PIGS AGISTED IN					
		Census 1		Census 2		Census 3		Census 1		Census 2		Census 3	
		M	F	M	F	M	F	M	F	M	F	M	F
WAULA	101+	-	-	-	-	-	-	1	-	-	-	-	-
	76 - 100	-	1	-	-	-	-	-	-	1	-	-	-
	51 - 75	-	-	-	-	-	1	1	-	-	-	-	-
	26 - 50	1	3	2	1	1	5	-	-	2	1	1	1
	-25	5	5	1	3	9	11	-	-	6	2	1	1
	Totals	6	9	3	4	10	17	2	-	9	3	2	2
BARIKANE	125+	-	-	-	-	1	-	-	-	-	-	-	-
	101 - 125	1	-	-	-	-	1	-	-	-	-	-	-
	76 - 100	1	3	-	3	-	-	1	-	-	-	1	1
	51 - 75	1	2	-	-	-	-	1	1	1	-	-	-
	26 - 50	1	-	-	-	-	2	-	-	-	-	-	-
	-25	-	-	-	-	-	-	-	-	-	-	-	1
	Totals	4	5	-	3	1	3	2	1	1	-	1	2

TABLE 8.3A <u>The social geography of Waula agistment</u>

Groups into which or from which pigs agisted	No. and weight (kg) of pigs agisted INTO and OUT OF WAULA											
	Census 1				Census 2				Census 3			
	IN		OUT		IN		OUT		IN		OUT	
	No.	Wgt	No.	Wgt	No.	Wgt	No.	Wgt	No.	Wgt	No.	Wgt
Other Nimai clans	–	–	2	40	1	102	2	73	–	–	–	77
Other Sinasina groups												
Dinga 2	–	–	2	117	–	–	1	26	–	–	–	–
Dinga 1	–	–	–	–	–	–	1	10	–	–	2	26
Kere	–	–	4	19	1	49	–	–	–	–	–	–
Tabari A	–	–	–	–	3	70	1	13	3	83	–	–
Gunangi	–	–	6	120	–	–	1	6	–	–	2	44
Dom	2	198	1	49	1	13	1	38	–	–	21	301
Other Chimbu groups												
Golun	–	–	–	–	5	61	–	–	1	42	–	–
Bari	–	–	–	–	1	13	–	–	–	–	–	–
Totals	2	198	15	345	12	308	7	66	4	125	27	448
Mean weight	–	99	–	23	–	26	–	24	–	31	–	17
Standard deviation	–	44	–	24	–	28	–	14	–	17	–	16

TABLE 8.3B The social geography of Barikane agistment

Groups into which or from which pigs agisted	No. and Weight (kg) of Pigs Agisted INTO and OUT OF BARIKANE							
	Census 1				Census 3			
	IN		OUT		IN		OUT	
	No.	Wgt	No.	Wgt	No.	Wgt	No.	Wgt
Other Dom clans	-	-	1	78	1	11	1	146
South Dom	-	-	1	78	-	-	1	32
Nimai	1	102	-	-	1	96	1	32
Kere	-	-	-	-	-	-	1	130
Tabari B	2	126	-	-	1	78	-	-
Era	-	-	6	391	-	-	-	-
Totals	3	228	8	547	3	185	4	340
Mean weight		76		69		62		85
Standard Deviation		23		22		45		62

of the movements. Three qualifications apply to these data. First, they apply only to the three points in time covered by the censuses. Thus pigs which were moved into, or out of, the two groups' territories for brief periods of a few days or weeks between the censuses, and which did not remain at the place of agistment at the time of a census, are excluded. One or two cases of such short term, inter-census, agistment were noticed amongst Waula, and presumably others occurred that were not seen, particularly in the case of Barikane. While exclusion of such cases means that Fig. 8.4 is incomplete for the entire period, it is not, I think, a serious underestimate. Further, as regards pigs claimed by, but agisted out of, the two groups, only those whose owners could be identified with some certainty were included. Thus five other pigs mentioned by Waula claimants, but absent from Waula territory for 17 months and not seen at their reported place of agistment, are also excluded. Finally, these data refer only to inter-clan agistment. Agistment between households belonging to the same clan (or subclan) was far less common: only five Waula cases were noted and none amongst Barikane members.

Over 12 months, eight Waula households received and took care of a total of 15 pigs belonging to nine non-Waula households. Conversely 19 Waula households agisted out 47 pigs to 21 non-Waula households. In all, 30 inter-household relationships were involved. Most agistment partners were close affines. Twelve of the relationships, accounting for 21 pigs, were between wife's father and daughter's husband, and nine, accounting for a further 23 pigs, were between wife's brother and sister's husband. If both inward and outward agistments are considered together, pigs of each sex were represented in approximate proportion to their overall distribution (females 53.3 per cent). Considered separately, males, with 73.3 per cent, outnumbered females among pigs agisted into Waula, while females predominated slightly (59.6 per cent) in the outward flow. The latter reflects the fact that several sows with unweaned litters were agisted out at both the first and last censuses (see the size distribution in Table 8.2).

In evaluating the questions posed earlier, we may note first that temporary local fluctuations in the availability of fodder were referred to by Waula in partial explanation of both the peak in their incoming agistments at November 1972 and the peak of outward agistments in April 1973. In November, 5 (all apparently belonging to one man) of the 12 pigs agisted in, came from Golun (south of the Wahgi) which was said to be suffering particularly the effects of the May-September drought. In April, 21 of the 27 pigs agisted out were moved within a few days of each other to a single area of Dom (at Kagul) where a sudden flush of sweet potatoes had become available as a result of replanting after the 1972 Dom festival. None of the Waula owners who moved their pigs to Dom claimed that they were specifically short of fodder at this time. Such movements, especially the latter, point to the difficulty of disentangling short-term from long-term fluctuations. Would Dom, for example, have had an abundance of sweet potatoes if their pig population had not been reduced 7 months previously? Although no firm answer is possible the Barikane data suggest that not all members of Dom experienced this surplus since only three pigs, two of which had been present since the previous July (at least), were held on agistment by them at this time (Tables 8.2, 8.3B). It would seem, therefore, that unpredictable local fluctuations account for some of the flows, and these may well be restricted to groups well below the level of tribes, if not to individual households. What then of relations between agistment and cyclical differences?

If a cycle is viewed as involving a progressive increase in the intensity of pig production which reaches its climax in the final pre-festival year, and if agistment is a means by which the impact of such intensification is softened, it is reasonable to expect that groups at early stages of their cycles are likely to have more pigs agisted in than out, and more pigs agisted in than groups at later stages. In addition, their inward agistments are likely to be from groups at later stages and therefore should tend to be larger animals than those they have agisted out. The Waula and Barikane data only partially meet these expectations. Table 8.4A shows that although Barikane had relatively more pigs agisted in (Column 1) seven months after its festival (Census 3) than before (Census 1), it still had more agisted out than in at both dates (Column 2). Further, pigs agisted in, at Census 3, were smaller than those agisted out (Column 3), while before the festival (Census 1) the relationship was reversed. The Waula data, on the other hand, shows two very different patterns: at the first and last censuses they had far fewer pigs agisted in than out, though the weight of the former far exceeded the latter, while at Census 2 when more pigs were agisted in than out, there was little difference in their average size.

The expectation that groups in the early stages of their cycles receive agisted pigs from groups at later stages thereby decreasing the

TABLE 8.4 Relationship between stage of pig cycle and features of agistment

A. Three ratios measuring characteristics of agistment

Cycle stage	Group	Census	Ratio of pigs agisted in to total pig population (pig numbers)	Ratios of inward to outward agistments	
				Pig numbers	Average weight
EARLY	Barikane	3	0.11	0.75	0.73
MID	Waula	1	0.01	0.17	4.30
	Waula	2	0.06	1.71	1.08
	Waula	3	0.02	0.15	1.82
LATE	Barikane	1	0.04	0.33	1.12

B. Waula and Barikane agistment by cycle stage of groups to/from which pigs were agisted

Cycle stage	Group	Census	No. of pigs by cyclical stage of group to/from which agisted							
			EARLY		MID		LATE		UNKNOWN	
			To	From	To	From	To	From	To	From
EARLY	Barikane	3	2	2	1	1	1	-	-	-
MID	Waula	1	-	-	10	-	5	2	-	-
	Waula	2	1	1	4	1	2	4	-	6
	Waula	3	21	-	6	-	-	3	-	1
LATE	Barikane	1	-	-	-	1	2	2	6	-

intensity of pig production in the latter, is also not fully met (Table 8.4B). After their festival, Barikane's inward agistments were, as expected from groups at early and mid stages of their cycles, but, before the festival, their inward agistments came from groups that were also at late stages. Unfortunately, information on the cycle stage of groups south of the Wahgi to which Barikane was then sending most of their outward agistments is incomplete, but at least two pigs were also held by groups at late stages. The Waula evidence is similar. Inward agistments at their first and last censuses were, as expected, mainly from groups at late stages, as they were also at their second census if pigs from south of the Wahgi are excluded. Outward agistments, however, do not fit so well. At the first two censuses, most were looked after by members of groups at similar or later stages than Waula themselves, and it is only at the third census that the expected pattern predominates.

This discussion suggests that agistment movements can only partly be understood in terms of cyclical differences between groups. The lack of a close fit is hardly surprising given that affines predominate as agistment partners, and that the affinal relationships of the members of even such a small grouping as a subclan are highly dispersed (Chapter 4; Appendix 5). Taken together these two facts militate against the likelihood, for instance, that a group at a late cyclical stage would have the majority of its agisted pigs cared for by one neighbouring group at an earlier stage.

Is however the movement of agisted pigs closely related to inter-household variation in the intensity of pig husbandry? A crude comparison between the size of pig herds owned by households which agisted pigs out, and by those taking care of agisted pigs, suggests an affirmative answer. In the Waula case the former (n=19) averaged 5.6 pigs (SD 3.8), the latter (n=8) only 3.0 (SD 2.5). On average, the former had 2.2 pigs (SD 1.8) agisted out, leaving a herd size of 4.4 pigs present, the latter 1.8 (SD 1.5) agisted in, pushing their average herd size up to 4.8. A more exact analysis, however, would require consideration not only of pig:human ratios, but also of those households not involved in agistment.

The origins of pigs

Upon completion of a pig festival a Sinasina group has few pigs, in the case of Barikane in 1972 only one to every four persons. Within a relatively short period, however, numbers may be multiplied rapidly (Fig. 8.1). How is a population rebuilt?

A broad distinction can be made between pigs that are bred and raised by the members of a group, that are, in Strathern's term, home produced (1969), and those that are acquired from outside a group either by trade or by gift exchange. Here and later, I employ these categories at the level of the two groups concerned, not of the individual households. Thus, for instance, a piglet acquired by a Waula man from a fellow clansman in return for the services of his boar is classed, if the piglet was bred by the donor, as produced, not as one obtained by exchange.[10] Trade and gift exchange as "pure types", are of course,

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[10]This usage is governed by the attempt to view the pigs of a group as a population. In fact it affects relatively few animals. Of the 108

Continued at next page

"...idealisations, the poles at the ends of a continuum of occasions when goods change hands" (Hughes 1977:209). Nevertheless, in practice, when there is sufficient time to inquire into the circumstances of transfer, the distinction between the two as regards pigs is relatively clearcut in Sinasina. This may be more pronounced today, due to pig trade virtually excluding all other items except money and plumes, than was previously the case. For present purposes what is significant is that pigs acquired by trade and gift exchange both originate from outside the pig population concerned. Trade transactions generally involved the immediate transfer of either money or plumes to the previous owner, and the partners to the transaction were usually not related, and, in many cases, not personally known to each other. Gift exchange, on the other hand, moved pigs between relatives and partners linked in continuing relationships. Gift exchange as used here includes a wide variety of transactions.[11] I also include within this category service fees for the use of a boar.

Continued from previous page

pigs classed as produced in the Waula population at May 1972, 26 (24 per cent) had been acquired from other households in the clan. The Barikane figures, for the July 1972 population, were 6 of 24 produced pigs. In order not to effect the comparison between Waula, a clan, and Barikane, a subclan, pigs that Barikane members acquired from fellow clansmen belonging to other Kumgau subclans, have also been classed as produced. There were 2 such pigs in the July 1972 population.

[11] Hughes' (1977:210) list of the contrasting characteristics between trade and gift exchange (prestation) is generally applicable to Sinasina, with the exceptions that, as regards pigs, transactions are not necessarily initiated by and channelled through leaders, nor need they be public and ceremonial.

As shown in Table 8.5 the reliance upon external sources for pigs was large. Over 75 per cent of the small Barikane population seven months after their festival had originated from elsewhere. Trade was responsible for 44 per cent. The Waula figures, though lower, are still high. In 1972, 51 per cent of pigs owned had been obtained from other groups, and a year later the proportion had only dropped a few points. Surprisingly, the Barikane figure just prior to their festival is also high at 70 per cent.[12] Before discussing possible relations between these varying proportions, cyclical population dynamics, and husbandry strategies, I look first at where, in locational terms, these substantial numbers of pigs acquired from elsewhere had originated.

The sources of pigs acquired elsewhere by both Waula and Barikane are shown in Tables 8.6A and B, by major group or tribe in the case of Sinasina and nearby regions, and by more general areas in the case of more distant locations. The distribution shows that both groups by the early 1970s had social and economic ties extending from Kainantu in the Eastern Highlands to Hagen in the west. Nevertheless the majority of pigs are obtained from a zone showing little expansion from that of pre-colonial days when trade horizons were limited, in such densely settled areas, to some 16 km (Hughes 1977:203). The general patterns shown by both groups are broadly similar, allowing for their respective locations in Sinasina. Of 113 Waula pigs, owned in May 1972 and acquired from elsewhere, 19 per cent had come from other

[12]According to Rappaport (1968:105), 87 per cent of the Tsembaga pigs on the eve of their festival had been home produced.

TABLE 8.5 Means by which pigs owned by Waula and Barikane at first and last censuses were acquired

Means of acquisition	WAULA				BARIKANE			
	May 1972		April 1973		July 1972		April 1973	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Production	108	49	129	53	24	30	6	22
Gift Exchange	62 (1)	28	72	29	36	45	9	33
Trade	51	23	44	18	20	25	12	44
Total	221	100	245	100	80 (2)	100	27	100

(1) Includes one pig which was "found".

(2) Excludes one pig the origin of which was unknown.

TABLE 8.6A Origins of Waula pigs acquired elsewhere, and owned in May 1972 and April 1973

ORIGINS	MAY 1972										APRIL 1973											
	GIFT			TRADE			GIFT & TRADE				GIFT			TRADE			GIFT & TRADE					
	M	F	Total	M	F	Total	M	F	Total	%	M	F	Total	M	F	Total	M	F	Total	%		
Other Nimai clans	6	9	15	3	4	7	9	13	22	19	4	5	9	5	3	8	9	8	17	15		
Other Sinasina groups																						
Dinga 2	2	-	2	2	-	2	4	-	4	3	4	1	5	-	1	1	4	2	6	5		
Dinga 1	1	2	3	-	-	-	1	2	3	3	-	-	-	-	-	-	-	-	-	-		
Kere	-	1	1	1	1	2	1	2	3	3	-	2	2	2	-	2	2	2	4	3		
Tabari 1	2	3	5	3	1	4	5	4	9	8	1	3	4	2	1	3	3	4	7	6		
Tabari 2	-	1	1	-	-	-	-	1	1	1	1	1	2	-	-	-	1	1	2	2		
Dom	5	9	14	-	4	4	5	13	18	16	10	11	21	1	2	3	11	13	24	21		
Gunangi	1	5	6	1	1	2	2	6	8	7	1	3	4	1	-	1	2	3	5	4		
Kebai	-	-	-	1	1	2	1	1	2	2	-	-	-	1	2	3	1	2	3	3		
subtotal	11	21	32	8	8	16	19	29	48	42	17	21	38	7	6	13	24	27	51	44		
Other Chimbu areas																						
Chuave-Elimbari	1	1	2	6	8	14	7	9	16	14	2	1	3	4	7	11	6	8	14	12		
Kuman	3	9	12	-	2	2	3	11	14	12	7	11	18	-	-	-	7	11	18	15		
South Wahgi	-	-	-	1	2	3	1	2	3	3	1	-	1	1	3	4	2	3	5	4		
subtotal	4	10	14	7	12	19	11	22	33	29	10	12	22	5	10	15	15	22	37	32		
Other provinces																						
West.Highlands	-	-	-	5	3	8	5	3	8	7	-	3	3	4	1	5	4	4	8	7		
East.Highlands	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	2	2	2		
Other (1)	1	-	1	-	1	1	1	1	2	2	-	-	-	-	1		-			1		
Totals	22	40	62	23	38	51	45	68	113	100	31	41	72	21	23	44	52	64	116	100		

(1) Both from Sinasina: one purchased from Catholic Mission, one 'found'.

TABLE 8.6B Origins of Barikane pigs acquired elsewhere, and owned in July 1972 and April 1973

ORIGINS	JULY 1972										APRIL 1973									
	GIFT			TRADE			GIFT & TRADE				GIFT			TRADE			GIFT & TRADE			
	M	F	Total	M	F	Total	M	F	Total	%	M	F	Total	M	F	Total	M	F	Total	%
Other Dom clans	3	4	7	2	-	2	5	4	9	16	1	-	1	1	-	1	2	-	2	9
South Dom clans	3	10	13	3	-	3	6	10	16	29	1	3	4	1	-	1	2	3	5	24
Other Sinasina groups																				
Nimai	1	1	2	-	1	1	1	2	3	5	-	-	-	-	1	1	-	1	1	5
Dinga 2	-	-	-	-	1	1	-	1	1	2	-	-	-	-	-	-	-	-	-	-
Dinga 1	-	2	2	-	-	-	-	2	2	4	-	-	-	-	-	-	-	-	-	-
Kere	-	1	1	1	1	2	1	2	3	5	1	1	2	3	-	3	4	1	5	24
Tabari 1	1	-	1	1	1	2	2	1	3	5	-	-	-	-	-	-	-	-	-	-
subtotal	2	4	6	2	4	6	4	8	12	21	1	1	2	3	1	4	4	2	6	29
Other Chimbu areas																				
Chuave-Elimbari	-	2	2	-	1	1	-	3	3	5	-	-	-	-	-	-	-	-	-	-
Kuman	-	1	1	-	1	1	-	2	2	4	-	-	-	1	1	2	1	1	2	9
South Wahgi	2	4	6	1	4	5	3	8	11	20	-	1	1	2	2	4	2	3	5	24
subtotal	2	7	9	1	6	7	3	13	16	29	-	1	1	3	3	6	3	4	7	33
Other provinces																				
West.Highlands	-	-	-	-	1	1	-	1	1	2	-	1	1	-	-	-	-	1	1	5
East.Highlands	-	1	1	1	-	1	1	1	2	4	-	-	-	-	-	-	-	-	-	-
Totals	10	26	36	9	11	20	19	37	56	100	3	6	9	8	4	12	11	10	21	100

Nimai clans, 42 per cent from all other Sinasina groups, 29 per cent from other locations in Chimbu, and 7 from the Western Highlands. By comparison, 16 per cent of Barikane's 56 extra-group acquisitions which were owned in July 1972, had come from neighbouring Dom clans within Sinasina, 21 per cent from four other Sinasina groups, 58 per cent from other Chimbu locations (but predominantly from groups directly across the Wahgi river to the south), and 6 per cent from other provinces. Certain groups or areas stand out as major sources in each case. For Waula, Nimai and the Sinasina Dom provided almost half the total of pigs received in gift exchange, while Chuave-Elimbari predominated as a source of traded pigs. For Barikane, groups to the south of Wahgi were to the fore, southern Dom for gift exchange, and Golun and Kia for trade. Possible reasons for such clustering will be considered later in relation to further material on the circulation of live animals during 1972-73. Although some pigs were acquired from almost all sources through both trade and gift exchange, geographically closer groups appear to supply the majority of pigs in gift exchange, distant groups those traded. In the case of Waula, for instance, 76 per cent of pigs acquired in gift exchange, but only 45 per cent of traded pigs, came from within Sinasina. The tendency is less marked, however, in the Barikane data.

This information on externally produced pigs, besides indicating the overall significance and pattern of such flows, is also suggestive of cyclical dynamics. Reproduction, I suggested earlier, is restricted during the course of a cycle: perhaps starting as early as four years before a festival and apparently resulting in a virtual halt on breeding during the final year. Does information on the varying proportions of produced and externally acquired pigs add to this suggestion? If reproduction did not decrease, but was continued at a relatively high and stable rate throughout, or for the greater part of, a cycle, it would be reasonable to expect that the proportion of home produced pigs, relative to those acquired from outside, would either increase or at least remain constant as the cycle continued. Conversely, given restrictions on breeding, the proportion of home produced pigs would be likely to decrease due to ongoing transfers of pigs through exchange and trade. Fig. 8.5, which uses the hypothetical eight year cycle, arranges data on the relative proportions of pigs acquired by different means from the four Waula and Barikane censuses (Table 8.5), as if they recorded the changing composition of a single population in an attempt to evaluate these hypotheses. Since two pairs of observations on two different populations are hardly a secure foundation I stress the exploratory nature of this evaluation.

The trends indicated by the different hatchings separated by solid lines in Fig. 8.5, are simple interpolations. It is, however, possible to indirectly 'test' them by means of a very crude retrodiction of the composition of past populations. Since the size-class composition of each observed population, and the breakdown of each size-class by mode of acquisition, are known, we can subtract the smallest size-class (by making the questionable assumption that the smallest size-class represents the previous 'year's' additions to the population), recalculate the percentages of pigs acquired by different means present the previous 'year', and thus reconstitute the population

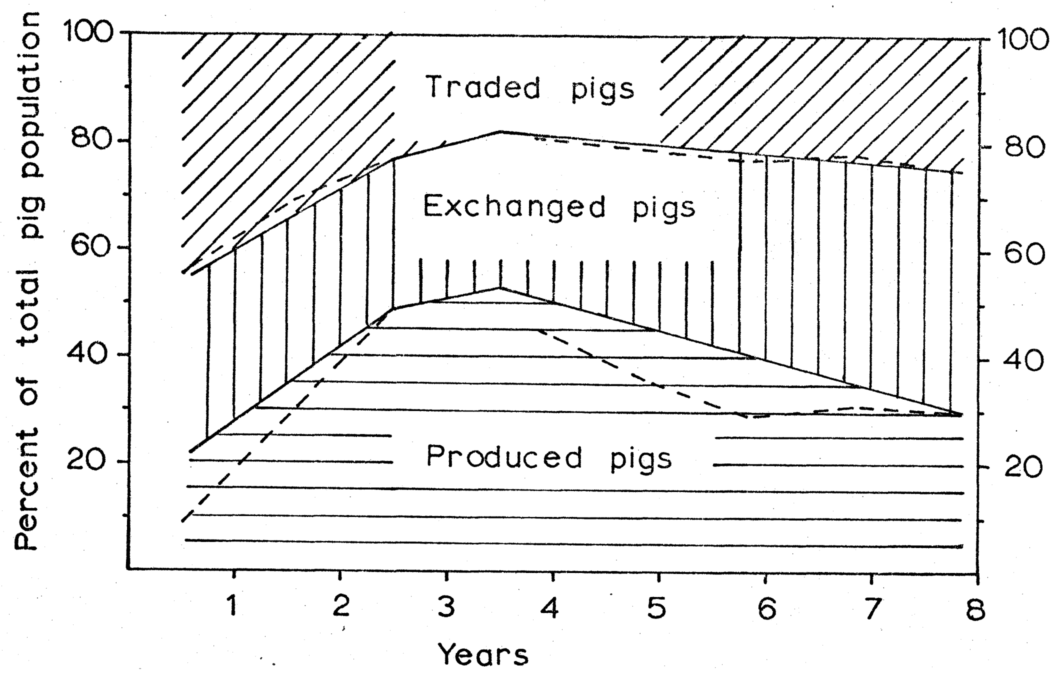

Fig.8.5 Percentages (of pigs present at censuses) of pigs acquired by production, by gift exchange, and by trade in Waula (2½, 3½ yrs) and Barikane (8 yrs, 7 months) populations (hatching distinguishes trends interpolated between four censused populations ; broken lines indicate trends retrodicted from July 1972 Barikane and May 1972 Waula populations).

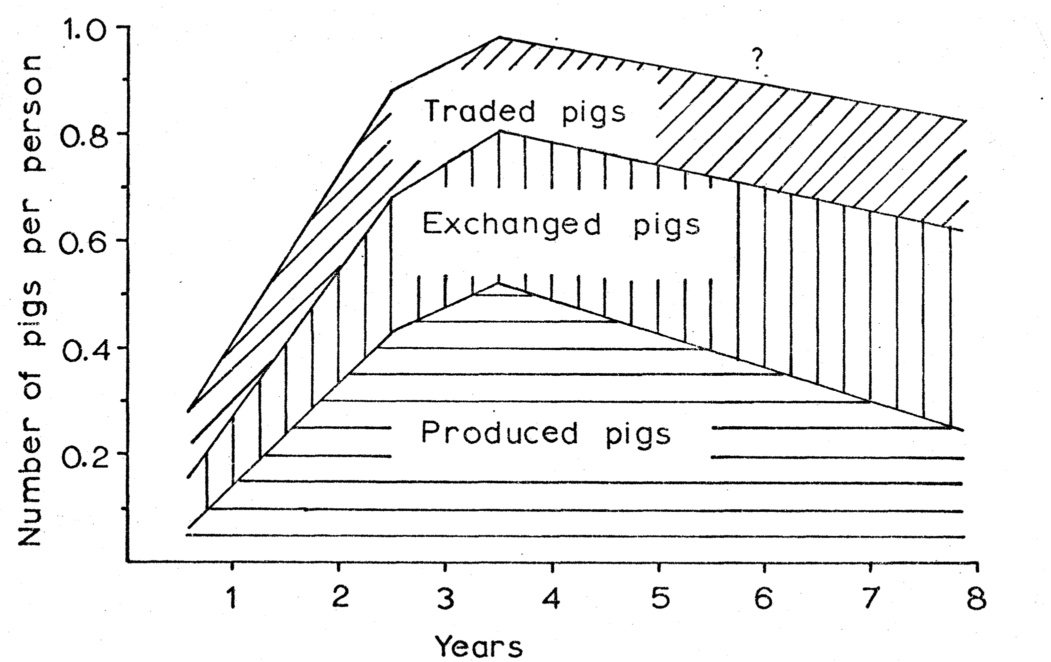

Fig.8.6 Composition of Waula and Barikane pig populations by modes of acquisition (interpolation of trends for an assumed 8 year cycle)

of that 'year'. I have done this only for the pre-festival Barikane population, retrodicting four 'years' to allow comparison with the observed Waula population at the three and a half year stage, and for the Waula population at two and a half years, retrodicting two 'years' for comparison with Barikane at seven months (dotted lines in Fig. 8.5; Appendix 8 contains the data base). While the method is crude in the extreme (especially the assumption about size), it provides rough confirmation of the interpolated trends.

The suggested trends are informative. Trade plays a major part in rebuilding a pig population at the beginning of a cycle. Though it accounts for almost half the pigs in an early population, pig numbers at this stage are likely to be relatively low (see Fig. 8.6 which combines Fig. 8.1 and Fig. 8.5 to relate composition by mode of acquisition to population size). As the proportion of pigs produced increases from under one quarter to over one half (Fig. 8.5; a five-fold increase in numbers suggested in Fig. 8.6), the proportion traded decreases to level off at about one quarter, apparently remaining stable for the remainder of a cycle. The interesting feature of the second half of the cycle is the suggested increase in the proportion of pigs acquired by gift exchange at the expense of produced pigs. Interpretation depends firstly upon assumptions about total numbers in the pig population. If the total population is assumed to increase steadily during the last half of a cycle then no restriction on breeding need be posited in explanation for the decrease in produced pigs: all that need be happening is a relatively greater increase in acquisitions through exchange than through breeding (and/or selective mortality and slaughter among the latter resulting in fewer surviving or remaining in the population). However, evidence considered earlier suggested that pig numbers, after an initial early rapid rise, remain at a relatively stable plateau for much of the cycle (i.e. Fig. 8.6; by using the Barikane pre-festival figures for population numbers at the end of a cycle I do not mean to indicate that numbers must necessarily decline during the final part of a cycle). If this suggestion is correct then the decreasing proportion of produced pigs in a population indicated here provides additional evidence supporting a decrease in reproduction. Not however conclusive, for the trend could also be produced by the disposal, or loss, of the majority of produced pigs through trade, exchange, or death. We must look, therefore, more closely at information on how Waula and Barikane were managing their pigs during the period of research. The loss of time-depth is partly offset by gains in detail.

Turnover: a summary

The bare numbers of pigs present at a particular time (i.e. 'standing crops'), given by censuses, and the gross increases or decreases between counts, while useful for certain purposes, "...tell us little, often nothing at all, about how many animals ... man could remove over a certain period of time" (Petrusewicz and Macfadyen 1970:5-6). For instance, the rise of 11 per cent in the number of pigs owned by Waula from 221 in May 1972 to 245 in April 1973, in no way indicates that only 117 of the animals recorded at the earlier date were still owned a year later. While a high turnover is not surprising in the case of Barikane due to their pig festival, the large number of pigs entering and leaving Waula (summarised in Table 8.7) indicate that pig management among populations even several years before a festival may be considerably more dynamic than might be expected.[13]

TABLE 8.7 Summary of gross changes in the number of pigs owned by Waula and Barikane between the first and last censuses

	Waula	Barikane
Population at 1st census:		
number	221	81
per capita	.88	.83
Additions between censuses:		
number	190	26
rate[(1)]	.76	.35
Removals between censuses:		
number	166	81
rate[(1)]	.66	1.09
Population at last census:		
number	245	27
per capita	.98	.28

[(1)] Number of pigs divided by human population during a 12 month period.

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[13] There are a number of technical measures of 'turnover' (see Petrusewicz and Macfadyen 1970:7-10). Perhaps the most relevant in this context is the turnover rate of individual pigs, or the fraction of the average number of individuals exchanged (in the ecological sense) during a given time period (in this case one year), calculated as $\frac{V}{\bar{N}}$ (ibid., 9-10), where V is the total number of pigs present at any time in the population during one year (i.e. pigs present at first census plus all additions), and N is the average number of individuals present at any one time. For Waula, then, where $V = 221 + 190$, and $\bar{N} = \frac{221 + 245}{2}$ (data from Table 8.7), the turnover rate for individuals is 1.76, or 176 per cent of the population during one year. The calculation for Barikane is more "artificial" due to their pig festival, and the fact that the data on pigs added to the population (the second component of the total number of pigs present at

Continued at next page

'Additions' and 'removals' are, however, gross categories, summarising a number of different movements and processes. For closer analysis both require disaggregation: the former into animals added to the population by birth, i.e. production, by gift exchange, and by trade; the latter into animals removed by mortality, slaughter, loss, and, transferred alive, by gift exchange and trade (Table 8.8). Comparison between Waula and Barikane shows that the major contrast between them stems (as expected) from the occurrence of the latter group's pig festival, i.e. Barikane had a far higher rate of disposal, mainly composed of slaughtered animals, and ones transferred live by gift exchange. Rates of removal, which measure only numbers of pigs, underplay this difference, which is more clearly shown by contrasting per capita figures of live weight. Barikane disposed of 59 kg live weight per capita over 9 months (all disposals), more than three times as much as Waula's figure of 17 kg over 12 months. Conversely Barikane's lower rate of acquisition was mainly due to the almost total lack of breeding, since both groups acquired live imports, through gift exchange and trade, at similar rates. For Waula, on the other hand, 108 births accounted for 57 per cent of total acquisitions. These produced animals were slightly outnumbered, however, by total deaths (mortality, slaughter, and loss), and Waula's increase was therefore due to live immigrants outnumbering emigrants, in particular pigs transferred through gift exchange (67 to 36). Before looking at

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any time) has to be extrapolated from its nine month base to one year. The figures are $V = 81 + 35$, $\bar{N} = \frac{81 + 27}{2}$, giving a turnover rate of 2.15 or 215 per cent per year.

TABLE 8.8 Pigs added to, and removed from, the Waula and Barikane pig populations; by number, live weight,(1) and rates per (human) capita per year(2)

A. ACQUISITIONS

Acquired by	WAULA (12 months) Pigs no.	%	Addition rate	Live weight kg total	%	average	BARIKANE (9 months) Pigs no.	%	Addition rate	Live weight kg total	%	average
Birth(3)	108	57	.43	80	3	.7	4	15	.05	3	-	.7
Gift exchange	67	35	.27	2470	87	37	14	54	.19	550	83	39
Trade	14	7	.06	300	10	22	8	31	.11	110	17	13
Subtotal - live imports	81	43	.32	2770	97	34	22	85	.29	660	100	30
Totals	189	100	.76	2850	100	-	26	100	.35	663	100	-

B. DISPOSALS

Removed by	WAULA (12 months) Pigs no.	%	Removal rate	Live weight kg total	%	average	BARIKANE (9 months) Pigs no.	%	Removal rate	Live weight kg total	%	average
Mortality	57	35	.23	590	14	10	1	1	.01	90	2	-
Slaughter	55	33	.22	1820	42	33	51	63	.68	3930	69	77
Loss	4	2	.02	100	2	25	-	-	-	-	-	-
Subtotal - deaths	116	70	.46	2510	58	22	52	64	.70	4020	71	77
Gift exchange	36	22	.14	1510	35	42	26	32	.35	1540	27	59
Trade	13	8	.05	320	7	25	3	4	.04	130	2	44
Subtotal - live exports	49	30	.20	1830	42	37	29	36	.39	1670	29	58
Totals	165	·100	.66	4350	100	26	81	100	1.09	5690	100	70

(Notes on following page)

Notes to Table 8.8 (continued from previous page).

(1) Weight is estimated as of the time a pig arrived or departed, i.e. by adding or subtracting a growth factor from an earlier or later measurement. Weights at birth estimated at 0.7 kg from a very few 3 day old piglets weighed.

(2) While standing crop ratios (i.e. pigs owned/held per capita) are useful, we need more dynamic measures to investigate the use made of animals. These addition and removal rates (number of pigs per capita per year) are a crude move in this direction. Since the Waula population was observed for one year, animal numbers are simply divided by 250 (average number of people present during year). Barikane is more complicated (a) because observation extended only nine months, and (b) because slaughter and exchange were very tightly bunched at the culmination of their festival at the end of September. I have not allowed for this bunching, and thus both slaughter and exchange (out) rates are exaggerated. To put the Barikane figures on an annual basis for comparison with Waula, pig numbers were simply multiplied by 1.3 before division by the average 97 people present.

(3) For the sake of completeness, dead births are included here (and also under mortality).

such live transfers, we need to examine the 'internal' processes, first of reproduction and growth, then of mortality and slaughter.

Reproduction

The rate at which an animal population can potentially increase by reproduction is a function of such parameters as the age of maturity, the length of gestation, the number of offspring, the period between births, the sex-ratio, and the mortality rate. Most of such parameters are changed in the course of domestication (with the length of gestation - 114 days for pigs - remaining the most stable), and vary more or less widely according to breed, and the goals and conditions of husbandry strategies. The management of reproduction in Sinasina has already emerged as a possible factor of some significance, and one requiring particular attention. This need is increased by the lack of studies of productivity under rural conditions, one consequence of which has been a tendency for some anthropologists to assume high potential productivity, perhaps with the performance of Euro-American breeds in mind,[14] and to focus on the social and ecological effects of high rates of increase (Vayda *et al*. 1961:71; Rappaport 1968:70; Strathern 1971c:135; La Fontaine 1973:49; Salisbury 1975:130).

The following analysis is based mainly upon the Waula pigs since only one litter was farrowed in the Barikane population during nine

[14] For comparison with later figures the following may be taken as representative of commercial parameters: females ready for breeding at 7-8 months, conception rate of c.80 per cent in a breeding season, litter sizes of 9-11, post-natal mortality of 20-30 per cent of those born alive, and sows managed for two litters a year with intensive feeding (Krider and Caroll 1971).

months. Nevertheless this absence of breeding during part of the cycle serves to highlight the significance of variation through time. Waula pigs, it will be recalled, were under close investigation from May 1972 to April 1973. To enlarge the sample and make use of a slightly longer time period, information collected from December 1971 is also drawn on. Thus this description applies to a population some two to three and a half years after a festival.

The general composition of the Waula pig population was described earlier (pp. 413-8). During the 12 months of 1972-73 female pigs averaged 56 per cent of the ecological population, and sixty-four of an average 119 female pigs present weighed over 25 kg. Some weighing less were undoubtedly sexually mature (cf. Table 8.10), giving perhaps an average 70 potentially fertile females present, or 33 per cent of the total population. Although male pigs averaged 44 per cent of the ecological population during 12 months, very few sexually active boars are retained. The great majority of males are castrated from three to six months after birth, perhaps a little later than the commonly cited figure of three months. Table 8.9, for instance, shows that an average 90 per cent of males weighing less than 10 kg (i.e. aged c.0-7 months, see Table 8.16 below), were still not castrated. The usual time for castration is said to be judged by teeth development, "when they come out of the mouth". At any one time there were three or four active boars in the Waula population during 1972-73; approximately two from the small pool of uncastrated pigs in the 10-25 kg size class, and one or two weighing over 25 kg (Table 8.9). This gives a rough ratio of one boar to 17-23 mature females (cf. Bennett

TABLE 8.9 Waula : number of uncastrated male pigs,(1) by size class,(2) at 3 censuses

Census	- 9 kg		10 - 25 kg		26 kg +		Total pigs	% of total males
	No. of pigs	% of size class	No. of pigs	% of size class	No. of pigs	% of size class		
1	25	100	4	22	2	4	31	36
2	14	82	7	35	1	2	22	23
3	21	87	2	10	1	2	24	24
Mean percentages		90		22		3		28

(1) Ecological populations.

(2) Size classes converted from following heart girths : - 18 ins, 19 - 26 ins, and 27 ins +.

1970:227, who cites a figure of 1 to 20-25 for pigs in general).

The castration of small males is considered of little matter by Nimai, needing only a pair of helping hands to hold the pig, and a razor blade (in the past a bamboo knife), and some salt to sprinkle on the wound. The testicles are eaten. A special meal, including perhaps tinned fish, may be given to the pig after the operation. Boars are not generally kept for long due to the extra management required. It is also said that too much copulation makes a boar thin. The largest in Waula weighed 45 kg at the time of castration in May 1972, when several men were required to hold it down. Retention of a male for breeding is a decision taken by an individual owner. Two men who kept boars both claimed avoidance of service fees to others as the main reason for doing so. Such fees appear to be negotiable, ranging from two dollars to a piglet. Size is said to be the main criterion for deciding which male of a litter to retain for breeding purposes. The only general colour preference stated, and this not specific to males, was a dislike of 'white' piglets which are believed to be particularly susceptible to disease. Since there are no feral pigs, and pigs are scattered widely throughout a group's territory, mating is normally the result of a decision taken by the owner of a female. When the female comes on heat, signalled by swelling and discolouration of the vaginal region, he approaches the owner of a boar and either takes the boar to his female, or the latter to the boar.

An interesting case concerning the consequences of an unplanned mating occurred in February 1973 when the owner of a sick lactating sow took the owner of the boar which had impregnated it to court, holding him responsible for the female's poor condition (compare Meggitt 1958:291). At the first hearing held before the councillor, the boar's owner refused to accept responsibility, saying essentially that the sex life of pigs was a matter for pigs,[15] not for court hearings. The claimant, however, persisted and since a settlement was not achieved both parties went to the kiap who returned them to the councillor. This time both the councillor and the defendant argued that there were no grounds for a court hearing. Further, as the defendant pointed out, it was usual for a fee to be paid for the boar's services.[16] Following the pig's death and butchery the next day, it was reported that the liver showed unmistakable signs of having been consumed by witches. Indeed, according to some, the attempted court hearing had been no more than a ruse (by the sow's owner) to allay the hungers of the suspected witches.

Females are not mated, and some are never bred successfully of course,[17] until they are an estimated 18-24 months old. This is a late age: very late compared with the 7-8 months of commercial husbandry,

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[15]In experiments, female pigs have been shown to play a critical role in meeting boars for mating (Hafez and Signoret 1969:359-60).

[16]The Local Court is occasionally used by claimants to force payment of such fees, i.e. Sinasina Local Court Register, 11 June 1971.

[17]Concern with fertility, and growth, is a central feature of the pig festival. More mundanely, the former is also expressed in several magical methods used now, or in the past, to ensure fertility. These include the use of the plentiful seeds of bube (Vernonia lanceolata), a small shrub fairly common in grassy fallow, and the fruit of maunigime barime (Ficus trichocera), a tree of the forest fringe. The inner greasy bark of eralime pege (Pipturus sp.), a tree of many uses, may also be rubbed on the rope of a pig that has failed to conceive. In the event of a sow sickening after birth bonadubole (Desmodium heterocarpon), a small shrub from lower altitude grassy fallow, may be struck against its rear legs.

and later than the 15 months given for a sample of 24 pigs in the Solomon Islands (de Fredrick 1971:23). The estimate is based upon observation of the absence of pregnancies among females born at the beginning of or just prior to my 17 month research period, upon growth rates, and from consideration of the reproductive histories of females in relation to their size (Table 8.10). It accords with investigations at the Goroka Research Station, where husbandry conditions are of high quality, which showed females reaching puberty at about 18 months (Malynicz 1970:201). de Fredrick found that Solomon Island sows were rarely retained for breeding beyond the age of four years, and that few had more than three litters in a lifetime (ibid., 25). While generalizations from the Waula data would be imprudent due to the early stage of the cycle, a similar pattern is suggested by the fact that only four per cent of all females owned (in April 1973), were known to have farrowed twice (Table 8.10). Such information is of course specific to those animals present at that time. A fuller perspective emerges from records on all the pregnancies reported between December 1971 and April 1973 (Table 8.11): a quarter were to sows that had previously farrowed. That only females in the 26-50 and 51-75 kg classes were found to be pregnant at any of the censuses suggests that after one or two farrows sows are no longer bred but fattened for eventual slaughter. A further factor to be noted is that breeding exacts a heavy toll of females. Six of 19 (37 per cent) females pregnant for the first time died either shortly before, or during, birth, or within 6 months after birth (Table 8.12). The latter deaths may be plausibily linked to breeding since sows lose much weight while nursing. In addition, the evidence

TABLE 8.10 Waula : reproductive histories of female pigs, April 1973[1] by size class, and per cent of size class

Size class kg	0 farrow		1 farrow		2 farrow		Unknown		Totals	
	pigs	%	pigs	%	pigs	%	pigs	%	pigs	%
0 - 25	69	91	5	7	2	3	-	-	76	100
26 - 50	22	54	14	34	4	10	1	2	41	100
51 - 75	6	54	2	18	-	-	3	27	11	100
76 - 100	4	57	1	14	-	-	2	29	7	100
101 - 125	2	100	-	-	-	-	-	-	2	100
Totals	103	75	22	16	6	4	6	4	137	100

[1] Sociological population.

TABLE 8.11 Pregnancies, by reproductive history of female pigs, and by outcome (Waula, December 1971 - April 1973)

	Reproductive history of female pig					Outcome		
	First Pregnancy	Second Pregnancy	Third Pregnancy	Unknown	Total	Birth[1]	Death of female	Pregnant April 73
Number of pregnancies	34	11	1	2	48	40	3	5
Per cent	71	23	2	4	100			

[1] For calculations of litter size (Table 8.14) information available for 37 only. Of the other three, one female miscarried, one farrowed in the bush and was not discovered for several days, and one was transferred, while still pregnant, out of Waula. While the details of the latter birth were incomplete, it was reported to have been successful.

TABLE 8.12 Waula : 'survival' of 23 sows farrowing between 12.71 and 11.72, by litter order; survival followed to 4.73, or departure from Waula

	N =(1)	Died before or at birth	Died 0 - 6 mth after birth	Slaughtered	Export live	Remain in Waula
1st litter	19	2	4	1	3	9
2nd litter	5	-	-	1	1	3
Totals	24	2	4	2	4	12

(1) One sow farrowed twice during the 12 months. It appears as both a 1st and 2nd litter case, and also twice as a survivor remaining in Waula.

on slaughter, and transfers through exchange and sale out of the clan of recently farrowed sows (Table 8.12), do not indicate a high value placed on the retention of a proven sow. Pospisil reports similarly for the Kapauku (1963:208).

The interval between litters, for sows that farrow more than once, is long. In 17 months, 45 females became pregnant 48 times, i.e. only three sows had two pregnancies during this period.[18] Of these three, the shortest interval was 30 weeks but this was exceptional, the result of a first litter consisting of a single piglet born dead. The other two intervals were 57 and 60 weeks. This suggests that sows farrowing more than once have their litters normally a year or more apart. For Solomon Island pigs, de Fredrick disregarded females producing either one or no litters and calculated an interval of nine and a half months (ibid., 24). While this may be useful in looking at production in an intensive commercial situation, such a birth interval figure says little of what is happening in a population. More usefully, the birth interval of an 'average' female in the Waula population during 1972-73 may be calculated, following Petrusewicz and Macfadyen (1970:70), by dividing gestation time (I assume 114 days, Kenneth and Ritchie 1953:19-21; but see Malynicz, nd., Table 9, who reports 116 days for New Guinea pigs), by the average pregnancy ratio (0.085, see Table 8.13). This gives an interval of 1341 days, or 3.7 years, which is extremely long.

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[18]Unfortunately, I did not investigate the incidence of mating. This would require far more frequent discussions with pig owners than my six monthly censuses.

TABLE 8.13 Waula : pregnant females at 3 censuses

A = ecological population [1]

B = sociological population

	May 1972		November 1972		April 1973		Average[2]	
	A	B	A	B	A	B	A	B
Total females	121	130	115	116	122	137	118	123
Pregnant females	4	6	14	15	4	5	9	10.5
Pregnancy ratio	.033	.046	.122	.129	.033	.036	.076	.085

[1] 0 females were agisted in at May 1972; 3 at November; 2 at April: none were reported as pregnant.

[2] Calculated from the May and November 1972 figures only.

TABLE 8.14 Number and size of Waula litters; by season and by number of times female pig previously farrowed.

	Dec. 1971 - April 1972 (1) (5 months)			May 1972 - Nov. 1972 (2) (7 months)			Dec. 1972 - April 1973 (3) (5 months)				TOTAL SURVEY - 17 months			
	1st Litter	2nd Litter	Total Litters	1st Litter	2nd Litter	Total Litters	1st Litter	2nd Litter	3rd Litter (4)	Total Litters	1st Litter	2nd Litter	3rd Litter	Total Litters
Number of litters	10	4	14	5	1	6	11	4	2	17	26	9	2	37
Total births	53	22	75	20	1	21	53	18	12	83	126	41	12	179
Mean litter size	5.30	5.50	5.36	4.00	1	3.50	4.82	4.50	6.00	4.88	4.85	4.56	6.00	4.84
Standard deviation	2.06	1.00	1.78	2.24	0	2.34	1.25	1.29	0	1.22	1.78	1.74	0	1.72
Dead births	6	2	8	6	0	6	1	1	0	2	13	3	0	16
Mean live litter size	4.70	5.00	4.79	2.80	1	2.50	4.73	4.25	6.00	4.76	4.35	4.22	6.0	4.49
Standard deviation	2.58	1.41	2.26	1.79	0	1.76	1.01	1.50	0	1.15	1.98	1.79	0	1.73

(1) One pregnant female died during this period (1st litter, four foetuses, 2M/2F).

(2) One pregnant female died (1st litter, three foetuses), one miscarried (1st litter, no foetus information), one farrowed in bush and information inadequate (1st litter, 1F survived), and one pregnant female transferred out of Waula during this period.

(3) One pregnant female died during this period (2nd litter, no foetus information).

(4) One sow farrowing for third time, and one whose reproductive history was not known.

Mean litter size of completed pregnancies for which I have reliable information was 4.8 (4.4 live births) for 37 litters farrowed over 17 months, and 4.5 (4.2 live births) for 23 litters over 12 months. The former figure may be slightly inflated by possible seasonal variation in litter size (see Table 8.14). Both figures may also slightly under-count since some litters are not discovered by their owners until a day or so following birth thus allowing time for either thefts or disappearances due to mortality. It may be noted that they are a little lower than de Fredrick's figure of 5.1 for Solomon Island litters (ibid., 24), though the lack of information concerning sample selection, and the time of year concerned, makes comparison difficult (compare, for instance, the December 1971-April 1972 figures from Waula in Table 8.14). Other New Guinea highland figures from unpublished reports cited by Malynicz (1976:3) range from 3.6 to 4.8.[19] For a small sample of 8 litters among the Kapauku, Pospisil gives an average of 6 (1963:203).

Waula owners, visiting daily, if not sharing, houses with their pigs, are quick to observe pregnancies (presumably expecting them, if breeding is as closely managed as it appears to be). As described earlier, pregnant females may receive extra rations (Chapter 7). Toward the time of birth a close watch is kept on the female in order to locate her nest. If the pig is kept outside the enclosure system, the first indication of impending birth is often her failure to return to the pig house to sleep. She is immediately looked for on the

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[19]Under experimental conditions, Malynicz (nd., p.4, Table 6) reports higher figures, and increases with parity.

following day. Though the nest may be made within 50 m of the pig house, it is usually well hidden in Miscanthus tufts. After the nest is located, owners usually make no attempt to move the sow and litter for at least a few days, nor should anyone but the owner take food to the nest. To do so, it is said, is likely to attract the harmful attentions of certain spirits (menabal). My eagerness to secure some post-birth weights drove home my ignorance on this point. Four days after a litter had been farrowed, I went with the nominal owner to weigh the piglets. Though advised not to by his father, who had located the nest and was feeding the sow, we weighed them. Much to our embarrassment one piglet had disappeared by the following day.[20] Pigs kept on tether within the enclosure may either make a nest in grass close to their house, or, if cut grass is judiciously heaped in front of their house, be encouraged to farrow inside it.

Although litters are not large by commercial standards, the possibility of four replacements per sow is still considerable.[21]

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[20]Traditional husbandry is here in agreement with modern knowledge. Disturbance of a newly farrowed litter is likely to increase a sow's nervousness which has been related to neonatal mortality, including cannibalism on the part of the sow (Hafez and Signoret 1969:374). With their strong sense of smell (ibid., 354) and conditioned responses to sounds (ibid., 355), sows probably tolerate feeding visits by an accustomed keeper, but not by strangers. Cheeseman, writing of an incident on the island of Waigeu (Irian Jaya), thought that New Guinea pigs panic at the smell of white people (1949:102).

[21]The extremely low productivity per sow revealed by this figure is highlighted by a comparison with medieval England. In about 1325 the 'target' which breeding stock on southern manors held by the Priory of St. Swithun's at Winchester were expected to produce (i.e. as fixed by the Responsio) was set at 15 piglets a year per sow, and this remained the standard for the estate until the end of the 14th century.

Continued at next page

That potential, however, is reduced by a number of factors, ranging from sickness to slaughter or sale. Table 8.15A summarizes the effects of such factors on 74 piglets belonging to 14 litters farrowed during a five month period at the beginning of 1972. These data are separated from later litters to allow the fortunes of the young to be followed, where available, up to the age of at least one year. Although mortality was relatively heavy, accounting for 42 per cent of the live births, Waula owners could still have gained as many as 2.8 pigs per litter. Through a combination of slaughter and transfers out of the clan, however, they reduced this possible gain to 1.5. Table 8.15B provides information on the litters born over the 12 months between May 1972 and April 1973. Although born throughout this period, over 70 per cent of the surviving piglets were still under 4 months of age in April 1973 and the analysis therefore does not yield results comparable to those in Table 8.15A. Nevertheless it is significant that owners had already slaughtered almost as high a proportion of these later births as they had of the earlier ones.

As indicated by the distribution of litters (Table 8.14), Waula were either managing their breeding with a preference for farrowing during the wetter months between December and April or there is a

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That this cannot have been abnormally high is indicated by the fact that if such targets were not met, the official responsible was liable to pay in cash the amount of the deficit. Further, it is similar to the 14 piglets per sow given by other sources of the time (Drew 1962:23).

TABLE 8.15 Waula : piglet 'survival'

A. 14 litters farrowed 12.71 - 4.72; survival followed to 4.73, or departure from Waula

	Males	Females	Sex unknown	Total	% all births	% live births
Dead at birth	4	4	-	8	11	-
Died: birth to age 12/17 mos.	15	12	1	28	37	42
Slaughtered	7	4	-	11	15	16
Export live	3	4	-	7	9	10
Remain in Waula	7	14	-	21	28	31
Total births	36	38	1	75	100	100

B. 23 litters farrowed 5.72 - 4.73; survival followed to 4.73, or departure from Waula

	Males	Females	Sex unknown	Total	% all births	% live births
Dead at birth	2	5	2	9	9	-
Died; birth to 0/12 months	4	6	1	11	11	12
Slaughtered	5	8	-	13	12	14
Export live	5	-	-	5	5	5
Remain in Waula	31	35	-	66	63	69
Total births	47	54	3	104	100	100

'natural' seasonality to breeding.[22] The ratio of pregnant females to all females was three times greater in November 1972 than in either May 1972 or April 1973 (Table 8.13). Unfortunately I did not pick this up until analysis after leaving Sinasina. Some seasonality in the breeding patterns of New Guinea fauna has been reported. According to Schodde and Hitchcock, many species of New Guinea land birds

> "...breed spasmodically throughout the year (though an individual pair may breed only once in that time)...there are general peaks of breeding in these species in the austral spring and early summer months (i.e. September-November, RH). Evidence for associating these peaks with the seasonal climatic variations, e.g. the onset and fall-off of rains in New Guinea, is somewhat conflicting...Much further study is needed..." (1972:76).

In a study of 10 species of murine rodents in an area some 20 km to the east of Koge, but at a similar altitude, during the period March 1972-January 1973, the zoologist Dwyer found that all showed "...seasonal breeding with reduced or no breeding through the drier months" (1975:44). This was least evident, however, among species living outside the forest.

The literature on pigs in New Guinea makes, to my knowledge, almost no reference to seasonality (cf. Morren 1979; Hide nd.). Burridge, writing of the Tangu, fifteen miles inland from Bogia Bay in the Madang Province, is however, one exception, though his comments are slightly ambiguous. Outlining the agricultural year of the Tangu,

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[22] According to Hafez and Signoret (1969:368) there is no evidence of seasonality in the female sexual cycles of domestic breeds, though they note that a breeding "season" has been reported for some feral swine, focused on November and December, but beginning as early as July and continuing until February. Presumably this report refers to the northern hemisphere.

he describes (1969:46) February as a month when, after the dearth months of December and January, new taros are coming up and being eaten, and the yam gardens, newly planted in the period October to January (ibid., 42) are maturing and requiring protective fencing. Plant growth is rapid, and women are busy weeding. Men sleep in the gardens to complete the fencing, to protect young crops from pigs, to ambush and kill pigs for meat, and to capture piglets for domestication. According to Burridge,

> "Pigs rut in this period, and sows, farrowing in the bush, find the gardens a relatively easy source of food. It is a man's duty to seek out piglets in the forest and bring them into the village to domesticate them. Thus building fences, sleeping in the garden, man's desire for meat and piglets, and the sows' and piglets' need for easier nourishment all coincide at one point in time and space: the garden" (ibid., 46, fn.1).

Since gestation is almost four months, Burridge's compression of rutting and farrowing into the one period of February is awkward. His description nevertheless implies that piglets are plentiful in February, suggesting that mating probably increases around October. It may be noted that rainfall records at Bogia show a relatively sharp change from dry to wet conditions between August and November, the four months having respective monthly means (in mm; n=7 years) of 42, 85, 149, and 207 (McAlpine et al. 1975:21).

Climatic seasonality in Sinasina, and seasonal variation in the supply of cultivated foods, have been discussed earlier (Chapters 2, 7), and it will be recalled that sweet potato, which provides the bulk of fodder provided for pigs, seems sometimes to be shorter in the approximate period December-February. How do these patterns relate to pig breeding? Since pregnancy ratios were low in April/May, we may assume little mating in the approximate period February-April; while the high ratio in November indicates far more in the approximate period September-November. The time of mating is not, however, important by itself but only in relation to the length of gestation and the period in which the young are produced and reared. Although exact dating of all births was not possible, they could be placed with some confidence in three month periods and the incidence of farrowing in Waula by quarter is shown in Fig. 8.7. If Waula were scheduling mating, they clearly favoured farrowing during the December-February quarter, followed by the six months from March to August. The explicit reasons for their decisions cannot of course be reconstructed retrospectively, but the likelihood of certain factors may be evaluated. There are, I suggest, three main candidates. Two are directly related to food. Pig breeders could be attempting to match the early months of their pig's lives with a secure supply of sweet potato. This seems a reasonable assumption, though the farrowing peak might be expected then to fall a little later than it appears to. However, it might be the post-weaning period which is regarded as crucial. Secondly, rather than cultivated foods, the availability of forage may be considered to be of equal or more importance. I have no relevant information on this possibility, though would speculate that many foraged items are more available in the wetter than the drier months. Alternatively, pig breeders could be attempting to avoid a period during which a number of

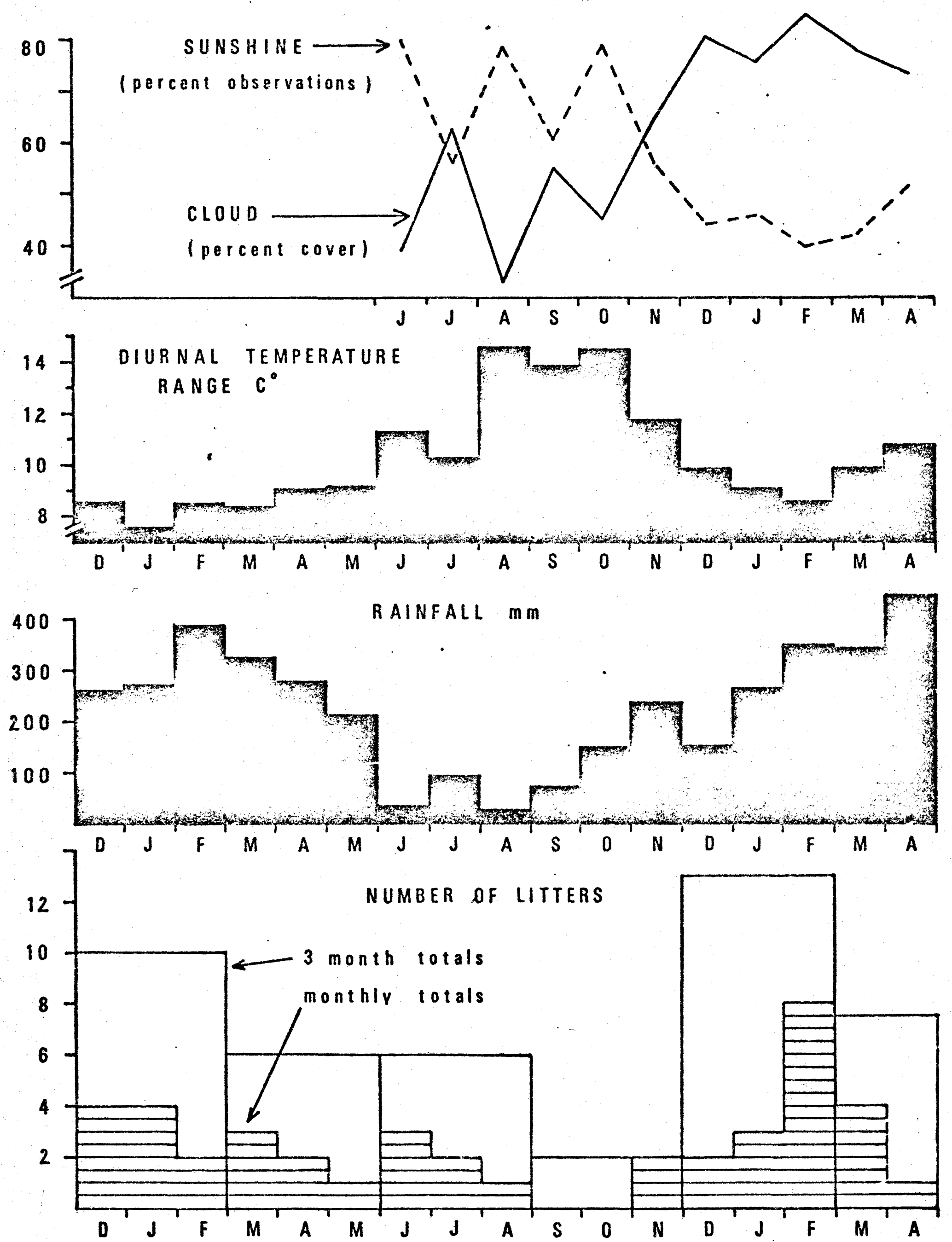

Fig.8.7 Number of litters farrowed by month and by quarter, Waula Dec.1971 - April 1973; with summary of climatic characteristics

factors such as temperature[23] and rainfall, perhaps in addition to food availability, combine to reduce the chances of successful ante- and post-natal growth. Though the cases are few it is noticeable that the litters farrowed between May and November 1972 were smaller at birth, and had a larger proportion of dead births, than those farrowed during the 1971-2 and 1972-3 wet seasons (Table 8.14). Clearly these three factors need not be independent. Further progress with the question must be left to future research.

Many of the features described above support evidence described earlier (on the demographic structure of pig populations and the proportions of animals acquired by different means), which indicated restrictions on breeding. In the Waula case the most significant of these features are that females do not seriously outnumber males, proven sows do not seem to be retained, birth intervals are extremely long, and litters are quickly reduced in size. As noted earlier the Waula pig population increased by only 11 per cent during 12 months, a rate which I described as low. Were Waula pig-keepers deliberately managing reproduction with the intention of achieving a low rate? Though no explicit statements asserting or denying such a strategy were made to me, the proceedings of an informal court case in early September 1972 suggest that at least some men acted with such goals in

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[23]Temperature would seem to be one possibility as piglets do not appear to have particularly efficient temperature regulating mechanisms (Williamson and Payne 1965:310). The latter authors suggest that cold air temperatures may contribute to increased mortality rates of piglets during the first two or three days of life. Although mean monthly temperatures in the highlands are remarkably stable (Chapter 2), the daily temperature range increases considerably during the dry season (Fig. 8.7).

mind.

The court was held to settle an intra-clan fracas, resulting in a couple of bloody noses and assorted bruises, which occurred two weeks before the final pig slaughter which concluded the Dom festival. It was heard by Mui, the big man of the Waula settlement at Koge, at the Koge men's house on the morning after the fight. B, the man responsible for the fight, arrived at the court heading a medium-sized sow and expressing his determination to compensate his injured fellow clansmen with pork. Mui, however, was equally determined that he should not do so, and the following exchange occurred:

Mui: "You say you want to kill this pig, but shut up and listen to me. Dom are about to slaughter and give pork to us. Dugul and Bomai (two Nimai clans with 78 per cent of the tribal population), are large, and they've been looking after their pigs well, and when they say, 'Let's kill our pigs (i.e. hold a festival) and return pork to Dom', what will you do?"

B: "I'm going to kill this pig and give it to those who were injured."

Mui: "The court isn't finished yet---don't touch the pig. Dom are going to give us a large amount of food (i.e. pork). I've told everyone here at Koge (one of the two major Waula settlements)---<u>don't put your sows with the boars</u>, but I don't think X's line (the other Waula subclan) have heard my words. When they all come here, we can hold a big meeting, everyone will hear this talk, and we'll start to look after the pigs. If a skinny pig or two dies, that's no matter, but you mustn't slaughter your pigs. I've said this and everyone's heard me. You mustn't kill this pig over this fight. Bring some money, divide it amongst the injured, and end the dispute. I forbid you to kill the pig.

B: "...I'm going to kill this pig...You mentioned Dom, but I haven't got any friends at Dom. When Dom kill their pigs all of you will receive pork but I won't.[24] I'm going to kill this one now."

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[24] In fact he received a considerable amount from Dom. He later mentioned what may have been the more important reason for his willingness to offer pork to the injured. "I've heard your gossip.

Continued at next page

Mui: "...Forget the pig. B, you say you want to kill the pig and your son supports you and also wants to kill it, and Y also, he supports you both and wants to kill it, but I don't want to kill your pig. Take it away and look after it. I'll settle this dispute. I'm not going to kill this sow, and I repeat, don't put it with the boars. Dugul and Bomai are large groups, and when they say let's kill the pigs and return our debt to Dom, what will you do? You heard me. We're not going to kill this pig. Look after it, and it will grow big and we can kill it to return our debt (to Dom)...The injured only used their fists, and only their noses are swollen. They can heat some water and bathe them, and they'll be fine. This isn't a big matter. If you kill your pig and they eat it now, later, when they start a quarrel and, in helping them, you bleed or hurt your hand, you're going to say, 'Before I started a fight, you helped me, and I killed a pig for you---you should kill one for me now'. If that happened, I'd be really angry, which is why I'm telling you to forget this pig."

Growth

Growth, like reproduction, is not a simple variable. Local values, specific to time and place, are determined by complex inter-relations between biological potential, presumably the result of adaptation, and the performance of individual animals under conditions partly defined by human goals and action. As mentioned earlier (pp. 454), the growth, and more generally condition, of their pigs are of major concern to Sinasina.[25] Given that large pigs are required for festivals, growth

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'That time the house burned down, he only showed his pig and then took it away', that's what you said and I remember it. Now when I'm telling you to kill this pig, you say don't, and we're not getting anywhere. I mention this now because that is what I'm thinking about."

[25]Like fertility, growth is the focus of numerous ritual aids. Although lacking mondono, the whitish powder distributed by the Gende from the north of the Chimbu valley as a dietary supplement to assist fattening (Hughes 1977:112-114), Nimai utilise a variety of vegetable materials, not all of which are ingested, to the same end. The leaves

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is also central to an understanding of the periodicity of production cycles. Before turning to Sinasina data, a brief review of present knowledge about the growth rates of Melanesian pigs may be useful.

All studies reveal growth rates that are far below those achieved (c.10-14 kg/month)[26] by Euro-American breeds under commercial conditions. Malynicz, referring to experimental work undertaken at Goroka, suggested in early papers that rates of 3.7-4.5 kg per month are possible under "careful management" (1970:201, 1971:72; see also de Fredrick 1971:75). Field studies of pigs under rural husbandry conditions, however, show rates well below such figures. Malynicz reports that Moore (a regional veterinary officer) obtained a mean of only 0.9 kg/month for 26 small

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of bemil (Cyrtandra sp.), and erama kinawa kama (Poikilogyne sp.) are both used only for wrapping sweet potatoes fed to pigs in pig-fattening rituals but are not themselves eaten. The small herb naganaga (Spilanthes grandiflora) is used to stimulate the appetite of a pig that has gone off its food by being placed within its mouth. Sticks of kolpaga (a term including an Eugenia sp. and (several?) Psychotria sp. or spp., but referring in this instance to P.dolichosepala), and gare nolgin (Syzygium sp.) are highly regarded for use in breaking sweet potato for feeding to pigs to ensure fatness. A kolpaga (Psychotria sp.) branch can also be rubbed against a piglet's snout to encourage growth, and kolpaga leaves may either be rubbed on a pig's skin or fed to it with sweet potato. The fruit may also be included in food. The leaves of dumulere (Medinilla sp. or spp.), rubbed on the skin of a thin pig, are held to restore health and fatness, and the leaves of several small herbs, either cooked with pork fat (i.e. malabe, Dichrocephala bicolor), or rates (i.e. danegume kirai, a term including Lysimachia japonica but in this case unidentified), are fed to pigs as tonics for the same purpose. It is perhaps little wonder that commercial pig concentrates are known in pidgin english as marasin, i.e. medicine.

[26]Growth rates in the pig literature are usually given as weight gain per week, or per day. Since Sinasina rates are too low to be calculated in these forms, gains per month are used here. My 'month' is one-twelfth of a year, i.e. 30.4 days or 4.3 weeks. For convenience of comparison published figures are converted to the same monthly basis.

pigs (weighing 2.2-16.2 kg) over a period of two months in the vicinity of Goroka in the Eastern Highlands Province, and has suggested that highlands pigs in general would weigh probably not more than 22.7 kg (50 lbs) at the age of one year; i.e. a growth rate of 1.8 kg/month (1970:201). Similar figures have been reported from the Solomon Islands by de Fredrick who found that the "average village pig reaches about" 22.7 kg in the first year, though he noted a range from 1.2 to 2.9 kg/month for pigs from different regions around this 1.8 kg/month average (1971:26, 27-30). These early figures are approximations. Though referring specifically to the first year of growth, they are generalized in relation to such factors as nutrition, sex, and husbandry strategy. In a recent paper, Malynicz reports figures from three highlands' locations distinguishing rates by sex and size (1976:3, Tables II and III). These reveal considerable variation both within and between populations: mean rates, however, (for all males and all females at each location) fall within the range 1.2-2.6 kg/month. His detailed results are more usefully discussed in relation to Sinasina figures.

A large number of animals, scattered over a wide territory, would be necessary for a full study of growth in which such factors as age, size, sexual and reproductive status, and nutrition are all taken into account. Such a study was beyond my resources. Instead I concentrated on determining the growth rate, in measured live weight gains, and heart girth increase, of a small non-random sample of Waula piglets during the first 12 (or less) months of life, and the growth rates, in measured heart girth change only, of all other Waula and Barikane pigs available for more than one census. The results are shown in Tables 8.16, 8.17 and 8.18.

In short, Waula pigs grew at an average 1.6 kg/month to reach just under 20 kg at the age of one year (Table 8.16). Though there was considerable variation (0.9-2.2 kg/month), this average rate agrees well with the figures cited above. Larger, older pigs also grew slowly, at least as estimated by conversion from measured heart girth change. The average growth rates, over a one year period, of pigs of varying size and sex, were all under 2.0 kg per month (Table 8.17). Again, however, there was much variation, with at least some pigs in almost all size classes exceeding 2.0 kg/month, and some gaining little, if anything. Reproduction, in particular lactation, is the major factor depressing the growth rates of females, as indicated by the rates of 0.3 and -0.2 kg/month for sows of 11-25 kg and 26-50 kg which farrowed during the 12 months. Recognising this, Waula often referred to a sow's condition when explaining why a litter had been weaned, or why one or more piglets of a litter had been given away or slaughtered. Unfortunately, sample sizes of larger pigs available for one year were too small to show significant variation in growth rates between the different size classes over this full period.

Differences between the rates achieved in the dry months from May to November and the wet months from December to April are strongly marked, at least for pigs over 25 kg (Table 8.17). Higher rates of gain were achieved in the former period, higher in most cases than the annual rates, while rates were lower, if not reversed, during the wetter months. I am uncertain whether this was due to fluctuations in

TABLE 8.16 Pig growth during first year.

Age in weeks	No. of Pigs (i)	No. of Litters	Weight lbs				Heart girth ins		
			Mean	Range	SD	Mean kg	Mean	Range	SD
.5	13	3	1.9	1.5 - 2.7	.3	.9	-	-	-
2	15	4	3.5	1.7 - 5.7	1.2	1.6	-	-	-
4	14	4	5.2	2.0 - 7.7	1.4	2.5	12.0	9.0 - 14.0	1.4
8	12	4	8.1	5.5 - 11.5	1.4	3.7	13.8	12.0 - 16.0	1.1
12	13	4	10.5	6.7 - 16.0	2.8	4.8	15.0	13.0 - 18.0	1.3
16	15	5	14.5	8.0 - 23.2	4.7	6.6	16.6	14.0 - 19.5	2.0
20	14	4	17.2	10.7 - 24.0	4.2	7.8	17.6	15.0 - 20.0	1.4
24	13	4	18.4	12.0 - 25.0	4.8	8.3	17.5	15.0 - 19.5	1.4
28	11	3	20.5	11.5 - 27.0	5.1	9.3	18.4	16.0 - 19.7	1.4
32	9	3	22.7	13.7 - 28.0	5.1	10.3	19.2	16.7 - 21.7	1.7
36	10	3	23.9	17.2 - 32.0	4.4	10.8	20.0	17.5 - 22.5	1.5
40	10	3	29.0	17.0 - 44.0	7.5	13.1	20.9	17.5 - 24.2	1.9
44	9	3	32.4	22.2 - 48.0	7.2	14.7	21.6	18.7 - 25.3	1.9
48	7	2	37.3	23.0 - 55.0	11.2	16.9	22.7	18.5 - 26.0	2.6
52	6	2	43.3	24.0 - 58.0	11.7	19.6	23.5	19.5 - 26.5	2.2
56	4	1	40.6	24.5 - 61.0	13.6	18.4	22.9	20.5 - 27.5	2.8
60	6	2	47.6	25.0 - 71.0	15.0	21.6	24.0	19.0 - 29.0	3.2
64	4	1	43.6	28.5 - 71.0	16.4	19.8	23.6	19.5 - 29.0	3.4

(i) A larger sample was weighed, but not measured, at 4, 8, 12, and 16 weeks. Average weights (lbs) were respectively 5.1 (N=21), 8.3 (N=19), 11.3 (N=20), and 14.7 (N=20).

TABLE 8.17 Seasonal and annual growth rates of Waula pigs: kg/month weight change converted from measured heart girth.

Size class kg	Sex(i)	May '72 - November '72 N=	Mean	SD	Range	December '72 - April '73 N=	Mean	SD	Range	12 months May - April N=	Mean	SD	Range
- 10	M	10	.9	.3	.5 - 1.4	11	.9	.4	.3 - 1.6	7	.9	.2	.5 - 1.1
	F	16	1.1	.7	.1 - 2.1	8	.8	.4	.4 - 1.6	12	1.1	.8	.4 - 2.3
11 - 25	M	11	1.7	1.3	-.2 - 4.3	10	1.1	1.1	-.1 - 2.7	11	1.4	.8	.2 - 2.4
	F	17	1.0	.5	0 - 1.9	21	.9	1.1	-.4 - 3.2	10 (A)	.8	.4	.5 - 1.8
	F (i)									4 (B)	.3	.9	-.5 - 1.5
26 - 50	M	16	1.5	.8	0 - 2.7	28	.9	1.1	-1.9 - 4.1	15	1.2	.7	.1 - 2.7
	F	21	1.1	1.1	-.8 - 2.9	18	.3	1.4	-2.8 - 3.2	11 (A)	.6	.7	-.3 - 1.7
	F (i)									7 (B)	-.2	.8	-1.3 - 1.1
51 - 75	M	6	2.1	2.4	-.5 - 6.0	5	.1	.6	-.6 - 1.1	2	1.7	0	1.7
	F	8	2.2	1.4	1.0 - 5.1	6	-.4	1.2	-2.2 - 1.1	5	1.1	.9	0 - 2.2
76 - 100	M	2	1.4	.8	.9 - 2.0	4	-.4	1.6	-2.3 - 1.3	2	.4	.6	0 - .8
	F	2	3.2	4.5	0 - 6.3	5	-1.5	1.0	-3.0 - -.6	1	(-.3)	-	-
101 - 125	M	5	3.7	1.8	2.3 - 6.7	5 (ii)	-1.8	2.0	-5.3 - -.8	5	1.4	1.7	-1.0 - 3.6
	F	1	-2.7		-	2	-1.0	.5	-1.4 - -.7	1	(-1.8)	-	-

(i) Since the consequences of reproduction strongly effect the female figures, all females known to be pregnant at the first or last measurement of any period have been excluded. All females which farrowed between measurements have also been excluded from all seasonal calculations, and from the two annual calculations marked (A). For these two size classes, the annual figures marked (B) give the growth rates for females which did farrow during the year. Note that although seasonal figures exclude females which farrowed during the season, they include females nursing litters, i.e. sows farrowing varying lengths of time prior to the start of a period. Nursing often resulted in rapid weight loss.

(ii) All five males in this season strictly belonged to the next higher size class. For the convenience of this table they are retained in their original class.

the supplies of cultivated, or of foraged, food. It is also not clear if it is a characteristic feature of all years, since, as I have stressed, climatic seasonality was unusually severe during 1972. There is some scattered evidence from other areas of the highlands which suggests that seasonal fluctuations in the condition of pigs are quite widely recognised, and affect the timing of festivals during the calendar year.

In central Chimbu, according to Bergmann, people say that,

> "When the sun comes back and is about half way then is the best time for the pig festivals...In that time, the pigs are in good condition" (1971, Volume 2, p.199). "During the bad time (of the year) the pigs have no fat, the people say" (1971, Volume 4, p.99; parenthesis added).

Elsewhere, he also relates the timing of festivals specifically to the availability of cultivated foods, though in this context for people not pigs (1971, Volume 4, p.95). Going beyond Chimbu, Bowers records that in the Kaugel Valley August is regarded as the month in which "pigs get fat" (1968: Tables 3, p.28). Rappaport also distinguishes, on the basis of differing annual cycles of plant development, between the Simbai Valley Maring whose festivals begin and end in October-November, and the Jimi Valley Maring whose festivals are more likely to begin and end in January-February (1967:215, fn.14).[27] I regard as probable, then, some regularity of seasonal variation in pig growth rates and condition, presumably determined by the seasonality of plant

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[27]The smiy festival, which is an occasion for pig slaughter (though pig husbandry is said to be a recent adoption), among the neighbouring Kalam of the upper Simbai and Kaironk valleys, is scheduled according to the seasonality of taro, which is harvested in June-July (Bulmer 1967:13).

development and thus by climatic factors. However, given the year by year variability of the latter, I would be inclined to emphasise, at this stage, 'some regularity' rather than anything stronger.

Information is presently inadequate to decide whether fluctuations in cultivated or foraged fodder are most significant. The following points seem important (cf. Hide 1980a). The modest daily rations of cultivated food per pig shown in Chapter 7 (though unfortunately restricted to the months of November and March), suggest, especially if studies of the basal metabolism of pigs of European stock (Brody 1945:388,465) are relevant to New Guinea pigs, that medium to large sized pigs must be finding a considerable proportion of their food for themselves. We do not know, however, what the proportions of the two sources are, nor whether they vary together (as would seem likely under severe climatic conditions), or independently (as would seem likely when declines in sweet potato supplies correlate with such events as pig festivals, cf. the discussion in Hide 1980b). More research, then, is needed.

It is possible (perhaps likely) that growth rates also vary in relation to the stage reached by a group in its ceremonial cycle. If breeding, for instance, is reduced or halted as a cycle progresses, non-reproducing females would grow faster than usual during the final year(s) of a cycle. Further, fatness is a quality sought for in pigs destined for festival slaughter (for Chimbu, see Bergmann 1971, Vol.4, pp.94, 97-8), and therefore it might be expected that an impending festival results in the provision of extra fattening rations and hence faster rates of growth. Data on the Barikane pigs are inadequate, both in terms of pig numbers and in time covered, for conclusive statements about the rapidity of growth during the final pre-festival stages of a cycle, but they do confirm the high dry season rates of the Waula pigs, and suggest that somewhat higher rates may be achieved (Table 8.18; note especially the upper range of Barikane pigs in the 76-100 and 100-125 kg classes).

TABLE 8.18 Growth rates of some Barikane pigs, August-September 1972: kg/month weight change converted from measured heart girth

Size-class kg	No. of pigs and sex	kg/month weight change		
		Mean	SD	Range
11 - 25	1M	(1.6)	-	-
26 - 50	2M	2.3	4.4	.8 - 5.4
51 - 75	3M, 10F	1.4	2.9	- 3.1 - 5.9
76 - 100	4M, 3F	2.5	4.6	- 3.0 - 9.9
101 - 125	4M	4.9	4.9	0 - 10.8
126 +	3M	-4.3	8.9	-10.7 - 5.9

Recognising that these figures are based on a single and perhaps exceptionally seasonal year, and on few animals, they are nevertheless substantially in agreement with other, similarly restricted, surveys (de Fredrick 1971; Malynicz 1970,1976). What do they add to an understanding of the dynamics of Sinasina pig husbandry? Members of Barikane, it will be recalled, had produced on the eve of their festival pigs weighing an average 70 kg, with approximately 40 per cent of their animals weighing more. On the basis of average growth rates falling in the range of 12-24 kg per year, most of their pigs would have been four to six years old. Growth then is a decisive factor setting minimum limits to the duration of inter-ceremonial periods.

Mortality

The different size structures of the Waula and Barikane populations are reflected in their differing patterns of mortality. Over 12 months, 57 Waula pigs died[28] while only one Barikane pig died in nine months. It seems unlikely that the Waula losses were exceptional, the result perhaps of the climatic severity of 1972. During the five months (December 1971-April 1972) before the one year survey, and thus before the 1972 drought, 23 Waula pigs died, a figure very close to the 21 lost during the same period a year later. Most deaths were of young pigs, and thus the Waula numbers are the result of the relatively high rate of breeding (Fig. 8.8A). That large females died more frequently than males is also, as suggested above (p.453), a consequence of reproduction.

Nimai recognise a variety of factors to be directly or indirectly responsible for the deaths of pigs.[29] These range from the malicious acts of nature demons or spirits (see p.245) and the constant depredations of meat-hungry witches, to disease, accident and poor husbandry. These need not, of course, be exclusive. The reasons given for any particular death (to an inquirer) are likely to

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[28]This figure includes nine piglets either born dead or dying between birth and the owner's first visit to the litter (Table 8.15B). Their inclusion in the total mortality figure is simply for the purpose of completeness.

[29]Sterly's paper on pig diseases and medicines in the Upper Chimbu Valley appeared too late for inclusion in this discussion (Sterly 1978/79).

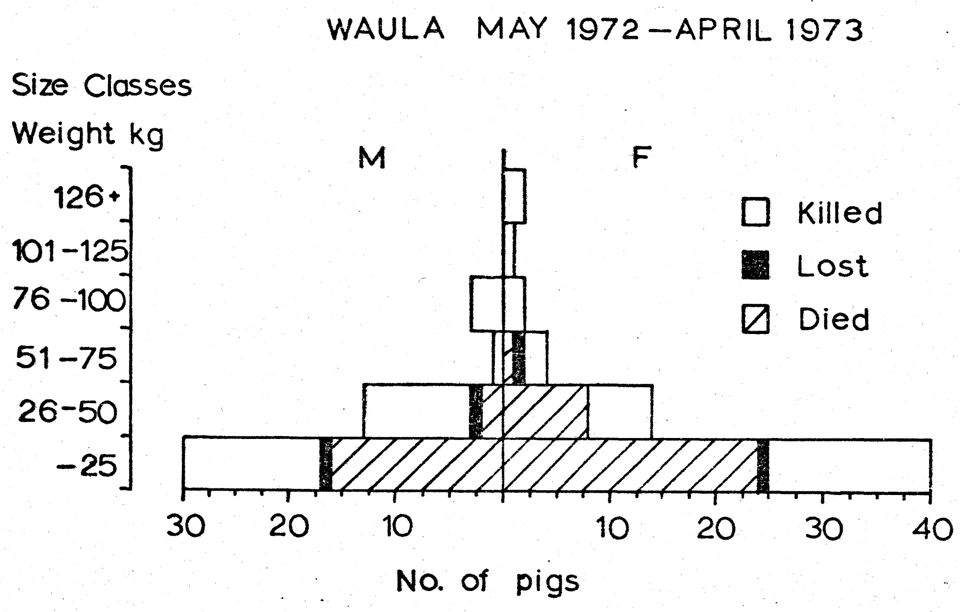

Fig.8.8A Mortality, slaughter, and loss of Waula pigs by number, sex, and size

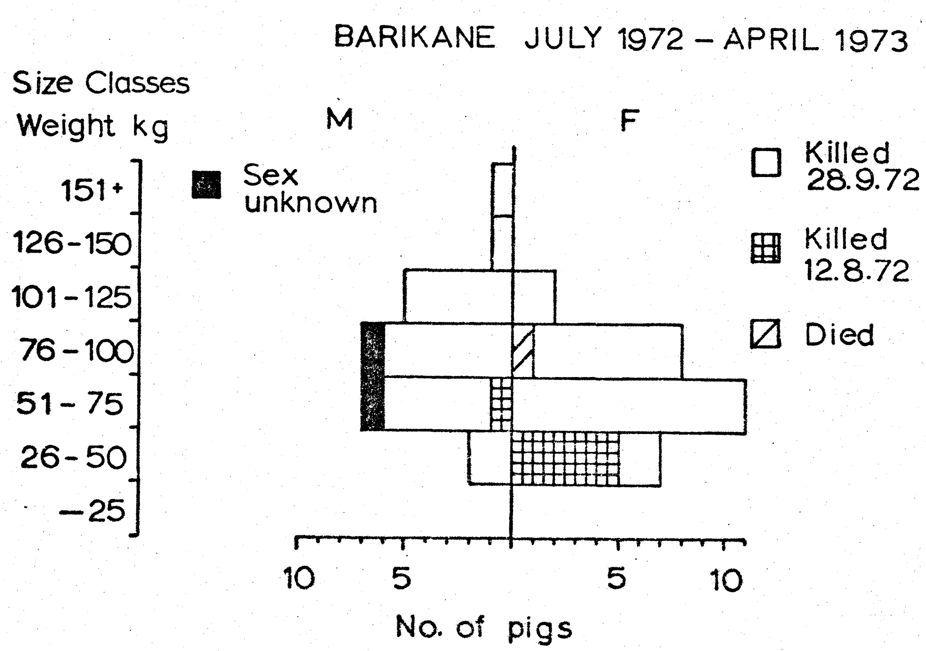

Fig.8.8B Mortality, slaughter, and loss of Barikane pigs by number, sex, and size

vary according to the pig owner's relationship to the person asking the question, and to his or her relationship to others present at the time. In addition, opinions may well differ among members of the same family. For these reasons, and in the absence of any post-mortem examinations, the 'causes' of deaths summarized in Table 8.19 should be taken as simply rough approximations of the kind of conditions which Waula owners regarded as useful in explaining particular deaths to direct questioning from an outsider.

Brief discussion of these conditions may be useful. Mortality directly related to reproduction, both of sows and piglets, is of major significance and clearly recognised by Nimai. A common reason for early weaning, for instance, is to prevent a sow becoming too thin. Nevertheless, in several cases where sows died within a few months of farrowing, owners did not mention this as a specific factor (note the 11 to 3 ratio of females to males in the unknown category, Table 8.19). A common complaint directed at an allegedly lazy spouse or pig-keeper refers to leaving pigs to the mercy of the elements, to be, in fact, "washed by the rain and burnt by the sun". These climatic conditions, not surprisingly, were linked by owners to the wet and dry seasons. Several kinds of sickness, specific to pigs, are distinguished, not all of which are represented in this record. "Shortwind" (in Nimai, miri siri), which is presumably porcine pneumonia, is common. Particular attention is also paid to internal organs, which may harbour 'worms' (den kagil bolere) and hence result in wasting, or, it is believed, suffer from the bites of ants (kikaul), or a centipede-like insect known as gainebare, presumably the same as the Kuman gaimbande. The latter,

TABLE 8.19 Waula pig mortality, by circumstances of death, season, and sex (May 1972 - April 1973)

Circumstances of death	No. of pigs dying May-Nov.	No. of pigs dying Dec.-April	Totals: Sex and Number M	F	unk.	Total	Per Cent	Live weight kg
Reproduction								
Sows[1]	1	1	-	2	-	2		84
Piglets (before or at birth)	9	1	2	4	4	10		5
Piglets (after birth)	3	6	4	3	2	9		12
subtotal	13	8	6	9	6	21	37	101
Climate								
Too wet	-	2	1	1	-	2		5
Too hot	4	-	1	3	-	4		44
subtotal	4	2	2	4	-	6	10	49
Disease								
Diarrhoea	5	-	1	4	-	5		38
'short wind'	4	1	4	1	-	5		81
'black stomach'	-	1	-	1	-	1		8
subtotal	9	2	5	6	-	11	19	127
Accident								
Poor management	1	1	2	-	-	2		13
Other[2]	2	1	-	3	-	3		47
subtotal	3	2	2	3	-	5	9	60
Unknown	7	7	3	11	-	14	25	258
Total	36	21	18	33	6	57	100	595
Live weight kg	310	285						

(1) One during pregnancy, one during birth.

(2) Two broke legs (after falls?), and one was unable to urinate. All were slaughtered.

Nilles notes (nd.:66), has a painful, poisonous, bite. Both are said to cause death. Pigs are also said to die of "swollen throat" (paune yaure), and from "sores" (tori siri) erupting on their skin. The latter complaint is said to have occurred as an epidemic in about 1948-50 (see p. 163). Although I failed to pursue the distinction between these, it is possible that both refer to anthrax. According to Egerton, the clinical signs of porcine anthrax in Papua New Guinea include "...unilateral or bilateral swelling of the throat region... (and) incision into this area shows the presence of a blood tinged gelatinuous oedema..." (1965b:142-3). According to an informant, the carcasses of animals dying in the 1948-50 epidemic were taken to the river, scorched, and then had their skins thoroughly scraped to the underlying flesh. The latter was considered quite edible.

Responses to the death of a pig vary greatly. At one extreme, and particularly if it is only one of a new litter that has died, the fact is simply accepted and no public display is made. At the other, household members may publicly demonstrate their loss, by smearing their faces with white clay and by crying. In the case of one young woman, married for two years but without a child, the death of her favourite piglet caused her to cut off the top joint of her finger. During 1972-73 no pig deaths were followed, to my knowledge, by any public action to discover the identity of a suspected witch. Indeed, in a case described earlier, action taken by the owner was seen by some as intended to divert the attentions of the suspected persons. All pigs which died were eaten. When one small piglet died, its nominal owner, a 10 year old boy, wished to bury it. He was, however, dissuaded by others who told him that the smell of its buried, decaying, flesh would cause other pigs to sicken.

Lost pigs

Four pigs were reported lost by Waula owners (Fig. 8.8A). It is a fair assumption, and one made by their owners, that they were in fact stolen. If so, they were almost certainly killed and eaten with dispatch.[30] Small piglets, however, might be retained. The pigs of other people, preferably belonging to another tribe, but also to other clans of the same tribe, are considered fair, but risky, game. The extent of such rustling, as the numbers indicate, is not great. Indeed, given the density of population and the importance of pigs it would be surprising if it was. It is nevertheless regarded as a constant danger by pig owners. Particularly vulnerable are locations, such as Kuai (Maps 5.1, 6.2) which lie on tribal borders. Here the pig-houses of members of Nimai, Dinga and Tabari are situated in close proximity and, understandably, suspicions are harboured that piglets from new litters, if not larger animals, are surreptitiously taken.

In such circumstances, the failure of an untethered pig to return to its house at night is treated with immediate concern.

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[30] A small monograph could be written on the fine art of pig stealing. Suffice it to note here the care with which circumstantial evidence is hidden. In an autobiographical account of pig theft collected by C. Hide, not only were the leaves in which the stolen pig was cooked thrown into the river, but the cooking stones were covered in ash to hide the traces of pork fat. Finally the children were sent to the river to search for frogs so that their skin would appear white and dull, not shiny with grease as it should after consuming pork.

Extensive searches, often continuing for several days, are made. A common problem, though one that usually only results in temporary loss, is caused by the acquisition of a new adult pig or the movement of pigs from an old to a new pig-house site. Care is taken to acquaint the animals with their new home: usually they are fed a special meal, often including tinned fish, and they may be kept tethered for a few days. If they do stray, search is focused on the route to their former home as they are expected to attempt to return to their old haunts. If a pig constantly strays, it is said that the habit can be cured by dunking it in a stream.

Slaughter and inter-group transfers of pork

The definitive characteristic of a Sinasina pig festival is the synchronised slaughter of many pigs on one occasion. Since the slaughtered pigs are predominantly large, this requires an extended period during which those holding the festival follow co-ordinated strategies of accumulation and production. Information from Barikane indicates the size of pigs attained (Fig. 8.8B). Seven weeks prior to the festival climax, at the ceremony at which Dom children were decorated and displayed before visitors, Barikane killed six smaller pigs averaging 46 kg each. The 45 pigs killed at the final slaughter (September 28, 1972), were considerably larger, averaging 81 kg each.

This pattern stands in marked contrast with that of Waula. Throughout 1972-73, Waula slaughter was neither synchronised nor focused on large pigs (Fig. 8.8A). A total of 55 pigs were slaughtered on 42 separate occasions spread over the whole year (Fig. 8.9), and the average animal killed weighed 33 kg. Twenty households killed only

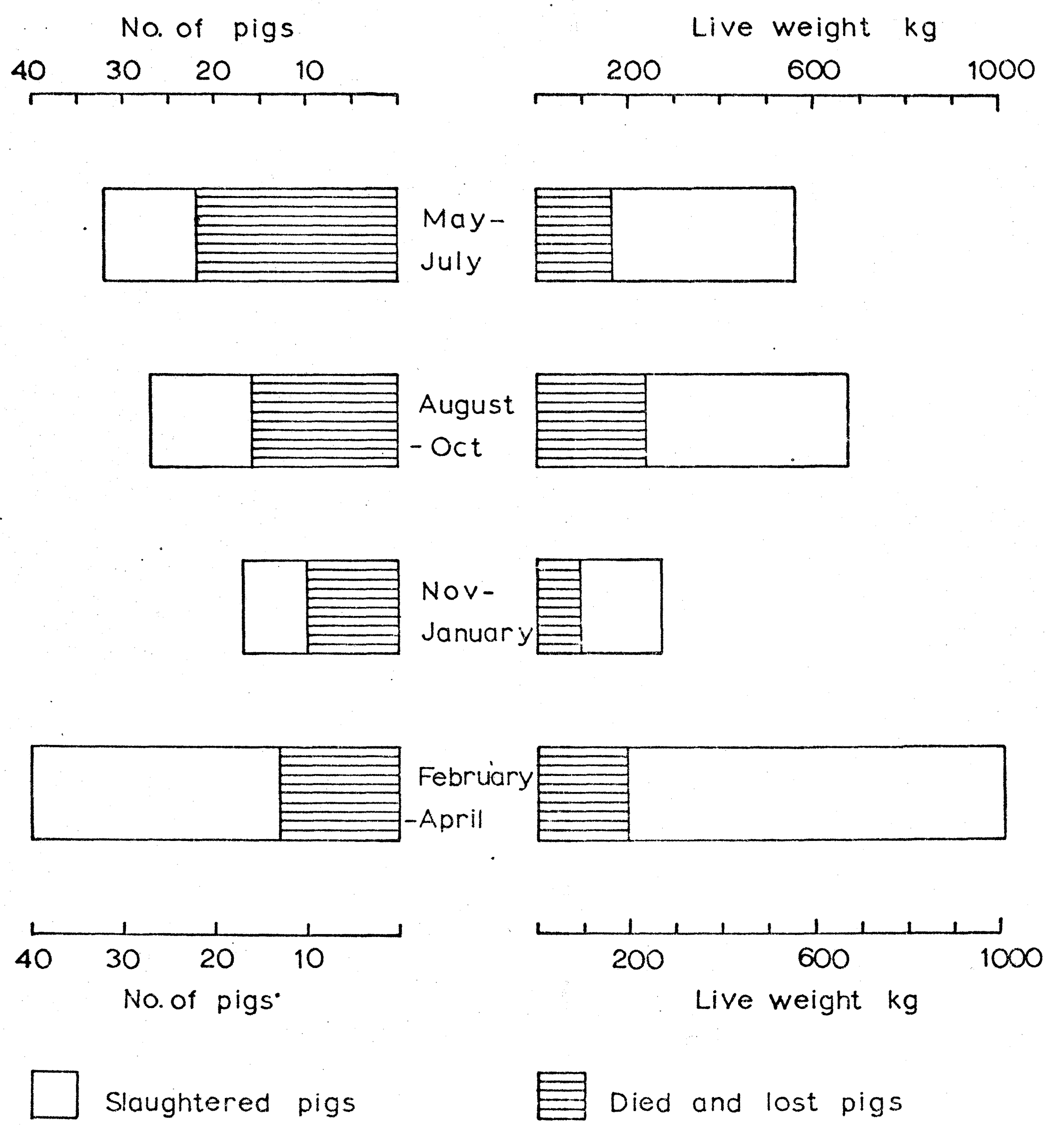

Fig.8.9 Mortality and slaughter of Waula pigs, by quarter

one pig each, seven killed two, four killed three, one killed four, and another five: in all a total of 33 households.

Marriages were the major occasions requiring slaughter by more than one household (Table 8.20). At the two largest marriage events, both return feasts to the groom's group, totals of 7 and 6 pigs were contributed by 6 households on each occasion. In contrast, most other occasions involved only the killing of a single pig by one household. Marriages were also marked by the slaughter of larger animals, averaging 60 kg each, or almost three times the average size (23 kg) of pigs slaughtered on all other occasions. Though numbers are small, exchanges between matrikin were the only other occasions on which large pigs were regularly killed.[31] As described later (p. 528), live pigs transferred at marriages are also usually larger than those moving on other occasions.

Waula killed almost equal numbers of males and females thus showing no tendency to retain females for breeding. Of the 11 pigs killed which weighed over 50 kg, seven were females. Two of these had each farrowed once, one had miscarried, three had never farrowed, and one had an unknown reproductive history. The fact that four of these larger females had not reproduced successfully suggests that they might have been killed after unsuccessful attempts at mating them. This is possible, though unfortunately I did not think to raise this

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[31] As indicated by the size of the standard deviations in Table 8.20, there was considerable variation in the size of animals killed on most occasions. The 'minor social events' for instance included the slaughter of a 84 kg pig for a small group of men who brought back the body of a clan member killed on a Wahgi Valley plantation.

TABLE 8.20 Number and kind of occasions on which Waula slaughtered pigs (May 1972 - April 1973)

Occasion[1]	Number of occasions	Number of pigs killed				Live weight kg			
		M	F	Total	Per Cent	Total	Per Cent	Mean	SD
Marriage[2]	4	4	11	15	27	901	50	60	48
Affinal visits	10	8	2	10	18	279	15	28	23
MB/ZS payments	2	1	2	3	5	158	9	53	26
Minor social event[3]	8	7	2	9	16	201	11	22	26
No specific reason[4]	8	2	6	8	14	113	6	14	22
Involuntary[5]	3	1	2	3	5	98	5	33	11
Sickness[6]	3	2	1	3	5	40	2	13	16
Sale of pork	2	1	1	2	4	26	1	13	11
Cull litter	2	1	1	2	4	4	-	2	0
Totals	42	27	28	55[7]	100	1820	100	33	36

(1) Assignment of a particular slaughter to a discreet occasion is not always straightforward. Wherever possible I have categorized according to the original circumstances, not the recalled use to which the pork was put, e.g. one of the pigs slaughtered after it had been wounded (classified as 'involuntary') was butchered and the pork was partly sold and partly distributed amongst neighbours and relatives.

(2) Three prestations to grooms' groups (14 pigs), one to bride's group.

(3) Includes 2 occasions of dispute settlement, and 1 each of planting new garden, son leaving for coast, baptism, friend visiting, funeral assistance, and ritual to influence exchange partner before going to a pig festival.

(4) 4 or 5 of these pigs were probably killed to cull litters (on basis of size/age of pigs when killed), though their owners did not volunteer this reason.

(5) 2 cases of pigs wounded (and thus subsequently slaughtered) by angry garden owners after garden-invasion, and 1 of pig killed by the owner of a chicken that had been killed by the pig.

(6) Either for consumption by sick person plus household (if pig very small), or for consumption by all the women of a clan, or smaller group, suspected of being "witches" (abalkum), and therefore the cause of the sickness.

(7) Mean weight of males 29 kg (SD 27), females 37 kg (SD 42).

with their owners at the time. Even if this were the case, the killing of almost equal numbers of smaller (less than 50 kg) males and females (23 and 21 respectively) is strong evidence that females receive little or no preference.

The wide variety of slaughter occasions listed in Table 8.20 indicate only roughly the pattern of distribution. A more precise accounting is possible from data in Table 8.21 showing which groups, or locations, consumed, or, to be more precise, since further redistribution is common, received, the major part of each slaughtered pig. The qualification implied by 'major part' is necessary in that varying proportions of slaughtered animals, blood, intestines, head, etc., may be retained for consumption by the owner's household, even though it is said that a pig was killed, cooked, and "given" to so and so. Insufficient information was collected on enough cases to allow any precise estimate of the average proportion retained. The predominance of slaughter for 'export' is marked. Although more than a third of the number of pigs was distributed within Waula, these were small pigs, averaging only 15 kg, and they accounted for only 17 per cent of the total live weight yielded by slaughter (probably less if the dressing percentage improves with size). The 34 pigs distributed outside the clan were larger, averaging 44 kg, and accounted for 83 per cent of the total live weight. Two marriages, by Waula girls with Tabari 2 and Yongamugl, account for the two peaks (16 and 25 per cent of total live weight), in the pattern of extra-clan distribution.

Although the pattern of Waula slaughter, and the distribution of pork yielded by it, during 1972-73 was not co-ordinated or synchronised

TABLE 8.21 Distribution of pigs slaughtered by Waula

(May 1972 - April 1973)

Group/location to which pork distributed	Pigs slaughtered during		TOTALS					
	May-Nov.	Dec.-April	M	F	Total	%	L.W.kg	%
Intra-clan (consumption)	5.5	15	10	10.5	20.5	37	302	17
Market (sale)	1	1	1	1	2	4	26	1
Other Nimai clans	1	2	1	2	3	5	64	3
Other Sinasina groups								
Dinga 2	-	2	2	-	2	4	104	6
Dinga 1	1	-	-	1	1	2	138	8
Kere	1	-	1	-	1	2	49	3
Tabari 1	2	-	-	2	2	4	132	7
Tabari 2	6	-	2	4	6	11	289	16
Dom	-	1	1	-	1	2	11	1
Gunangi	-	1	1	-	1	2	26	1
subtotal	10	4	7	7	14	25	749	41
Other Chimbu areas								
Kuman	0.5	7	2	5.5	7.5	14	462	25
Other provinces								
East. Highlands	1	2	2	1	3	5	42	2
West. Highlands	2	3	4	1	5	9	175	10
subtotal	3	5	6	2	8	14	217	12
TOTALS	21	34	27	28	55	100	1820	100
Live weight kg: totals	910	910						

at the clan level, the same cannot be said of all the pork received during the same period. A complete account of this inward flow, matching the outward one, cannot be given since I did not attempt to record all receipts of pork. Nevertheless, information from the three months of daily records kept on the sample of ten Koge households (p.397), from general observation of such events as marriages, and from interviews with all Waula households concerning pork received from pig festivals held during the year, provides a clear outline of the flow. Waula households not only received intermittent gifts of pork from slaughter occasions similar to those they themselves celebrated, but, over-shadowing these sporadic events, they were also the recipients of a very large quantity of pork from the Dom festival in September 1972.

The significance of pork received from the Dom festival is best seen in comparative perspective. During 1972 three pig festivals were held within eight km of Waula; by the Tabari 2 on 27 August, by the South Dom across the Wahgi on 31 August, and by the Sinasina Dom on 28 September (all dates refer to final slaughter). Waula involvement in the first two festivals was restricted, and not on a corporate basis: that is to say, no close relationships between leaders in segments of the host groups and members of Waula were made the central features of exchanges at the final slaughter. No dance group was organised by Waula to visit either festival. Though many members of Waula visited both festivals, particularly the Tabari one, to watch the dancing, and to attend the final slaughter, they visited as individuals, either as unrelated spectators, or as guests of specific relatives or friends amongst the host groups. Indicative of the extent of their involvement in these two festivals are the relatively small numbers of Waula households which directly received pork gifts from members of South Dom and Tabari (Table 8.22). I term such direct gifts "primary", to distinguish them from all redistributive or "secondary", gifts made by persons with pork (and, to a limited extent, other items, Table 8.23), received directly from the festival. Strictly speaking, one could distinguish also "tertiary" etc. gifts, according to the number of times an item changed hands, but I apply secondary here to all subsequent transfers after an initial, primary, exchange. At the South Dom festival only four Waula households were primary recipients, at Tabari, 28 (6 and 42 per cent respectively, of the total 67 households from which information was collected). The total quantities of pork entering Waula, however, were increased in both cases by similar numbers of secondary gifts: from 18 secondary donors, belonging to five tribes, after the Dom festival, and 21, also belonging to five tribes, after the Tabari one. Most of these secondary donors, as might be expected, belonged to groups living between Waula and the sites of the festivals: nine of the secondary donors after the South Dom festival were members of Sinasina Dom, and, after the Tabari festival, 10 secondary donors belonged to Tabari 1. All such gifts were made to individual Waula households. As Table 8.22 indicates, and Tables 8.24A and B show in detail, a number of Waula recipients, both primary and secondary, made redistributive gifts of cuts of pork[32] to fellow clansmen (some of

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[32]There is no hard and fast distinction between a cut of pork given to a fellow clansman, and the sharing of a piece of meat. When asking Waula about pork distribution, I recorded whatever gifts they

Continued at next page

whom had not received other pork gifts, see notes to Tables 8.24A,B,C) and they also passed on, in further secondary gifts, a certain amount of their pork to relatives and friends belonging to other groups. These transfers, also, were not organised at the clan level, but were arranged and implemented by each participating household.

The character and scale of Waula involvement (and that of the Nimai as a whole), in the Sinasina Dom festival was very different (Tables 8.22, 8.23, 8.24C). In public interaction with Dom at an early ceremony ('the giving of sweet potato') in the festival, on dance visits, and at the final pork exchange, Waula presented themselves, and were regarded as a corporate entity. As Table 8.22 shows, 60 of 67 'households' were primary recipients of gifts from Dom. Each received an average of 4.2 gifts, or nearly three times more than did primary recipients at the earlier Tabari festival. Though there was wide variation around this mean, very few households received less than two primary gifts (Table 8.24C). The day after their return from Dom, Waula assembled at their two main mens' houses (Iremil and Koge) and publicly gave away much of the Dom pork in further external exchanges which equalled in number the total of incoming primary and secondary gifts (Table 8.24C, Map 8.1). In the Koge case, this exchange was preceded by a public accounting, organised by two big-men, of the state of each household's exchange balance with Dom. Information from

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Continued from previous page

mentioned. Some, when recalling that they received no pork gifts, occasionally mentioned that they did however 'eat' some meat (originating from a specific festival) when visiting a friend. I have not included the latter as gifts. In general, the information on redistribution within Waula, where both donors and recipients were interviewed, matches well.

TABLE 8.22 The flow of gifts through Waula after three pig festivals in 1972[1]

Kind of gift[2]	SOUTH DOM			TABARI			SINASINA DOM		
	Donors	Recipients	Gifts	Donors	Recipients	Gifts	Donors	Recipients	Gifts
Gifts from outside Waula									
Primary	2	4	5	24	27	39	141	60	255
Secondary	18	15	18	21	16	22	41	33	51
subtotal	20	19	23	45	37	61	182	65	306
Redistributive gifts within Waula	5	8	8	11	21	23	46	52	130
External gifts made by Waula	6	6	6	20	27	29	67	195	306

[1] Source: Interviews with 67 adult Waula men (assisted in several cases by their wives), 63 of whom were heads of households containing more than one person, and 4 were mature bachelors or widowers either living alone or attached to other households. Interviews were held between December 1972 and March 1973. Not interviewed were 6 young household heads, who were either absent for most of the year, or who only married during the year.

[2] See text.

TABLE 8.23 Contents of gifts passing through Waula after three pig festivals in 1972[1]

Contents of gifts	SOUTH DOM				TABARI				SINASINA DOM			
	Primary	Secondary	Redistributive	External	Primary	Secondary	Redistributive	External	Primary	Secondary	Redistributive	External
Pork only	2	16	7	6	32	22	23	29	176	50	129	275
Pork and live pig	1	-	-	-	-	-	-	-	9	-	-	-
Pork and money	-	1	-	-	2	-	-	-	6	1	3	19
Pork and plumes	1	1	1	-	2	-	-	-	13	-	-	3
Subtotal	4	18	8	6	36	22	23	29	208	51	132	297
Live pig only	-	-	-	-	-	-	-	-	15	-	-	1
Money only	1	-	-	-	1	-	-	-	24	-	4	7
Plumes only	-	-	1	-	2	-	-	-	6	-	1	1
Other	-	-	-	-	-	-	-	-	2	-	-	-
Total gifts	5	18	9	6	39	22	23	29	255	51	137	306

(1) Source: as Table 8.22. For categories of gifts (primary, etc.) see Table 8.22 and text.

TABLE 8.24A Waula participation in exchanges after South Dom festival

Number of gifts	Number of Waula households which: received gifts from outside Waula — Primary	received gifts from outside Waula — Secondary	received gifts from outside Waula — Total	engaged in redistribution within Waula — Gave	engaged in redistribution within Waula — Received	gave gifts outside Waula
4	-	-	-	1	-	-
3	-	-	-	-	-	-
2	1	3	4	1	-	-
1	3	12	15	3	8	6
0	63	52	48	62	59	61
Total households (2)	4	15	19	5	8 (1)	6
Total gifts	5	18	23	9	8	6

(1) Six of which had received no gifts from outside Waula. (2) Which participated.

TABLE 8.24B Waula participation in exchanges after Tabari festival

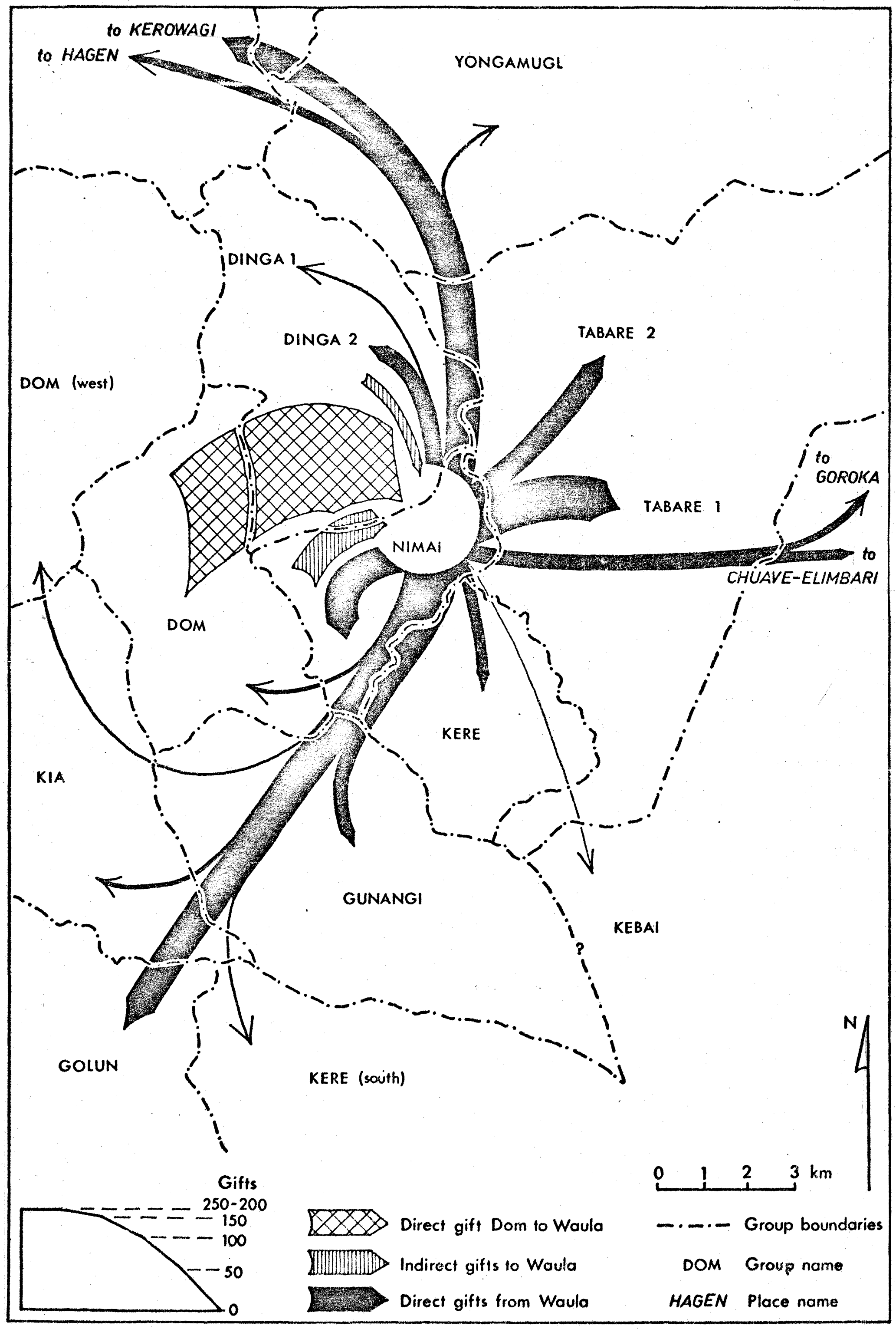
Number of gifts	Number of Waula households which					
	received gifts from outside Waula			engaged in redistribution within Waula		gave gifts outside Waula
	Primary	Secondary	Total	Gave	Received	
10	-	-	-	1	-	-
7	1	-	1	-	-	-
4	-	-	1	-	-	2
3	1	2	2	-	-	-
2	4	2	11	1	2	3
1	21	12	22	9	19	15
0	40	51	30	56	46	47
Total households (2)	27	16	37	11	21[1]	20
Total gifts	39	22	61	21	23	29

[1] Eight of which had received no gifts from outside Waula. [2] Which participated.

TABLE 8.24C Waula participation in exchanges after the Sinasina Dom festival

Number of gifts	Number of Waula households which: received gifts from outside Waula			engaged in redistribution within Waula		gave gifts outside Waula
	Primary	Secondary	Total	Gave	Received	
17	-	-	1	-	-	-
15	-	-	-	-	-	1
13	1	-	-	-	-	1
12	2	-	2	-	1	1
11	2	-	2	1	-	2
10	2	-	3	1	-	2
9	-	-	2	-	-	4
8	1	-	3	-	-	1
7	5	-	3	1	-	6
6	1	-	3	2	1	2
5	3	-	6	5	6	7
4	10	1	8	4	4	5
3	15	4	15	8	5	13
2	9	8	8	8	16	10
1	9	19	9	16	19	12
0	7	35	2	21	15	0
Total households	(2) 60	32	65	46	52 (1)	67
Total gifts	255	51	306	137	130	306

(1) Two of which had received no gifts from outside Waula. (2) Which participated.



Map 8.1 The flow of gifts through Waula following the Dom festival
(Data base: Table 8:25)

TABLE 8.25 Groups or locations to which Waula made secondary external gifts after three pig festivals in 1972

Groups or locations	SOUTH DOM			TABARI			SINASINA DOM		
	Donors	Recipients	Gifts	Donors	Recipients	Gifts	Donors	Recipients	Gifts
Other Nimai clans	1	1	1	7	9	10	22	30	39
Other Sinasina groups									
Dinga 2	-	-	-	2	3	3	15	16	19
Dinga 1	-	-	-	-	-	-	4	3	4
Kere	-	-	-	1	1	1	9	11	13
Tabari 2	3	3	3	1	1	1	36	38	58
Tabari 1	-	-	-	-	-	-	16	9	27
Dom	1	1	1	7	6	7	4	4	5
Gunangi	1	1	1	1	1	1	11	16	17
Kebai	-	-	-	-	-	-	1	1	1
Other	-	-	-	-	-	-	2	2	2
subtotal	5	5	5	11	12	13	53	100	146
Other Chimbu areas									
Chuave/ Elimbari	-	-	-	1	1	1	11	6	13
Kuman	-	-	-	2	2	2	28	15	41
South Wahgi	-	-	-	2	2	2	34	38	51
subtotal	-	-	-	5	5	5	47	59	105
Other provinces									
West.Highlands	-	-	-	1	1	1	6	5	9
East.Highlands	-	-	-	-	-	-	7	1	7
subtotal	-	-	-	1	1	1	13	6	16
Total	6	6	6	20	27	29	67	195	306

later interviews indicates the extent of individual debt (Table 8.26).

TABLE 8.26 Status of primary and secondary gifts received by Waula from Sinasina Dom festival

Status of gift	Primary gifts		Secondary gifts	
	No.	Per cent	No.	Per cent
Returning previous gift	125	49	11	22
New gift	84	33	11	22
Return and new	23	9	2	4
Unknown	23	9	27	53
Totals	255	100	51	100

Following the prestations a meeting was held at which the debt was collectively recognised, plans for returning the pork considered, and the date of their own next festival discussed. The major speech was made by the Waula councillor, and is summarized below.

> He started with a lecture on the necessity for careful disposal of certain personal leavings and old female clothing to prevent pigs from eating such stuff and dying, because, he said "we have just received much pork from our friends (i.e. Dom). Dugul and Bomai are large groups and we are only small but we do have a 'name', and Dom, when they gave out pork, did not think only of Dugul and Bomai, they also gave to us, Ogole-Waula (linking Waula with the fourth, small, Nimai clan), and now we have redistributed it to all our friends". He urged people not to wander around, visiting friends and relatives, and playing cards, "you must stay at home, look after your small pigs, and cook food for them both morning and evening." If they didn't do this, then later, "when we want to do something (i.e. hold a festival), it will go wrong. We will have forgotten about all those who have given us pork and won't be able to return it. Then we will have done a great wrong." He reminded them of the tribes which had either just killed (Tabari 2, Dom) or which would kill in the next year or so (Dinga 1, Tabari 1, and Kere), and said that the pork they had received from Dom was "enough". "I don't want you to go and dance at Tabari, I don't want you to exchange tobacco and smoke with them (i.e. make friends with). I think it's better if we stay here. We've received a lot of pork from Dom, and we mustn't try to get more from Tabari 1." He warned

them not to get into trouble which might lead to fights and deaths requiring compensation payments, "we must think of our friends who have given us pork and not let such troubles interfere with our return gifts." He urged them to obtain more pigs, and "if a friend of yours should kill a big pig for you (i.e. during this interceremonial period), then only kill a small one in return. If your friend balks at this and says 'I killed a big one for you," tell him you haven't got any big pigs, and that you're giving him all you've got." He said he was talking to them like this in order that they should know what he had in mind when there was a big meeting with representatives from all the Nimai clans. He lectured the young single men on the need to help their older married brothers and fathers, but asked everyone to remember their own debts individually, not those of their brother or father, and to work towards repaying them. He ordered the women who might be witches (abalkum) not to eat the stomachs of pigs and children and thus prevent them growing but to go outside the settlements and eat faeces instead. The flesh of children and men was 'sour', anyhow, and not good for eating. He told the men to get rid of their wives if they didn't look after the pigs properly. He concluded on a rhetorical note, asking them if, on their way to Dom and back, they'd noticed the size of the Dugul pigs, "Big, eh? and what if they say 'we want to hold the festival now.' "What will we do?" After a brief flurry of public criticism of certain individuals, the timing of the next festival was discussed, as follows.

A.(Councillor) "...I'm thinking of 4 more years,[33] in the 5th year we'll return the pork. 3 years from now I'll go round and look at your houses (i.e. to look at pigs; possibly also a reference to the fact that new houses are built prior to a festival)."

B.(another bigman) "Leave out this year, start counting from next year..."

A.(interrupting) "Yes, not counting this year. Next year in the 11th moon I'll go round all your houses, and every year after that I'll do the same..."

B."When you go to the big meeting (i.e. involving the whole tribe), mark 4 years more."

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[33]In this instance he used the pidgin phrase foa yia. In the following sentences he and B used yia and krismas interchangeably. Actual dates ('73 etc.) were used, with the years counted off on fingers. Months were also in pidgin. Sinasina traditionally reckoned time by the movement of the sun along the Porol range, and I collected a fragmentary calendar of named 'months' (cf. Bowers' table of 3 Western Highland calendars, 1968:28). The sun's movements are still sometimes referred to by old people, but not the calendar.

A."Yes, not counting this year, starting in '73, I'll go round in '73, and then in '74, and again in '75, and then in '76 we'll have another meeting.

B."In '76, you must all start work on new gardens."

A."In the 5th moon of '76, we'll talk and start blowing the flutes. In the 9th moon, that's the time for killing the pigs and we'll hold the festival. All you old people have got friends too, and it wouldn't do to wait any longer because some of you might die, and then we'll be left to return your debts as well as ours."

B."When you go to the big meeting, however many years Dugul and Bomai want, you tell them we want 4 more. Whether they listen to this or not, that's the time we should mark."

A."When the council was trying to decide how much tax should be paid, you (Waula) said it should be $8.00. Everyone heard this and the council marked the tax at $8.00. It wasn't just the big groups, all you small groups have got a voice, and it was heard. You say 4 years more, and in the 5th year kill the pigs. Now, however many years Dugul and Bomai say, we'll all listen, and then we can vote on it, and whichever wins, then we'll know. If you've got any money, don't go and buy pigs that are too small. Buy medium-sized ones, ones with long legs, they're the ones to get. First go and count the pigs you've got, 'this one for returning a debt, this one for a bride price, this one for killing and eating', count them all off to be sure where you stand....O.K., the meeting's finished. Listen out for Dugul and Bomai, and whatever day they mark for the big meeting, go and mark 4 years more...we'll work for 4 years, and in the 5th we'll return the pork. If any of you go to the meeting, that's our decision." (T/RH 72 8B)

The organization of the pork and pig prestations sketched summarily in the preceding paragraphs will be examined at another time. All that requires emphasising here is the size of the debt and its obvious consequences for production strategies.

Pork consumption

The figures of pig mortality, loss and slaughter reported here for the small population of Waula would appear to contradict the findings of a number of nutritional studies conducted in the Chimbu area, all of which conclude that slaughter is infrequent, and daily per capita consumption of pork very low.

Writing of Sinasina (Yobakogl in Tabari) in 1956-7, Venkatachalam described pigs as not regularly used as food, stressing instead that they

> "are an indicator of wealth and are slaughtered only on important occasions, normally two or three times a year. On such occasions the meat is distributed among a large number of people and the individual share is small. In addition to these small feasts, there are gatherings known as 'sing-sings' (i.e. pig festivals, RH) which take place at intervals of a few years, when thousands of pigs are killed in the course of a week but the last of the meat is not eaten until some weeks later" (1962:5, cf. Ivinskis et al. 1956:46).

How did Venkatachalam reach his conclusion about the frequency of the smaller events? His nutritional investigation of 13 families found that, during the 6 days covered by the study, half of the 52 people investigated ate pork slaughtered at a marriage, resulting in an average 18.7 g pork consumed per person per day for the whole sample (ibid., calculated from Tables 3, 4 and 5 on pp. 8-9). "On questioning," reports Venkatachalam, "it was found that the last occasion when pigs were killed was five months previously" (ibid., 7), presumably the source of his estimate of small-scale slaughter occurring two to three times a year. This is clearly a problematic estimate. Nine pigs were killed at the marriage in question (five by the bride's group at Yobakogl and four by the groom's from Dinga): did the Yobakogl respondents mean that it was five months since a similar kind of slaughter, either a marriage or similarly significant social occasion, had occurred, or since any slaughter had taken place? Further, to what unit of analysis does Venkatachalam's two or three times a year apply: the "village"(ibid., 7), or the group of 13 families (ibid., 7), or a single family, as implied earlier (ibid., 5)?

It makes a great deal of difference which is meant, since the "village" of '13 families' would suggest that people consume pork only two or three times a year, while the 'family', if scheduling is regular, could, in a collection of 13 families, mean as often as once a fortnight.

Later studies have not clarified the situation. Bailey, for instance, while following Venkatachalam's distinction between very infrequent pig festivals, and more frequent small festivals, describes the latter as occurring "...every few weeks, months, or years in relation to family events (birth, puberty, marriage, sickness, death) or religious occasions (especially Christmas)" (1963:6). Again the slaughter frequency is not related to a specific unit of analysis (social grouping), either in terms of slaughter, or pork distribution. However, Bailey's nutritional studies, carried out by Whiteman, revealed extremely low per capita daily figures of pork consumption (0-3 g for a sample of 32 persons in 10 families, with consumption weighed on "about 5 non-consecutive days for each member of the family individually" (Bailey and Whiteman, 1963:377,380). In the most recent Sinasina survey, Lambert's re-study at Yobakogl, in February-March 1975 (Lambert 1976:37), no pork was reported consumed (by a sample of 78 persons belonging to 13 families surveyed for 6 consecutive days, Lambert (1975:5) and the "...last occasion on which pork had been consumed in the village...was 3 months previously at Christmas when several hundred pigs were killed at a big 'sing-sing' (ibid., 13). If the latter event was the Tabari 1 pig festival, as seems likely, the survey therefore caught Yobakogl very soon after the majority of their pigs had been killed, and the lack of pork is not surprising.

The only study, not a nutritional one, suggesting a higher rate of pork consumption is that of the less densely populated Siane by Salisbury in 1952-53 (1962). Salisbury estimated that a Siane clan-village, with a total population of 200 (ibid., 12), received about 100 pigs annually, each yielding 112 lbs (50.8 kg) of pork (ibid., 80), thus providing 70 g of meat/per capita/per diem. Though he emphasised that consumption was highly sporadic, it is difficult to square this comparatively huge figure with those resulting from the nutritional studies. To make his estimate Salisbury combined a total of 37 pigs from minor social exchanges (15 from 3 weddings, 10 from 5 funerals, 5 from other rites of passage, 3 from peace-makings, and 4 from sickness-curing ceremonies) which he counted entering one village during a year, with an estimated 60 pigs per year received from Pig Festivals, assuming that each village kills c.150-200 every third year at a Festival, and receives over the intervening years about the number of pigs it kills (ibid., 80). It may be noted that such an estimate assumes an annual average slaughter rate of c.100 mature pigs of about 72 kg live weight (assuming that Salisbury's 50.8 kg estimate of meat per pig represents a dressing percentage of 70), by every 200 Siane persons (or 25.4 kg of pork per person annually). By 'average', I mean that production is being 'smoothed' over all Siane. The average village, given a three year cycle between Festivals, and a total of 180 mature pigs slaughtered at the end of the cycle, would also have to slaughter 120 mature pigs in the 36 months between festivals, or an average of 40 a year. Given standing crops of the size indicated by Salisbury (ibid., 92-93), and in the light of growth rates described earlier (p. 473), I consider such a level of production unlikely.

The Waula data allow estimates of the availability of pork for consumption by clan members during 1972-73. A minimum estimate might include only those pigs which died (Table 8.19), and those which were slaughtered and consumed within the clan (Table 8.20), giving a total of 77 pigs with a combined live weight of 892 kg. It is difficult to convert the latter gross quantity into even a meat per capita figure because the dressing percentage of such small pigs is not known. If 70 per cent is assumed (cf. Malynicz 1973b:25; 73-75 per cent for 3.3 month old pigs weighing 20-24 kg), these pigs provided 624 kg of meat, which, for a population of 250 residents for the year, gives 6.8 g per capita daily.[34] Meat from these sources was obtained throughout the year, though with considerable irregularity (Fig. 8.9, Table 8.21). Further, the small average size of the animals involved suggests that the pork from each animal would not have been widely distributed. Nevertheless these figures indicate that the early statement by Ivinskis _et al_. that "(t)he pig contributes little to the nutrition of the natives...Sometimes a pig is killed for food or if a pig dies it is eaten, but these events are so infrequent that they can be disregarded as a source of protein" (1956:146), needs qualification, at least for the early 1970s, and for groups at early

[34] Assuming 95 per cent digestibility, and protein as 18 per cent of meat (Dornstreich and Morren 1974:7), this converts to 1.2 g of protein/per capita/per diem.

cyclical stages when a considerable proportion of the pig population is young. Further, this minimum estimate does not include any pork received from exchanges with members of other clans. Beyond surveying particular receipts from such major events as pig festivals, and recording the occurrence of pork consumption by Koge sample households over three months (Chapter 7), I made no attempt to investigate this inward flow of pork in quantitative terms. However, an estimate can be made, if it is assumed that the outflow from Waula during the year (35 pigs, combined live weight 1518 kg, Table 8.21), was roughly equivalent to the quantity received (excluding pork from pig festivals). Using the conversion factors for the minimum estimate, this live weight quantity converts to 11.6 g of meat/per capita/per diem (or 2 g of protein). With the addition of the minimum figure, estimates of about 18 g of meat (or 3 g of protein)/per capita/per day are therefore obtained. Calculations in Chapter 7 indicated that households consumed pork, on average, once a fortnight. Assuming an average of four persons per household, the amount of pork "consumed" by each household was therefore approximately 1 kg of pork per fortnight.

How reasonable is this estimate in relation to Waula pig production? The total live weight of Waula's dead and slaughtered pigs was 2410 kg, which constitutes 33 per cent of the average total live weight (7357 kg, average of 3 censuses, Table 8.1) of the Waula pig population in 1972/73. A 33 per cent 'yield' seems reasonable in terms of estimates of the growth rates described earlier. For instance, the average-sized pig in May 1972 was 30 kg. Over the next 12 months, male pigs in the size class 26-50 kg gained an estimated 14.4 kg and females 7.2 kg, giving (Table 8.17) an average gain of 10.8 kg, or 36 per cent, on their original 30 kg.

Circulation of live pigs in gift-exchange and trade

Although large-scale, co-ordinated, transfers of live pigs between groups are not part of institutionalised exchange sequences in Sinasina, as they are in the Te and the Moka systems of the Western Highlands (Meggitt 1972, 1974; Strathern 1971), live animals nonetheless move constantly across group boundaries in both trade and gift exchange. Evidence of the extent of these flows has been given earlier. Fifty per cent of Waula's May 1972 population had been produced elsewhere, and, during 1972-73, Waula acquired and disposed of live pigs at rates of 0.3 and 0.2 pigs per capita respectively (Tables 8.5, 8.8A). The Barikane figures were similarly high: 70 per cent of pigs owned in July 1972 produced elsewhere, and acquisition and disposal rates of 0.3 and 0.4.

Trade

Of the two kinds of transfer, trade is quantitatively less important. Over 12 months, members of Waula only bought 14 and sold 13 pigs, whereas they received and gave in gift exchange 67 and 36 animals respectively. The Barikane figures show a similar imbalance, though their purchases were twice as numerous as their sales (Table 8.8, Fig. 8.10B). Traded pigs are not only fewer in number, they are also smaller than those transferred by gift exchange. Pigs traded by Waula weighed an average 15 to 17 kg less than those exchanged, those traded by Barikane 14 to 26 kg less (Table 8.8,

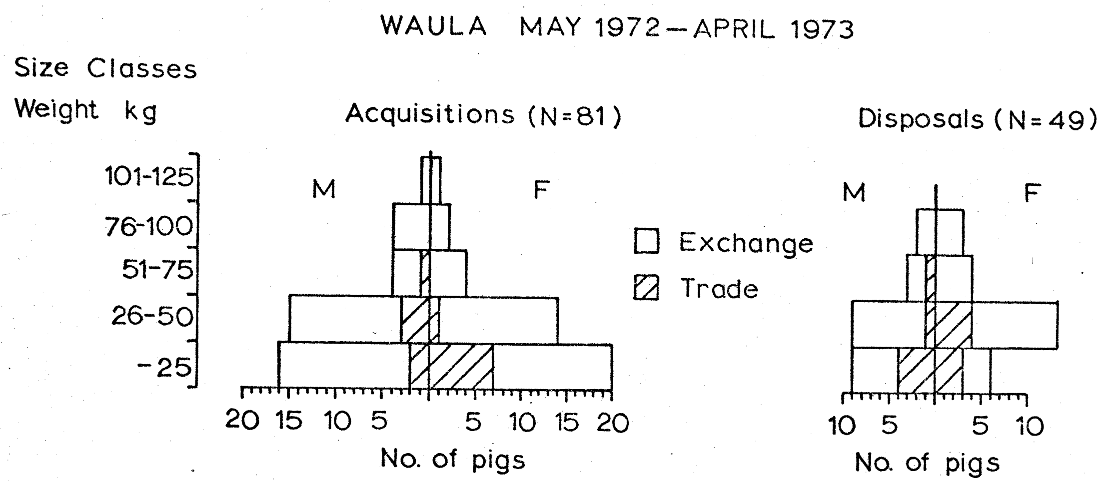

Fig.8.10A Acquisition and disposal of live pigs through gift exchange and trade, Waula : by number, sex, and size

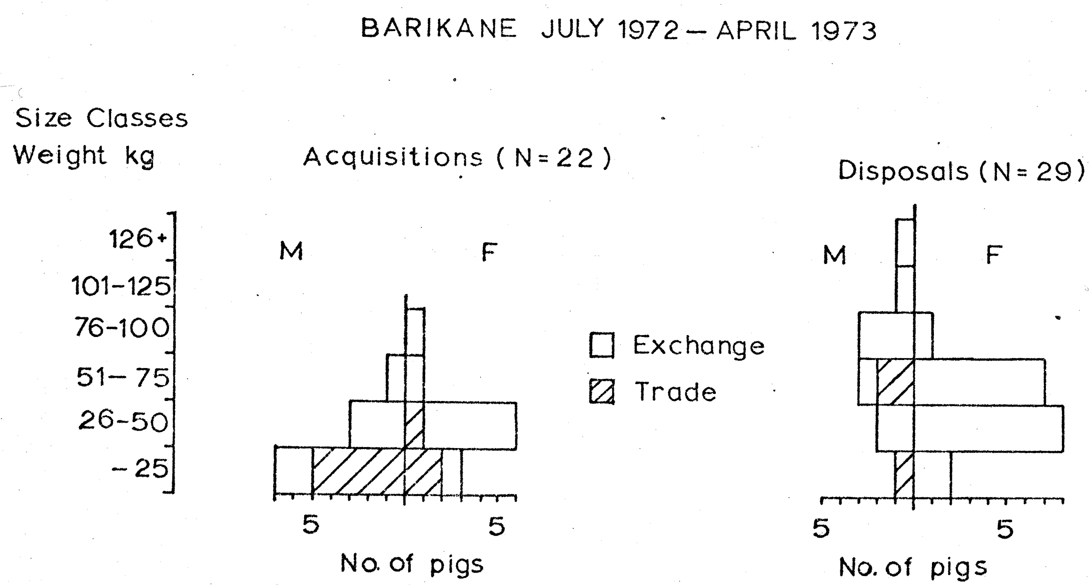

Fig.8.10B Acquisitions and disposals of live pigs through gift exchange and trade, Barikane : by number, sex, and size

Fig. 8.10A).[35]

There is no evidence for a significant preference for females in trade, as might be expected if the acquisition of breeding stock was a major objective (cf. Meggitt 1958:288). In the case of Waula, females constituted 55 per cent of pigs (n=51) acquired by trade before, and still present at, May 1972 (Table 8.6A), and similar percentages of the pigs acquired, and disposed of, through trade in the following 12 months (respectively 57 and 54 per cent, Tables 8.36A,B). Of 20 Barikane pigs acquired by trade, and present in July 1972, females also formed 55 per cent (Table 8.6B), though the small number of intercensal movements through trade over the following nine months (n=11) show an imbalance in favour of males (73 per cent). If the latter movements are discounted, all these figures are close to the overall distribution of females in the two populations generally (56 to 58 per cent), and at birth (53 per cent, Table 8.15).

Ideally, pigs, especially mature ones, are destined for slaughter and eating. The Waula councillor, in a public address, drew an explicit contrast between coffee, which is produced only for money, and pigs, which, he said, "are not for buying things like clothes or for paying taxes, but for eating". Although assertion in such a context suggests that the distinction is felt by some to be threatened, it was nonetheless generally valid in 1971-73. As

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[35]Compare Harding on Siassi overseas canoe trade: "Generally, the animals are under one year of age, because not only are they cheaper, but they are easier to transport and are more likely to survive long trips" (1967:35). In Sinasina cost is perhaps a more important factor.

indicated by the low volume of trade and the small size of traded pigs (Fig. 8.10), sale is not seen as a primary aim of production. Further, trading is not restricted to a few specialist households. The 51 traded pigs owned by Waula in May 1972, for instance, had been purchased by 31 households. Only one household had bought as many as four pigs; three had bought three, 11 two, and 16 one pig each. Similarly, the sales and purchases during 1972-73 of 13 and 14 pigs involved 11 and 10 households respectively. These transactions added a further eight households to the 31 trading before May 1972.

Money and plumes are the main items for which pigs are traded (Table 8.27). Although there is a general, continuous, demand for

TABLE 8.27 Media of exchange in pig trade

	Number of pigs traded for				
	Money only	Money+ plumes	Plumes only	Other and incomplete	Totals
Waula					
Bought before May 1972	30	4	15	2	51
Bought 1972-73	12	-	2	-	14
Sold 1972-73	10	1	2	-	13
Total	52	5	19	2	78
Barikane					
Bought before July 1972	8	-	7	5	20
Bought 1972-73	4	-	4	-	8
Sold 1972-73	3	-	-	-	3
Total	15	-	11	5	31

money within Sinasina, specific demand for relatively large lump sums is either calendrically regular for such outlays as tax and high school fees, or, in the case of bride payments, compensation payments, and fines, sporadic. Money-pig transactions tend to be closely related to a pig seller's pressing needs for cash. Plume-pig transactions, on the other hand, tend to have a different periodicity, which is partly regulated by pig festivals. I discuss money transactions first.

Analysis of the total of 67 (Waula and Barikane) pigs traded for money shows that sex appears to influence price as little as it affects the number of animals traded (Table 8.28).[36] The low average price of $20 reflects the small average size of pigs traded for money. The distribution of prices, however, reveals marked 'bumps' at $10 and $20 (30 and 21 per cent respectively of transactions), which suggest both a 'customary' size of pig for trade, and relatively fixed prices, at least in the short-term (Fig. 8.11). Prices paid for pigs of known size correlate well with size for a small sample (Fig. 8.12). Despite incomplete information on the circumstances of sales, emergency cash needs seem to have loomed large. Stated reasons for the sale of six Waula pigs included impending tax collection, assistance to a friend for a court fine, the accidental death of a brother (requiring payment for those who had brought his body home), and absence of other income (a clan member who had recently returned from 15 years residence in another group and lacked coffee). In another case a son sold, without permission, one of his father's pigs to raise funds for travel to the

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[36]Unlike Siassi where "(f)emales are more high valued than males (except for boars with curved tusks)" (Harding 1967:35).

TABLE 8.28 Average cash payments in pig trade, by sex, group, and time period

Group and Period (1)	Number of pigs and size of payments								
	Males			Females			Totals		
	No.	$	Mean	No.	$	Mean	No.	$	Mean
Waula									
Bought before May 1972	15	253	16.9	15	287	19.1	30	540	18.0
Bought 1972-73	5	168	33.6	7	112	16.0	12	180	23.3
Sold 1972-73	5	100	20.0	5	174	34.8	10	274	27.4
subtotal	25	521	20.8	27	573	21.2	52	1094	21.0
Barikane									
Bought before July 1972	5	71	14.2	3	35	11.7	8	106	13.2
Bought 1972-73	2	46	23.0	2	16	8.0	4	62	15.5
Sold 1972-73	3	130	43.3	-	-	-	3	130	43.3
subtotal	10	247	24.7	5	51	10.2	15	298	19.9
TOTALS	35	768	21.9	32	624	19.5	67	1392	20.8

(1) Pigs bought before May or July 1972 refer only to those owned at the first census; 1972-73 refers to 12 months for Waula, 9 months for Barikane.

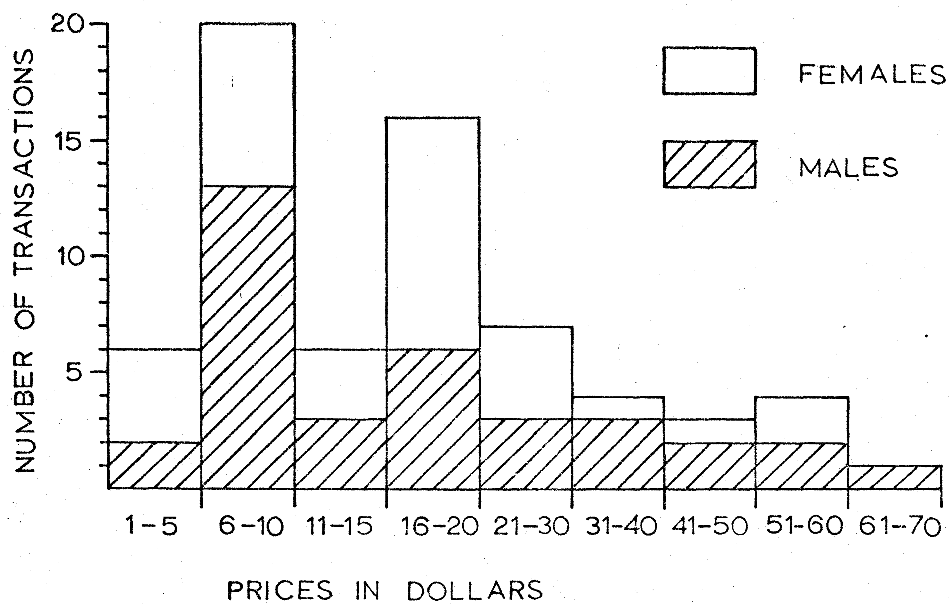

Fig.8.11 Frequency distribution of cash prices paid for pigs

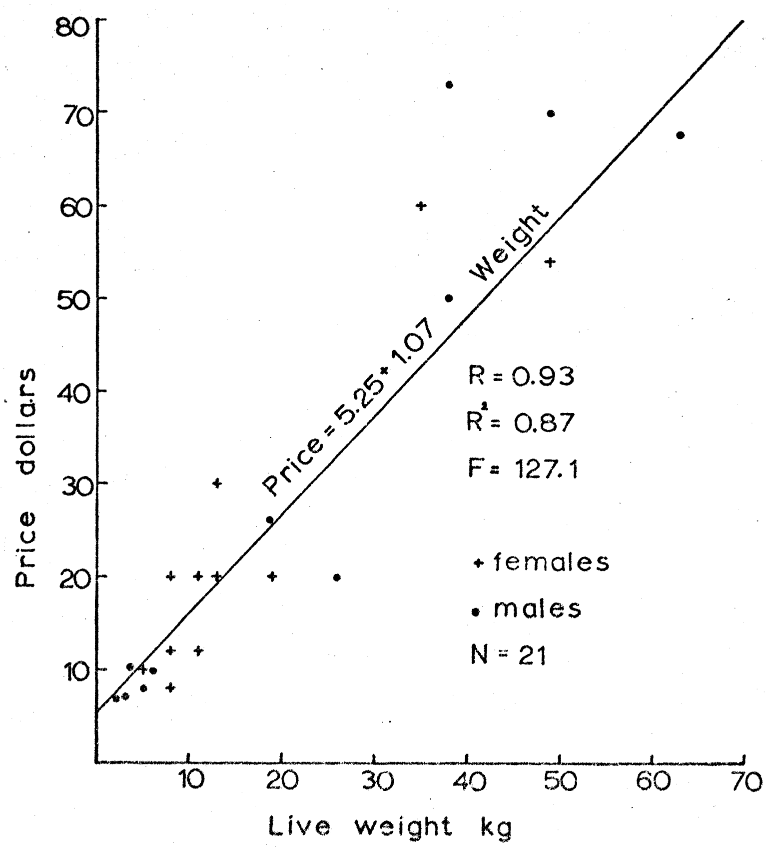

Fig.8.12 Relationship between price and pig size

coast. Although his father and elder brother traced the animal, and the son was stopped on the Highway before finding transport, the sale was not dissolved. All three Barikane sales were said to be explicitly for the purpose of raising money for a death compensation. Sales, in short, often occur under forced conditions. Larger pigs are, usually, priced too high to be within the reach of most individuals and it was noticeable that the two most expensive pigs bought by Waula ($60 and $70), were purchased by two men with regular, though small, cash incomes (a councillor and an assistant store-keeper). The emergency nature of cash sales, and the very modest total volume of pig trade for money, indicate the absence of a regular market for live animals. With cash transactions it is generally the seller who makes the first move in offering an animal for sale. During the last few years the twice-weekly market at Koge has offered a convenient location for prospective sellers but their appearance is still not common. Alternatively, pigs may be led around neighbouring settlements in search of a buyer, or simple word of mouth may be effective. The sporadic appearance of pigs for sale results in a situation of opportunistic buying, as shown by the following case.

> After harvesting sweet potatoes from a garden near the Nimai-Tabari border, a woman (A) met her husband's mother's sister (B), a resident of Tabari where tubers were then short. A gave B the tubers and visited her settlement for the night. The next morning she was given $2 and some bananas and corn to take home with her. Crossing the Highlands Highway she met a traveller from the Western Highlands who asked if he could buy some of her food. She sold him 40 cents worth. Reaching Koge, she saw some people carrying piglets which had just been sold by someone to raise cash to return some stolen money. In reply to her question whether any piglets remained, she was told that all the ones for $4 had been sold but that there were still some for $2. And so, "I left my <u>bilum</u> of corn on the road - I just held my $2 and ran. I asked the wife of the pig owner and she said that all the piglets had been sold and taken away except one male and one

female which she wanted to keep herself. But, after a while, she said, 'I'll just keep the male one. My child is nearly grown up...If anyone brings me $2 they can have the female.' So I gave her my $2 and took the piglet...(At home) I said to my husband, 'I went to see your mother's sister. She had many pigs and wanted to kill one for me. But I saw that the pig's hair was good and so I told her that I wanted to look after it. He said, 'You've done a good thing.' I spent 20 of the 40 cents on tinned fish...and I cooked sweet potatoes and fed them to the pig with the tinned fish. The pig grew large and I called her 'One Pound'".

This incident occurred in the early 1960s. While similar conditions continued in Sinasina during 1972-73, more modern offers for sale were noted in the vicinity of Kundiawa in late 1975. One well-known entrepreneur from Naregu was using the provincial radio station to announce the sale of a large pig from his piggery, and at the Kamanuku pig festival, a handwritten advertisement tacked over the front of a trade store declared:

> "Dear ol wantok. Mi tok save long mi salem onepela pik. Usat man meri laik baim mas kam long Kundiawa. Pai belong pik K(ina) 20.50 Kena. By Mondo Ombo, Village Gon."[37]

Pig trading for plumes, I suggested, is partly regulated by pig festivals. This may be illustrated by a simple model. As a group holding a festival enters the final year of preparations it requires both plumes and pigs. Demand for plumes peaks first, however, since they are needed for dancing regalia by the host group which dances before being visited by guest dancing groups. Thus plumes, acquired through loans, gifts, and trade, flow into a host group up to the time that its own members dance. Some pigs will be expended on such trade.

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[37] Dear friends, I announce that I have a pig for sale. Any man or woman who wants to buy it should come to Kundiawa. The price of the pig is Kina 20.50.

Upon completion of host group dancing, several weeks or months before the final slaughter, some plumes then become available for last-minute pig acquisition. At this time too, demand for plumes among guest dancing groups is high. Some time before the final slaughter, therefore, the inward flow of plumes is halted and probably reversed. At the final slaughter the distribution of pork is accompanied by plume gifts, and the reverse, or outward, flow of plumes becomes heavy. Some, however, are retained and these provide the basis for plume-pig trade by means of which pig numbers are partially rebuilt in the post-festival stage of a cycle.

This outline model fits the Waula and Barikane data reasonably well. In the case of Waula, 19 of the 51 traded pigs owned two and a half years after their 1969 festival had been traded either for plumes alone, or for plumes with some money (Table 8.27). Fourteen of these pigs, however, had come from one source area, the Elimbari region to the east of Sinasina (Table 8.31), a clustering I did not perceive until analysis after leaving Sinasina. In response to a letter of inquiry, Michael Aure, a member of Waula attending the Bomana Seminary, replied:

> "Why did a lot of pigs come from Elimbari? As my father and others here told me, and from my own knowledge, the Elimbari people need plumes and other ornaments when they were about to have their pig kill (bona ege). Those who lacked decorations sell some of their pigs for plumes of birds of paradise. Normally they hire a truck and take their pigs to Koge and other places to exchange for such plumes as mile, kale and kawale[38] etc. Similarly, when our people hear that Elimbari are preparing for their pig kill they ready ornaments. Sometimes, but not always, it works the other way round. When any of our fellows is really in need of a pig he goes

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[38]Respectively, Princess Stephanie's Bird of Paradise, 'lories' and 'parrots' (see Table 8.29).

to the place where they are having a pig kill. But the regular practice is for the Elimbari people to bring their pigs here, that is, if the pigs are not too big. If an Elimbari man wanted to sell a large pig he has the description and measurement[39] with him, and tells our people that he has a pig of such and such size at home and wants to sell it for such and such things. Usually he would pick a pig of similar size around Koge and point it out to an interested Nimai man. If the Nimai man agrees, and the Elimbari man accepts the feathers or other ornaments offered, they would both go to Elimbari and the Nimai man receives the pig. In such exchanges, pigs should be healthy and plumes new or undamaged, but, according to the condition of the pigs and the plumes, so the business runs" (Michael Aure, pers. comm. December 1973).

This raises some interesting questions, which, since the pattern was not obvious to me during field research, I cannot answer. Was this relationship between central Sinasina and Elimbari institutionalised before the colonial period? It will be noted that it differs somewhat from Nilles' account of 'proto-markets' in the upper Chimbu valley where, according to the Denglamaglu

> "...when their pigs have increased rapidly, and the next feast (i.e. festival) is still distant, they invite the Gende people to come over for a barter day. Once only did I see such a market day. Pigs were given in exchange for goldlip shells and axes, and small pigs for tambu and cowry shells" (1944:12; cf. Hughes 1977:206-7).

Granted the Nimai claim that most plumes in pre-colonial days came to them from the south and west, and also that, by comparison with most Elimbari groups they were closer to sources of stone and salt, it would seem probable that the relationship is not recent. Given Elimbari access to forest, and thus plumes, on the Wahgi Divide, it seems

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[39] See Bergmann: "Measuring a pig with a string was well known, mostly in cases where they wanted to trade in a pig, or if the man to whom it was traded claimed it was not big enough, and the one he gave was as big as the string indicated. Or if there were several pigs and each one claimed his pig (was) bigger than those of the others" (1971, Vol.2, p.206).

doubtful that the major item sought by Elimbari in the past was plumes from the west. However, information cited by Healey (1977:61-2) indicates that in the colonial period, at least, the Siane and Dene people of the Elimbari region have been primarily plume importers from a wide range of areas. There is also the possibility of some recent export, perhaps westward into Chimbu.

The outline model also fits the very small volume of plume-pig trade conducted during 1972-73 by Waula. The two pigs purchased for plumes during this period came from Tabari (at Yobakogl) and Kere, whose co-ordinated festival was scheduled for 1974-75 and held, I believe, in late 1974. In other words, by comparison with Nimai, they were entering a period of plume accumulation. In contrast, the three pigs sold for plumes went to Tabari (at Womai), Dom south of the Wahgi, and Dom in Sinasina. All three of these groups held festivals during 1972. In the Tabari and south Dom cases, both Waula pig sellers said that the reason they sold was to acquire plumes for dancing at the Dom (Sinasina) festival. In both cases, however, trade was initiated by those offering the plumes who, on the evidence of the dates on which trading occurred, sought pigs for slaughter (or gift) in the final phases of their festivals. Pigs may sometimes be offered first. In August 1972, a man of Nimai Ogole clan was seen leading two pigs northward to Tabari seeking (unsuccessfully in this case) to exchange them for plumes. His asking prices seemed high: eight *Astrapia stephaniae* for a 42 kg female, and three of the same plumes for a 23 kg male.

Information on the kind of plumes used in pig trading is summarised in Table 8.29. Numerically, long black tails, parrots and lories are

TABLE 8.29 Plumes in pig trade [1]

	WAULA	BARIKANE
No. and sex of pigs		
Males	10	6
Females	14	5
Total	24	11
Plumes [2]		
Epimachus spp.	3	2
Astrapia stephaniae	32	24
Lories [3]	76+	21
Parrots [4]	6	3
Paradisaea minor	1	-
Paradisaea raggiana	-	1
Pteridophera alberti	2	1
Lophorina superba	-	1
Total	120	53

(1) Included are pigs purchased before first census (but present then), and all purchases and sales during the period covered by research. Five of the Waula transactions included some cash, for a total of $35.

(2) For Nimai terms, see Chapter 4, p. 149

(3) Mainly *Charmosyna papou*.

(4) Mainly *Psittrichas fulgidus*.

most significant, as they are in other contexts (see Table 4.2). Variation in the individual quality of plumes, and the particular needs of a person seeking plumes, make an exact scale of plume 'prices' or exchange rates for pigs impossible. Some indication of the range is given by the eight transactions for pigs of known sizes listed in Table 8.30. By comparison with pig trading for money, there is probably a tendency for larger pigs to be traded for plumes.

Since festivals regulate or influence local levels of demand and supply, directional movements of plumes from original source areas are probably distorted, at least in the short run. Possibly directional flows were more pronounced in the past, before freedom to travel opened up new source areas throughout the country. Thus the directional tendencies indicated in Tables 8.30 and 8.31 should be interpreted cautiously. The tendency for traded pigs to be acquired from greater distances than pigs obtained through gift exchange, which was suggested by information on the origins of pigs present in May 1972 (see p. 439), is confirmed by movements in 1972-73 (Table 8.32). Trade from outside the borders of Chimbu is, on the Waula evidence, sporadic and usually the result of a term of employment elsewhere, rather than of a specific trading visit.

The rates at which Waula and Barikane traded pigs varied little in the intercensal periods (Table 8.33). While Waula sold as many pigs as they bought, Barikane bought more than twice as many as they sold, and maintained this higher purchasing rate both before and after their festival.

TABLE 8.30 : Some plume payments for 8 pigs of known size.[1]

PIGS		PLUMES										
Sex	Weight kg.	*Epimachus* spp.	*Astrapia stephaniae*	Lories	Parrots	*Paradisaea minor*	*Paradisaea raggiana*	*Pteridophera alberti*	*Lophorina superba*	Pig Seller's Group	Pig Buyer's Group	Direction of plumes movement
M	10	-	-	-	2	-	1	-	1	Kere	Dom	SE
M	32	1	1	-	-	-	-	-	-	Kere	Nimai	SE
F	32	-	2	3	-	-	-	-	-	Nimai	Dom	E
F[2]	42	1	-	-	-	-	-	-	-	Nimai	Dom	E
M	45	-	6	-	-	-	-	-	-	Tabari	Nimai	NE
F	49	-	7	3	-	-	-	-	-	Kere	Dom	SE
F	49	-	5	5	-	-	-	-	-	Kere	Dom	SE
M	73	1	-	4	-	1	-	2	-	Nimai	Tabari	SW
Totals		3	21	15	2	1	1	2	1			

(1) For Nimai terms for plumes, see Chapter 4, p.149

(2) Included $20.

TABLE 8.31 Movement of plumes in pig purchases made by Waula and Barikane prior to first censuses

Pigs purchased by	Pigs purchased from	Type of Plume (1): *Epimachus* spp.	*A. stephaniae*	Lories	Parrots	No. of transactions	Direction of plume movement (see Map)
Waula	Other Sinasina tribes						
	Kere	-	-	25	-	1	SE
	Kebai	-	-	-	1	1	SE
	Dom	-	2	-	-	1	SW
	Other Chimbu areas (2)						
	Elimbari	-	21	23	1	13	E
	South Wahgi	-	-	21+	4	3	S
Barikane	Other Sinasina tribes						
	Kere	-	7	5	-	2	SE
	Tabari	-	5	-	-	1	(N)E
	Other Chimbu areas						
	Elimbari	-	1	-	-	1	E
	South Waghi	2	3	3	-	3	S
	TOTALS	2	39	77+	6	26	

(1) See Appendix 3 for Nimai terms.
(2) Four of these purchases included some cash, for a total of $15.

TABLE 8.32A Percentages of live pigs originating from, and sent to, major areas outside Waula, by gift exchange and trade[1]

Origin/destination	Pigs acquired				Pigs disposed of	
	before May 1972		during 1972-73		during 1972-73	
	Gift	Trade	Gift	Trade	Gift	Trade
Other Nimai clans	24	14	10	21	19	0
Other Sinasina groups	52	31	66	43	53	77
Other Chimbu areas	23	37	21	14	28	23
Other provinces	0	16	3	21	0	0
Total	100[2]	98[2]	100	100	100	100
Number of pigs	62	51	67	14	36	13

(1)For detailed breakdown by specific groups, see Table 8.6A for acquisitions before May 1972, and Tables 8.36A,B for 1972-73.

(2)Excluded 1 pig acquired by each means from other sources within Sinasina.

TABLE 8.32B Percentages of live pigs originating from, and sent to, major areas outside Barikane, by gift exchange and trade[1]

Origin/destination	Pigs acquired				Pigs disposed of	
	before July 1972		during 1972-73		during 1972-73	
	Gift	Trade	Gift	Trade	Gift	Trade
Other Sinasina Dom clans	19	10	36	0	15	67
South Dom clans	36	15	43	0	27	33
Other Sinasina groups	17	30	7	62	27	0
Other Chimbu areas	25	35	7	37	31	0
Other provinces	3	10	7	0	0	0
Total	100	100	100	100	100	100
Number of pigs	36	20	14	8	26	3

(1)For detailed breakdown by specific groups, see Tables 8.6B, 8.37A,B.

TABLE 8.33 Rates at which Waula and Barikane traded pigs(1)

		Purchased	Sold
WAULA	May - November	.05	.06
	December - April	.06	.04
	Whole period	.06	.05
BARIKANE	August - September	.12	.06
	October - April	.10	.04
	Whole period	.11	.04

(1) Rate = number of pigs purchased, or sold, per person per year. For actual numbers, see Tables 8.36, 8.37.

Gift exchange

Just as the extent of trade appears to vary with cyclical stage so too does the considerably greater movement of larger pigs in gift exchange. While Barikane gave almost twice as many pigs as they received (26 to 14), the Waula flows were reversed (67 received, 36 given). Most of the Barikane transfers took place during the two months before their festival (Table 8.34) after which their acquisition and disposal rates, but particularly the former, dropped to much lower levels. Waula, on the other hand, had relatively stable rates throughout the year, with the exception of the May to November period when they received an especially large inflow of pigs from the Dom festival (Table 8.34).

TABLE 8.34 Rates at which Waula and Barikane transferred live pigs in gift exchange[1]

		Acquisitions	Disposals
WAULA	May - November	.34	.12
	December - April	.19	.17
	Whole period	.27	.14
BARIKANE	August - September	.68	.99
	October - April	.05	.18
	Whole period	.19	.36

(1) Rate = number of pigs transferred per person, per year. For actual numbers, see Tables 8.36, 8.37.

Neat categorisation of the 'occasions' on which pigs are transferred is more difficult than in the case of slaughter, but a rough classification distinguishing marriage exchanges, other non-festival exchanges with affines and matrikin, and festival exchanges (most of which are also with the same categories of relatives), is possible in the case of Waula. The crudity of the typology (and the reason why it is less easily applied to the Barikane data), is due to the fact that marriages and other exchanges may be deliberately scheduled by members of a group holding a festival to coincide with that event. Table 8.35A shows that the majority of pigs given by Waula were transferred by individual households on separate occasions, with marriages standing out as events characterised by the transfer of larger number of animals, usually contributed by more than one

TABLE 8.35A Number and kind of occasions on which Waula acquired and disposed of live pigs in gift exchange

Kind of occasion	Disposals				Acquisitions			
	Number of occasions	Number of pigs	Size of pigs (kg) Mean	Size of pigs (kg) SD	Number of occasions	Number of pigs	Size of pigs (kg) Mean	Size of pigs (kg) SD
Marriage								
to bride's group	3	6	67	24	6	14	54	33
to groom's group	3	7	42	20	1	2	44	35
return to groom's group after divorce	2	4	39	33	-	-	-	-
return bride payment assistance	2	2	10	6	-	-	-	-
Pig Festival	-	-	-	-	2	24	39	19
Affinal/matrilateral gifts	13	14	36	20	19	19	26	28
Other	3	3	46	27	6	8	26	27
Total	26	36[1]	42	25	34	67[2]	37	28

(1) 19 females (mean size 46 kg, SD 26), 17 males (mean size 37 kg, SD 24).

(2) 33 females (mean size 36 kg, SD 26), 34 males (mean size 37 kg, SD 29).

TABLE 8.35B Number and kind of occasions on which Barikane acquired and disposed of live pigs in gift exchange

Kind of occasion	Disposals				Acquisitions			
	Number of occasions	Number of pigs	Size of pigs(kg) Mean	SD	Number of occasions	Number of pigs	Size of pigs(kg) Mean	SD
Marriage								
to bride's group	2	8	68	37	-	-	-	-
to groom's group	-	-	-	-	2	5	47	27
Affinal/matrilateral gifts		16	59	25		6	30	10
Other		2	30	18		3	45	41
Total		26 (1)	59	30		14 (2)	37	22

(1) 18 females (mean size 48 kg, SD 17), 8 males (mean size 84 kg, SD 37).

(2) 8 females (mean size 42 kg, SD 20), 6 males (mean size 35 kg, SD 22).

household. As was the case with slaughter (see p.487), pigs transferred at marriages, especially those given to the bride's group, were larger on average than those moved on other occasions. Though the same pattern is shown by pigs received by Waula, this latter flow is distinguished by the large number of pigs received from festivals. Description of the latter transfers as a single occasion, while justified in terms of the present classification, is not meant to imply that the 23 pigs were handed over as a single "gift" from one corporate entity to another. The pigs were transferred from 23 Dom households belonging to 5 clans, to 15 Waula households. Some reached Waula three weeks before the final Dom slaughter, the majority were handed over during the final ceremonies and a few straggled over from Dom some weeks later. That the transfers of live pigs between Waula and their exchange partners, with the exception of the Dom clustering, was primarily a matter of individual households acting in accordance with their separate interests is reflected in the social-geographical distribution of such movements (Tables 8.36A, B).

In the Barikane case, isolation of specific occasions is not so simple, partly for the reason mentioned above, and partly because of the brief time I spent with Barikane members. Partial disaggregation is given in Table 8.35B. Two marriages, both of young Barikane men, were celebrated. One, with South Dom, was held just before completion of the festival, the other, to Sinasina Kere, just after. Together they accounted for approximately one third of the number of pigs transferred in gift exchange (both acquisitions and disposals). Most of the remaining pigs given by Barikane appear to have moved as gifts

TABLE 8.36A Waula: live pigs disposed of by gift exchange and trade: by destination

Destinations	Number of live pigs															Live weight (kg)
	May-Nov. (7 mths)		Dec.-April (5 mths)		12 months - totals											
					Gift			Trade			Totals					
	Gift	Trade	Gift	Trade	M	F	Total	M	F	Total	M	F	Total	%	
Other Nimai clans[1]	1	-	6	-	4	3	7	-	-	-	4	3	7	14	280
Other Sinasina groups															
Dinga 2	1	1	3	-	3	1	4	1	-	1	4	1	5	10	74
Dinga 1	3	-	-	-	1	2	3	-	-	-	1	2	3	6	224
Kere	-	1	-	-	-	-	-	1	-	1	1	-	1	2	4
Tabari 1	4	1	3	-	2	5	7	1	-	1	3	5	8	16	368
Tabari 2	3	3	-	-	2	1	3	1	2	3	3	3	6	12	247
Dom	1	1	-	3	1	-	1	2	2	4	3	2	5	10	79
Gunangi	1	-	-	-	1	-	1	-	-	-	1	-	1	2	29
subtotal	13	7	6	3	10	9	19	6	4	10	16	13	29	59	1025
Other Chimbu areas															
Elimbari	-	-	1	-	-	1	1	-	-	-	-	1	1	2	35
Kuman[2]	1	1	5	1	2	4	6	-	2	2	2	6	8	16	301
South Wahgi[3]	3	1	-	-	1	2	3	-	1	1	1	3	4	8	191
subtotal	4	2	6	1	3	7	10	-	3	3	3	10	13	26	527
Totals	18	9	18	4	17	19	36	6	7	13	23	26	49	100	1832

[1] 6 to Bomai, 1 to Dugul.

[2] Includes 4 to Bari near Kerowagi, 3 to Yongamugl and 1 to 'Kuman'.

[3] 3 to Golun, 1 to South Dom.

TABLE 8.36B **Waula: live pigs acquired by gift exchange and by trade: by origins**

Origins	Number of live pigs															Live weight (kg)
	May-Nov. (7 mths)		Dec.-April (5 mths)		12 months - totals											
					Gift			Trade			Totals					
	Gift	Trade	Gift	Trade	M	F	Total	M	F	Total	M	F	Total	%	
Other Nimai clans	3	2	4	1	4	3	7	2	1	3	6	4	10	12	323
<u>Other Sinasina groups</u>															
Dinga 2	3	-	2	1	3	2	5	-	1	1	3	3	6	7	151
Kere	3	2	-	-	-	3	3	2	-	2	2	3	5	6	82
Tabari 1	5	1	-	1	2	3	5	1	1	2	3	4	7	9	263
Tabari 2	2	-	1	-	2	1	3	-	-	-	2	1	3	4	238
Dom	23	-	3	-	14	12	26	-	-	-	14	12	26	32	1034
Gunangi	1	-	-	-	1	-	1	-	-	-	1	-	1	1	3
Kebai	1	-	-	1	1	-	1	-	1	1	1	1	2	2	55
subtotal	38	3	6	3	23	21	44	3	3	6	26	24	50	62	1826
<u>Other Chimbu areas</u>															
Elimbari	-	-	1	-	1	-	1	-	-	-	1	-	1	1	35
Kuman	1	1	10	-	5	6	11	-	1	1	5	7	12	15	455
South Wahgi(1)	1	-	1	1	1	1	2	-	1	1	1	2	3	4	42
subtotal	2	1	12	1	7	7	14	-	2	2	7	9	16	20	532
<u>Other provinces</u>															
West.Highlands	-	-	2	1	-	2	2	1	-	1	1	2	3	4	70
East.Highlands	-	-	-	2	-	-	-	-	2	2	-	2	2	2	19
Totals	43	6	24	8	34	33	67	6	8	14	40	41	81	100	2770

(1) Golun and South Dom.

associated with the festival. Though possibly co-ordinated to occur at the same time, these gifts were not aimed, however, at a single major recipient. As shown in Table 8.37A, the 16 pigs were given to relatives in a wide scatter of groups, thus confirming the Waula evidence which showed that their gifts of live pigs from Dom came from partners distributed among five clans. Pigs received by Barikane at other than marriage exchanges also seem to have been transfers which were generally associated with the festival. Most arrived before the final slaughter (Table 8.37B), and six of a total of nine came from other Dom clans (both South and Sinasina Dom).

It may be noted that, as with trade, movements into and out of Waula through gift exchange showed no preference for either sex (Table 8.36A,B). Though Barikane received approximately equal numbers of both sexes, they gave a disproportionate number of females (69 per cent, n = 26), mainly to groups south of the Wahgi (Table 8.37A,B), which could reflect exclusion of breeding stock from festival slaughter. No such imbalance, however, was apparent among the total of 26 pigs received by Waula from Dom (Table 8.36B), so the Barikane distribution may be simply the result of a small sample.

Table 8.38 provides details of the extent of participation in gift exchange by households of the two groups. As with other transfers, there is no evidence of restriction.

TABLE 8.37A Barikane: live pigs disposed of by gift exchange and trade: by destination

Destinations	Number of live pigs												Live weight (kg)
	Aug.-Sept. (2 mths)		Oct.-April (7 mths)		9 months - totals								
					Gift			Trade	Totals				
	Gift	Trade	Gift	Trade	M	F	Total	M only	M	F	Total	%	
Other Dom clans	3	1	1	1	2	2	4	2	4	2	6	21	288
South Dom clans	6	-	1	1	2	5	7	1	3	5	8	28	479
Other Sinasina groups													
Kere	-	-	2	-	1	1	2	-	1	1	2	7	138
Tabari 1	1	-	-	-	-	1	1	-	-	1	1	3	73
Tabari 2	-	-	1	-	-	1	1	-	-	1	1	3	63
Nimai	-	-	3	-	2	1	3	-	2	1	3	10	196
subtotal	1	-	6	-	3	4	7	-	3	4	7	24	470
South Wahgi[1]	6	-	2	-	1	7	8	-	1	7	8	28	436
Totals	16	1	10	2	8	18	26	3	11	18	29	100	1673

[1] Era, Kia, and Golun.

TABLE 8.37B Barikane: live pigs acquired by gift exchange and by trade: by origins

Origins	Number of live pigs															Live weight (kg)
	Aug.-Sept. (2 mths)		Oct.-April (7 mths)		9 months - totals											
					Gift			Trade			Totals					
	Gift	Trade	Gift	Trade	M	F	Total	M	F	Total	M	F	Total	%		
Other Dom clans	5	-	-	-	3	2	5	-	-	-	3	2	5	23		236
South Dom clans	4	-	2	-	2	4	6	-	-	-	2	4	6	27		247
<u>Other Sinasina groups</u>																
Kere	1	2	-	2	1	-	1	3	1	4	4	1	5	23		86
Nimai	-	-	-	1	-	-	-	-	1	1	-	1	1	4		13
<u>Other Chimbu areas</u>																
Kuman	-	-	-	2	-	-	-	1	1	2	1	1	2	9		6
South Wahgi[1]	-	-	1	1	-	1	1	1	-	1	1	1	2	9		49
West. Highlands	1	-	-	-	-	1	1	-	-	-	-	1	1	4		21
Totals	11	2	3	6	6	8	14	5	3	8	11	11	22	100		658

[1] Kia and Golun.

TABLE 8.38 Household participation in exchange of live pigs

No. of pigs	Waula (May'72-April'73) No. of households which		Barikane (Aug.'72-Ap.'73) No. of households which	
	gave	received	gave	received
1	13	18	6	7
2	7	10	4	2
3	1	2	2	1
4	-	3	-	-
5	-	1	-	-
6	-	1	1	-
Total households	23	35[1]	13	10[2]
Total pigs	36	67	26	14

[1] 16 of which also gave pigs, thus a total of 42 'participated'.

[2] 6 of which also gave pigs, thus a total of 17 'participated'.

Summary

Sinasina pig festivals are held, co-ordinated at the level of one and sometimes two, tribes, at intervals of approximately 7-10 years (at least in the recent past). Cyclical variations in pig production and use have been inferred from data on the pigs (and transactions involving pigs and pork) of two lower-level segments of two tribes at different stages of their respective cycles (assuming relative cyclical regularity and that the pig populations of the two groups were broadly representative of major variations due to cyclical processes).

Comparison of the relative numbers and the size/sex distributions of animals in the two populations showed a progression from few, mainly small, pigs following a festival to many, relatively large ones before the next. The size (and hence, presumably, age) distribution of pigs appeared to be more diagnostic of cycle stage than numbers alone. Sex differences were not generally significant: though females slightly outnumbered males, there were few or no signs of preference for retaining sows at any stage, and females were not disproportionately represented in patterns of trade (or price), exchange, and slaughter. The practice of agistment necessitated a distinction between 'ecological' and 'sociological' pig populations. Agistment may be related as much to local unpredictable fluctuations in the availability of pig food as to cyclically determined factors.

Definition of the aggregated pig-herds of group members as a population is an analytic abstraction: considerable numbers are produced elsewhere and acquired by trade and gift exchange. The proportions of animals obtained by different means may vary in populations at different cycle stages: trade seems to be especially significant during early stages.

There is evidence that reproduction is managed in relation to the cycle, in particular that it is gradually restricted during the later stages. Moreover, even the Waula population, several years away from a festival, revealed a low rate of reproduction. Seasonal factors may affect the incidence of mating. Growth is slow. Measured rates for various size-classes of animals were mostly well below 2 kg/month. Reproduction seriously depresses female growth rates. Growth rates between May and November were higher than those between December and April but the 1972 drought may have influenced these results. Given a predominance of large animals slaughtered at festivals, low growth rates are interpreted as setting minimum limits to cycle periodicity. However, since growth is dependent on food intakes, considerable variation can be expected.

Losses from death and other causes probably vary cyclically, and in the former case, can be related to the size/age distribution of the population. Slaughter rates also vary. Apart from festivals and marriages, slaughter is generally unco-ordinated, and usually involves smaller animals than is customary for such events. Most meat yielded by slaughter at festivals and on other occasions is transferred by exchange out of the clan/subclan. Direct participation in exchange is extensive and not restricted to a few prominent households or individuals. Pork gifts received by members of a group from a festival can be very numerous, though much of such pork is transferred in secondary exchanges to individuals in other groups. Careful account is kept at the level of both individual men (households) and wider groupings (i.e. men's houses) of the state of exchanges. Various estimates of the amount of pork available for consumption (excluding that received from festivals) by Waula were made. Although suggestive of levels higher than those indicated by nutritional surveys, they appeared reasonable in relation to growth rates.

The turnover of live animals in gift exchange and trade is considerable, apparently throughout the cycle. Of the two, trade moves fewer and smaller animals, but moves them across wider distances.

Money and plumes are the two media for pig trade, each displaying differing characteristics. Plumes, particularly, reveal cyclically related movements. Occasions for gift exchange are diverse, but, as with slaughter, both festivals and marriage are most significant.

CHAPTER 9

Conclusion

Introduction

In this concluding chapter I discuss some of the main characteristics of Sinasina pig production and use in terms of material from other parts of the New Guinea highlands. After a brief look at a recent study confirming the operation of the kind of cyclical management practices suggested in Chapter 8, I re-examine the ecosystemic model used by Rappaport in his analysis of Maring husbandry. I conclude by pointing out the difficulties of relating, on the basis of present information, presumed variation in pig production to other agrarian and social features of the core central highland areas.

Some confirmation

In the previous chapter I emphasised evidence indicating a co-ordinated cycle of pig management culminating in a pig population composed mainly of large animals and thus implying the restriction, at some stage of the cycle, of reproduction (or, alternatively, some other means of keeping the number of juveniles low). This finding, which has significant implications for the ecosystemic model of pig cycles outlined in Chapter 1, was necessarily tentative, first because it was based on the pigs of only two small groups, and second because the evidence supporting it only emerged following analysis after leaving Sinasina. It is therefore significant that similar findings are reported by a subsequent comparative study of pig husbandry at four locations in the highlands (Malynicz 1976).

Two of the groups studied by Malynicz (Lapegu and Namaro) were located in the Eastern Highlands Province and did not, he suggests, traditionally stage major pig festivals. Both displayed shallow size/sex pyramids (no pigs weighing more than 75 kg), with very broad bases (ibid.,Fig.1). Of his other two groups, one (Keruveku, a subclan of the Gena tribe near Kerowagi), was located in the western part of the Chimbu Province, the other (Roni-Pingeri) near Hagen in the Western Highlands. The last festival held by the Keruveku was apparently some twenty years previously, the next not due for another few years (ibid.,5). The structure of their pig population was distinctive of the kind of husbandry strategy described in this study ; that is to say, thin and vertical, and including many more large animals than either of the Eastern Highlands groups (ibid.,Fig.1). The Hagen population was similar as regards pigs weighing more than 25 kg, but differed in having a relatively large number of pigs under that weight. As Malynicz emphasises, such gross differences "...suggest fundamentally different strategies of managing the pig herds" (ibid.,3).[1]

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[1] Cf. Collier and White's inference that "societies can utilise their domestic animals in very different ways, resulting in very different slaughter patterns" (1976:100). Their general point, that a high proportion of immature animals by itself is not sufficient evidence for domestication (in archaeological reasoning) is partly born out by material presented in this study. However, the fact that slaughter at a festival may include a majority of mature animals does not necessarily imply that, in the period between festivals, immature animals may not be cropped in disproportionate numbers (see Fig.8.8A), i.e. the 'oddity' of cylical production may leave no trace in the archaeological record. Given the diversity of factors determining the survival of animal remains in archaeological sites, their warning is clearly timely.

In particular, he also identified the control of breeding as a major factor, specifically contrasting the Eastern Highland groups with Keruveku in Chimbu (ibid.,3-4).

The extent to which some of Malynicz's populations and those presented in this study differ can be neatly described with a simplified version of a model used by Barrett (pers.comm.) to explore relationships between shooting intensity and productivity in research on wild and feral pigs. In Fig.9.1, I compare the presumably non-cyclical population of Lapegu in the Eastern Highlands, with, in descending order of young (i.e. less than 25 kg) pigs per sow per year, the cyclical populations of Waula (2½ years after their last festival), Keruveku (a 'few' years away from their next festival), and Barikane (2 months before their festival slaughter). It is a nice paradox[2] that a festival which, *inter alia*, celebrates the

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[2] I suggest that this paradox is present, with some variation, at several levels of Sinasina experience and symbolism. An attractive argument could be developed to the effect that the achievement and maintenance of 'fat', the embodiment of health in humans and pigs, are, for Sinasina, constant problems of both husbandry and human relations because of what they perceive to be the debilitating, but entirely essential, processes of 'fertility'. In husbandry, for instance, although fatness is the goal of cyclical production, it is opposed by too much mating which is considered directly inimical to the fatness of male pigs, and, indirectly, in its effects, to that of sows (and presumably, to both if there are too many pigs to be cared for). Control of fertility is achieved by castration and segregation of boars from sows. Partial parallels in human relations are obvious (male 'fat' is threatened by too much intercourse, and maintained by sexual segregation etc.), and the two frameworks meet and interrelate in the organization of production, residence, and exchange. The complex of activities associated with festivals could then be interpreted as occasions on which temporary resolutions or mediations of some of these 'contradictions' or 'complementary oppositions' are expressed. For explorations of similar themes in other New Guinea contexts, see Lindenbaum (1976), LiPuma (1978), Schwimmer (1973).

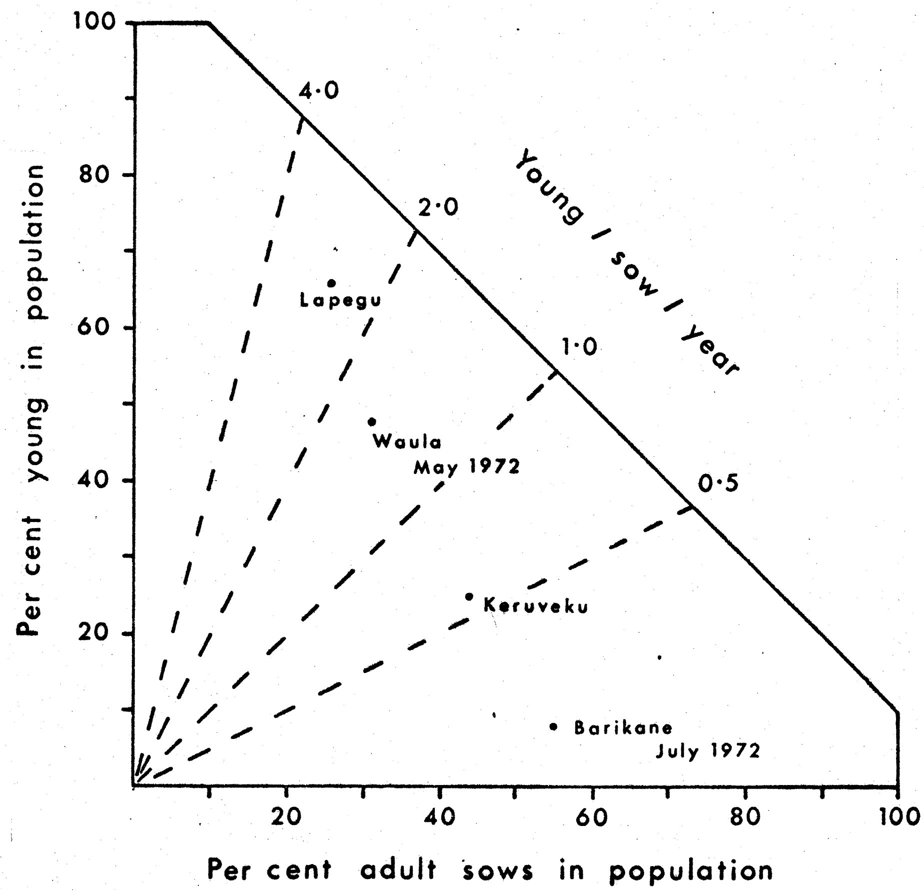

Fig.9.1 Relationship between pig population structure and productivity

(Form of graph after Barrett, pers.comm. Values for Lapegu and Keruveku populations from Malynicz,pers.comm.)

success of a group's pig-raising activities, is accomplished by the progressive negation of pig fertility.

The ecosystemic model reconsidered

One of the aims of this study, as described in Chapter 1, was to contribute to discussion concerning the ecosystemic model proposed for certain aspects of New Guinea pig husbandry, in particular the periodic slaughters of the highland region. Although the magnitude of recent change in Sinasina precludes close comparison with the Tsembaga 'case', a re-examination of Rappaport's analysis in the light of evidence presented here nevertheless serves both to underscore significant differences, and to pinpoint aspects which, with hindsight, now seem either problematic or incompletely explored by the ecosystemic model. To minimise the kind of distortion which so frequently affects summaries of work by others, I give a relatively full account of the Tsembaga material. Further, since (as noted in Chapter 1), Rappaport's model derived from that outlined by Vayda *et al*. (1961), I begin with the latter.

Opposing earlier writers who had viewed Melanesian pig husbandry as uneconomic, wasteful, or nonadaptive, Vayda *et al*. argued that pigs were "...vitally important to the management of subsistence" (ibid., 69). In support of their case they noted that since pigs were often eaten quite regularly they could well provide an important dietary addition ; that they might provide significant protein where other sources of animal protein were scarce ; and that inequalities in food consumption were likely to be reduced since not only was slaughter usually carried out by those best able to afford it but distribution was customarily extensive. Their main points, however, rested on a consideration of the limits affecting the ability of Melanesians to survive in a situation where meteorological factors caused temporal variation in the supplies of vegetal subsistence resources used by both people and pigs. Given annual variation in the production of food crops (for which storage techniques were generally not available) they suggested that the surplus of good years might be fed to pigs, which they therefore likened to mobile food reserves. In bad years, however, pigs could be traded or given to better supplied groups, left to forage for themselves, or, at worst, slaughtered for food. In other words, they proposed that pigs might operate as a "buffer" (cf. Hardesty 1977:27), enabling Melanesians to cope with lean years when subsistence was critically low.

At the other extreme, they also noted, their model could defend the great festivals of the highlands, at "...which so many hundreds and sometimes even thousands of pigs are slaughtered that some of the pork becomes inedible or is eaten in sickening and excessive quantities" (ibid.,71), against the charge of mismanagement. Instead of treating, like previous writers, the disposal of huge quantities of festival pork as 'problematic', they proposed that the significant ecological problem met by such slaughters was the large number of pigs present within a territory prior to a festival. Pig populations, they argued, oscillate in size from normal or safe levels, that is when there are sufficient animals for the suggested purposes of food storage and of regular pork consumption, to abnormal or dangerous levels when they may constitute a direct threat to their keepers' gardens. Such oscillations they traced to a combination of two factors :

> "although pigs in general breed quickly, their deaths from natural causes and their frequent slaughter for the big and small feats that are,...a feature of many occasions, constitute a continuing check on the too-rapid expansion of the total pig population....Nevertheless, if the growth of the crops and wild plants that constitute major souces of food for the pigs is favourable throughout much of a large territory for a succession of years, and no bad times intervene, the pig population may then increase...(ibid.,71).

Periodic festival slaughters, therefore, could be seen as a means of preventing the land from being overrun by pigs, thereby contributing to the maintenance of a long-term ecological balance.

Some of the shortcomings of this model, for instance the lack of attention paid to history or prehistory, are understandable given the extant sources : overviews of longterm agricultural, ecological, and demographic changes in the region did not appear for several years. This was, however, probably convenient for the kind of analysis outlined and proposed. Like the earlier anthropologists whose views were disputed, the perceived problem was the customary behaviour of a given people, which from the perspective of ecology, was situated in the context of populations occupying specific territories. With time held constant, and a long-term balance between humans and resources assumed, the analytic goal was presented as a search for the ecological rationality underlying the "problematic" behaviour. The context of debate, the sources, and the mode of analysis all combined, as perhaps is common in the exploration of a new approach, to focus attention on positive cases. While this focus was later to draw increasing criticism, the Vayda _et al_. treatment of the large slaughters at festivals illustrates the risks of rigorously excluding possibly negative cases. Thus, by identifying the large number of pigs held prior to a festival as a possible threat to subsistence cultivation, and treating this rather than the disposal of pork at festival slaughters as their analytic problem, they were able to suggest that such slaughters might be ecologically sound. In retrospect, it can be argued that this view, like the position it sought to refute, focused too narrowly on "explaining" the final slaughter, thereby underplaying the fact, partly documented and argued in subsequent studies (Brookfield 1973b:134-7; Rappaport 1968:61-2; Waddell 1972a:117-121), that a festival (or large-scale exchange event as in the case of the Enga) concludes an extended period of increased production to meet the fodder requirements of increases in either the gross number of pigs, or the number of large animals (or both). Further, such increases imply more than an increase in the use of cultivable land. Since pigs are primarily managed on a free-range basis, their use of, and impact on, fallow and forest is also increased. A number of recent studies (Dwyer 1978a, 1978b; Smith 1977:309-10; Walker 1966, 1972) indicate that their impact on the vegetation, and fauna, of such zones is not inconsiderable.[3] If we apply to this impact the generalization on which Vayda _et al_. based their

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[3]See also the earlier discussion in Aitchison (1960), other papers delivered at the same symposium (UNESCO/TPNG 1960), and Brookfield with Hart (1971:87). In this context, it is worth citing Holloway's apposite comment that "(t)here is no one situation and there is no 'once-and-for-all" (1964:24), made in a paper on forest modification by introduced mammals in New Zealand.

argument, that "...biological reactions are controlled not so much by the average amounts of essential factors in the environment as by extremes in the presence of these factors" (ibid.,70), it may be suggested that the damaging influence of such "percussive highs" (Darling 1956:784-5) associated with cyclical maxima could have played a significant part in the long-term processes by which highland peoples have transformed (and continue to do so) their environments (cf. Hughes 1977:212).

Further, it may be noted that the Vayda et al. model of pig population oscillation, which allows the argument that pig numbers may increase to pose a danger to gardens, rests partly on the same assumption made by these authors in order to suggest that pigs fulfilled a "buffer" role in lean years, i.e. that temporal variations in the availability of vegetal foodstuffs due to meteorological fluctuations critically limited Melanesian subsistence. A run of good years, they indicated, may therefore result in increased numbers of pigs. However subsequent research has not generally upheld this assumption, at least within the central highlands.[4] Without the

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[4]See, for instance, Bowers (1968), Brookfield (1972a), Brookfield with Hart (1971), Rappaport (1968:63-5), Waddell (1972a:129). In passing, it may be pointed out that long runs of data on food production are not available for any part of Melanesia. Nevertheless, the weight of evidence, at least from the highland region, cannot support an hypothesis of a long-term demographic equilibrium limited by sporadic production failures. This, however, is not to deny that occasional famines or severe shortages did occur, and that in certain situations (i.e.the high altitude areas of the Western Highlands, Waddell 1975), limits may well have been approached. Nevertheless, there is a considerable difference between noting the fact of occasional shortage, and demonstrating correlations between such shortages and population size. For a brilliantly documented longterm case (continued over page)

support of this assumption, it can be argued that their model of pig population oscillations exaggerates the potential of pig populations as a system threatening variable. This is not to deny the patent fact that pigs can, and do, damage gardens, and that increased numbers of pigs increase the possibility of garden losses. Nevertheless it implies that increased numbers are not necessarily dependent, as suggested by their model, on a run of good years. Such a suggestion probably under-estimates the degree of development of some highland systems of pig management.

The most thorough application, critical assessment, and extension of this model appeared in Rappaport's study (1968) of the role of ritual as a regulator of the ecological (and other) relationships of the Tsembaga, one of more than 20 small local groups which make up the Maring-speaking population of some 7000. Located on the northern periphery of the New Guinea highlands, the Maring contrast with peoples in the core areas in that they are settled at lower population densities, their territories contain more forest, their cultivation is less intensive, and their diet less dominated by sweet potato. Despite such differences, several aspects of Maring culture, in particular their periodic pig slaughters, share several formal similarities with those found among some core groups. Rappaport cast his description of the material relations of the Tsembaga with

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[4] (continued from previous page) in medieval England, see Postan (1973:150-185). In recent publications, Vayda has questioned the relevance of this assumption to ecological anthropology (Vayda and MaCay 1975), explicitly states that he does not consider it generally valid in his own field context among the Maring (Vayda and McCay 1977: 414), and indicated that hard evidence for limited energy (and protein) availability in Melanesia generally is lacking (ibid.)

their environment, and his discussion of the regulatory functions of their ritual cycle, within the analytic frame of ecology and systems theory. Two systems were distinguished : the ecosystem consisting of Tsembaga territory, with the Tsembaga population and the other living and non-living components located within the territory, and the regional system, composed of the aggregate of Maring local populations and some neighbouring groups. The former system was defined in terms of localized trophic exchanges, the latter in terms of (mainly) non-trophic exchanges (ibid.,224-7).[5]

On the grounds that severe environmental variation was not reported by the Tsembaga to seriously affect their production, Rappaport discounted the Vayda _et al_. suggestion that pigs might act as energy stores in situations of production shortfalls (63-5). His empirical findings concerning the considerable energy costs, and relatively poor energy returns of Tsembaga pig husbandry did not, however, lead him to reject their general hypothesis. Maring pigs, he argued, were not "...luxuries. They are a very expensive necessity"(68). Developing one of their minor points, and foreshadowing a recent trend in ecological anthropology in which the significance of limited protein availability is stressed (Gross 1975; Morren 1977), he suggested that the major contribution of pigs to their Maring keepers was in converting vegetable calories into animal protein (66-68). Although the amount of protein in normal Tsembaga diets appeared to be adequate, he hypothesised that it might not be so in times of stress

[5]All unreferenced page numbers in the following paragraphs refer to this study.

and argued that the customary (ritual) restriction of non-festival slaughter to situations of misfortune and emergency "...tends to provide physiological reinforcement when it is needed to those who need it" (78-87). Whether protein is, or was, a significant problem for the Maring (and other Melanesians) is, however, now questioned by several writers (McArthur 1974,1977; Vayda and McCay 1977:415).[6]

With pigs established as subsistence "necessities", albeit expensive ones, Rappaport followed Vayda et al. in regarding the increase in size of a pig population, from few after a festival slaughter to many prior to the next festival. as posing a cluster of potential social and ecological problems. Identification of these was as significant for his analysis as it was for theirs, since, conceptualised as potentially dangerous changes in the relationships between variables within a Maring local, or eco-, system, they provided him with the means for arguing that the kaiko festival could be regarded as a mechanism which, occurring in response to such changes, returned the variables to "former and more viable levels" (164), and that therefore such ecosystems were self-regulating. Before considering these problems, Rappaport's analysis of other factors determining cycle periodicity (the duration between festivals) requires attention.

Unlike Vayda et al., he did not consider the direct effects of meteorological conditions, as reflected in food supplies available

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[6] Since the Maring population prior to epidemics during the colonial period may have been higher (Rappaport 1968:14-5,95; cf. Bowers 1971), it could be argued that protein was likely to have been scarcer in the past.

for pig fodder, to be a major determinant of Maring cycle periodicity. Rather, since most non-festival pig slaughter occurred, according to informants (82), in situations of misfortune and emergency, he inferred that the duration of a cycle was largely dependent upon the extent to which the "natural" increase (153,155) of a pig population (i.e.through breeding rather than imports by trade or other exchange, see fn.7 below), was depressed by such slaughter, hence indirectly reflecting the well-being of the pig-keepers (156). However, despite his emphasis on pig population dynamics for understanding cycle periodicity (57, 153), details of Maring management of pig breeding were scanty (70-71; cf. Shantzis and Behrens 1973:270,282).

Rappaport described a relatively extensive system of husbandry, with feral animals as well as domesticated herds present within Maring territories. Since Maring castrate all domesticated males at about three months of age, they rely upon feral boars for mating with domesticated females. Observing that sows were kept above 4000 feet, while feral males were "inclined to stay below 3000 feet", Rappaport inferred that matings must be infrequent (cf.p.452 above). Such altitudinal restrictions, though observed in the festival year of 1962-63, were presumably not dependent on cyclical factors since settlement was usually above 3500 feet (238). However, the particularly low figure of only 14 pregnancies by some 50 potentially fertile females during 14 months of field research was, Rappaport thought, not representative of the rate of reproduction over longer periods. He suggested that it was the (?unintended) result of the extraordinarily nucleated pattern of Tsembaga settlement, established in 1957 on return from exile (69), since

> "(f)eral pigs tend to avoid areas that are densely populated by humans and domesticated animals do not seem for the most part to wander very far afield. Moreover, in 1963 the movements of domesticated pigs were restricted by the situation of the Tsembaga settlement, which was separated from much of the territory by streams the pigs found difficult to cross" (70-71, fn.2).

Describing what appears to be the same segregation, though in the context of people and pigs separated from gardens by a steeply banked stream, he further noted that this was "both unusual and transitory. Informants say that there had never before been such separation, and it is unlikely that it will occur again" (161-2). Though the degree to which the Tsembaga had segregated their pigs in 1962-63 from both gardens and easy access to feral boars was therefore apparently fortuitous, it is interesting that a "high degree of (residential) nucleation" is normal towards the completion of a Maring ritual cycle when most houses are located around the dance grounds (21), which implies that opportunities for mating would normally tend to be restricted during the last phase of a cycle. It is therefore of particular interest that the average size of pigs held by the Tsembaga before their festival was an estimated 120-150 lbs (54-68 kg), while afterwards they averaged only 60-70 lbs (27-32 kg). In other words, the former population was composed primarily of adult (or large) animals, implying that, for some prior time, either breeding had been restricted, or that young animals had been disposed of by other means.

Thus there is some evidence to indicate that Maring pig breeding practices, in addition to inhibiting reproduction in general, as suggested by Rappaport (70), may also vary during the course of a cycle, thereby casting doubt on, or at least qualifying, the several secondary accounts of Maring pig population dynamics which stress "rapidly growing" numbers (Hardesty 1977:31), and "upward spurts" (Harris 1974:50), or which extrapolate exponential or quasi-exponential rates of increase (Shantzis and Behrens 1973:270,275). Be that as it may, the maximum rate of pig accumulation is determined by the facts of pig reproduction and growth under the prevailing conditions of Maring husbandry, given that trade appeared to be a relatively insignificant means of aquisition.[7] Rappaport calculated that the minimum inter-festival period, given the low rate of reproduction and heavy juvenile mortality (71), and a slow rate of growth (2-3 years to maximum size, 156), could be as short as 5 or 6 years (156). While possible under the best of conditions this would not be usual, however, and he reported a probable mean of 12-15 years ranging in some cases to over 20 (156-7).

Arguing that the explicit goals which Maring seek to fulfil at a kaiko (i.e. sacrifices to spirits and slaughter for prestations to others), do not specify the exact number of pigs required, and that there is no constituted authority directing when a kaiko should be held, Rappaport suggested that the consensual decision to hold a kaiko is triggered by the pressure imposed by large numbers of pigs.

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[7]Inferred by Rappaport from the fact that relatively few (13 per cent) of the animals held by Tsembaga prior to their festival had been acquired by trade (105). Further, usually only small animals were transferred by trade, and these "are always in short supply" (159). Other researchers amongst the Maring suggest that the movement of pigs in trade may be more extensive (Buchbinder 1974; Healy 1977).

He identified three problems posed by large herds. In the first place they result in residential dispersion (21,154-5), which, though reducing house to garden distances and hence transport costs, may have disadvantages both for effective social organization (by diminishing the frequency of social contacts),[8] and for defence. Secondly, they require greater amounts of labour. Rappaport calculated that feeding one pig required, on average, an approximate daily energy expenditure of 125 calories by humans, and estimated that therefore the maximum number of adult pigs which the average Tsembaga woman (aged ten or more years) could care for, was only four (157-8). Given uneven ownership, however, he considered such a maximum average to be unlikely to occur since families with larger herds would probably begin to agitate for the need to hold a kaiko, leading to eventual consensus (158-9). Thirdly Rappaport combined Vayda et al.'s suggestion that the possibilities of garden invasion, and hence crop damage, are increased with large numbers of pigs, with Brown and Brookfield's (1959:22) observation of the frequency and severity of the social effects of such depredations (the killing of pigs, disputes, potential violence, and the disruption of social relations possibly leading to residential, or even group membership, change). Increased pig numbers, therefore, eventually result, in Rappaport's analysis, in deviations from acceptable levels of either pig-related labour (signalled by women's complaints), or garden invasions (signalled by complaints about damage, disputes etc.), or both. Acceptable levels

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[8]This is perhaps arguable. Elsewhere, he notes that "...residence is largely independent of land use. Distances are not great..."(21).

are defined by actors. Described ecologically (in terms of the operational model of the environment), the limits, or system-endangering levels, of such deviations are definable in terms of parasitism and competitiveness (159-162). A third limit involved is that of carrying capacity, the number of pigs that could be supported by a human population of given size without reducing the length of fallow periods. Rappaport calculated approximate limits for both parasitism and carrying capacity (92-6), and found that the size of the Tsembaga pig population prior to their festival was below both such levels (94-5, 158). He therefore suggested that the upper limits of the reference values, or range of values, of the actors' cognised model are set, or likely to be, below the limit(s) of the goal ranges required for maintenance of his operational model of the Tsembaga ecosystem (240-1).

Rappaport's model, although a major advance in several respects, thus still shares several of the shortcomings of the earlier version. In the first place, the calculations of carrying capacity again excludes the direct foraging requirements in forest and fallow of pigs (295), and therefore no account is taken of the effects of pig disturbance on such zones. If these are as significant as suggested by some recent studies (p. 547 above), it is possible that carrying capacity measured only in terms of cultivation requirements, while adequate for specifying the conditions of relatively short-term system endurance, overestimates the number of pigs a given area of territory can support without the occurrence of long-term environmental transformation. Secondly, there is a tendency to assume, on the one hand, a relatively close correlation between production (whether of energy or protein foods) and the biological requirements of individuals, and, on the other, the containment of levels of production within limits defined by the ecological imperatives of the ecosystem in which they participate. Rappaport expresses the latter point explicitly in subsequent publications :

> "...in small undifferentiated societies such as that of the Maring, in which all adult members are directly and continuously engaged with the natural environment and in which corrective informational feedback from the environment is direct, observable and relatively quick, we may expect a close correspondence between culurally specified motives and goals and the requirements of ecosystemic processes" (1977:161; see also 1979:56).

I would question this expectation. How easily and directly perceived, for instance, are such changes as slight incremental decreases in yields which, given long cultivation cycles, will occur only over relatively long periods? How many times does a Maring cultivate the same plot of land in his lifetime? A major difficulty here is that Rappaport's implicit comparison appears to be with industrial societies not with the neighbouring and closely similar peoples of the core central highlands amongst whom the evidence for such a correspondence is, in places, lacking (Golson 1977:53).

Further, adopting a sceptical position on the significance of limited protein, it can be argued that Rappaport's analysis, both of the functions of the kaiko and the means by which the kaiko is triggered, relies too heavily upon the trophic exchanges between humans and pigs within a local system. Parasitism, for instance, Rappaport defined operationally as "...a relationship between two or more individuals through which one or more are benefitted or supported at the expense of others, to whom their return is significantly less than equivalent, or to whom injury is done in the process, or both" (159,fn.2). While overwork (injury) is unambiguous, the returns provided by pigs to their keepers are calculated by Rappaport only in trophic terms at the level of the ecosystem. "The kaiko," he thus writes, "...provides, among a group in which the slaughter of pigs is in large measure advantageously restricted to ritual to stress situations, a ritual means of disposing of a parasitic surplus of animals....(it) also provides a means of limiting the amount of calories expended in acquiring animal protein" (159). If, however, the role of pigs in supplying protein to persons in stress is given less weight the question arises whether such functions are significant.

Empirically, it seems possible that a large proportion, if not the greater amount, of pork produced by a Maring local group, is exchanged for such diverse and critical items as goods, wives, and assistance in warfare (i.e. some of the means of production, reproduction, and security), in the transactional network articulating local groups within the regional system. If it is the case that the exchange commodity role of pigs (or of the pork they supply) is more significant[9] than the protein supplying role, it follows that costing

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[9]Meaning that limited protein availability is not critical, and that, in cases where there is a choice of slaughtering an animal either for a stress situation or for use in an exchange event (or retaining an animal for a future exchange event), decisions predominantly favour the latter.

of protein output in terms of the calorific expenditure of labour in pig husbandry, and description of the large, pre-festival herd as "surplus", may be inappropriate. This is not of course to say that the relationship of pigs to producers cannot become either parasitic in the second sense of Rappaport's definition (i.e. their numbers may result in injurious work loads), or competitive. Is it necessarily the case, however, that the signals (complaints by women, or disputes) concerning such relationships provide the mechanism by which a kaiko is triggered? In Rappaport's analysis it was clearly important that they did, since he sought to argue that the occurrence of a kaiko primarily reflected the state of variables within a local system. As far as other "external" variables were concerned, he reviewed only the possible effects of the timing of the kaiko of neighbouring groups, especially those of principal enemies.[10]

It is necessary to point out, however, that the empirical basis for the 'internal' relationship posited by Rappaport between 'stress', signals, and festival occurrence is weak (and excusably so, since the events he reconstructed occurred before his arrival). If the suggestion made earlier that the size structure of the Tsembaga pig population prior to their festival indicates the operation of management

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[10]Noting that it was rare for the festivals of antagonistic partners in the same fighting to be separated by more than one or two years he concluded that this was probably related to the fact that a greater interval would expose the group holding the later festival to possible attack, and he conceded that "(i)t may thus have been the case that in some instances groups chose to stage the kaiko with somewhat fewer animals than they could have tolerated" (166).

practices applied several years before the kaiko is correct, the relationship between a final product (large pigs) and the means of achieving it (particular management strategies), implies a prior decision acted upon by a sufficient number of pig keepers to produce a significant effect upon the composition of the entire population. I suggest that Rappaport's reconstruction of the timing, and the process, of agitation leading to consensus among the Tsembaga underestimates this factor.

The Tsembaga began their approximately year-long kaiko in mid-1962,[11] when their pig population stood at some 169 large animals. Certain men, Rappaport notes, who included the owners of the largest number of pigs, were urging "as early as 1960 or 1961" that a kaiko should be staged (158). Others, "with few or no pigs responded to the talk of an approaching kaiko by attempting to acquire animals.... As more people obtained more pigs, voices were added to those favouring the uprooting of the rumbim" (159). Rappaport did not indicate how long the process of consensus formation might take, though he implied that it was brought about by the increasing number of pigs : "(a)gitation for a kaiko starts when the relationship of some pigs to their owners changes from one of support...to one of parasitism....(consensus is achieved) when this unfavourable change in relationship occurs in enough cases" (159). If my identification

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[11] If the planting of stakes on their territorial boundaries in June or July is taken as the beginning (166); commitment to a festival presumably occurs when new gardens are cleared and planted - during April to June - since larger taro-yam gardens seem to be required for feeding festival visitors (42, 61, 182).

of the size structure of the pig population as 'problematic' is correct, 1960 does not seem particularly early. Even if it is granted that consensus was achieved immediately in 1960, we may ask whether two years would be sufficient to achieve the population structure found two years later.

In this re-examination I have concentrated on those parts of Rappaport's analysis which are either based on controversial assumptions (i.e. the protein problem, carrying capacity based only on cultivated fodder requirements), or for which Sinasina evidence suggests alternative relationships or arrangements. The latter indicates that, in Sinasina,

(1) discussions to plan the timing of future festivals are held several years before decisions to hold them are taken, and

(2) such plans are made explicitly in terms of the state of inter-group relations, and include

(3) directives concerning strategies of pig manangement and use aimed at producing pig populations in which fertility is restricted and most animals are large.

Such factors, taken in association with information on the magnitude of flows of pigs and pork between groups during inter-ceremonial periods (as well as at festivals), suggest a considerably closer relationship between the demography of a group's pig population and the state of its external relations than obtained among the Maring. This is an important difference, both in empirical and analytic terms.

Analytically, as Rappaport pointed out, one of the difficulties posed by discrimination of such subsystems as a local ecosystem and a regional system is that they are only relatively independent,

"...they are likely to share some components, and, through these, events in one system eventually are likely to affect events in others" (1968:228). In the Tsembaga case, pigs could be viewed primarily in terms of relations between components of a local ecosystem. Pig demography, which Rappaport describes as primarily determined by the interplay of their own population dynamics and the incidence of human misfortune, could be postulated as the determinant of cycle periodicity (1968:153-7, 229). Such relative autonomy cannot be sustained for Sinasina in the early 1970s, and, without it, the potential sensitivity of cycle duration to the ecological imperatives of local systems is presumably endangered. What is important then, is the extent to which extra-local relations affect local ones, in particular the extent to which pigs, besides providing a rough index of the well-being of their keepers within the borders of their own territory (Rappaport 1968: 156), become an explicit 'currency' (tokens in Meggitt's term) for conducting the majority of extra-local relations. Greater significance of pigs in the latter sphere implies increasing coherence between the phenomena they relate, and conversely, a decline in the autonomy of local units to determine the use to which they are put, the level of effort invested in their production, and the extent of their impact on local resources (cf. Watson 1977).

On the relative intensity of pig husbandry in the Chimbu area

The previous section indicates that once broad, approximate,[12] relationships between the relative 'intensity' of pig management systems (i.e. in terms of standing crop measures of pig : human or pig : area ratios, the extent to which feral or wild pig populations are relied upon as sources of either piglets or breeding boars, and the size of pig rations), and population density and human impact on the environment have been 'mapped' (Baldwin 1978; Brown 1978; Bulmer 1968; Morren 1977), one area of interest rather quickly narrows to core areas of the central highlands with characteristically high population densities, intensive agriculture, generally high pig:human ratios (Brookfield with Hart 1971:111-114; Waddell 1972a,1972b), and a variety of forms of ceremonial exchange (Rubel and Rosman 1978; Ryan 1972; Strathern 1969; Yoshida 1972). However detailed comparative work at this level rapidly outstrips the available data on pig production and management.

Waddell, for instance, attempting to fit central Chimbu into a postulated evolutionary sequence of agriculture suggests that the apparent anomaly of their high human population density without agricultural intensification of the kind found among the Enga, may be related to a "lower pig population" and to the "seemingly reduced

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[12]Generalizations to the effect that lowland pig keepers do not feed agricultural productions to their animals (Rubel and Rosman 1978: 341) cannot stand scrutiny (Brookfield with Hart 1971:86-7; Oliver 1949:15-16). For important and interesting exceptions to other generalizations see also Bulmer (1976:171-2), and Schwartz (1963:75).

dependence (of pigs) on cultivated foods" (1972a:212; parenthesis added).[13] Though Waddell leaves open the question whether Chimbu pig production is (or was) in fact lower than that of the Enga,[14] Rubel and Rosman, apparently using the slightly less tentative version of his argument (Waddell 1972b), are less cautious. For them the Te makes the "greatest demands upon production" of the various exchange systems they examine (1978:345), and Chimbu is described as lacking the open field / mixed garden dichotomy of Enga (but cf. Brookfield 1973b), which they associate, without qualification, with a lower pig : human ratio (ibid.,343). Although a tempting correlation, such a statement is not warranted on the evidence they cite.[15] Comparative work at this scale requires

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[13]Alternatively, he saw Chimbu as either lacking terrain suitable for intensification or representing a "slightly different response to similar constraints" (1972a:212-213,1972b:27). However, recent investigations by Pain and Wood, cited in Howlett _et al_.(1976:84), indicate deposits of volcanic ash up to six metres deep in the Chimbu area. Perhaps Chimbu agriculture faced less environmental constraints than did that of the Enga (cf. Waddell 1973:48-9).

[14]His evidence was not only slim, but, in its presented form, a distorted version of the original sources (compare Waddell 1972a:212, with Brookfield and Brown 1963:58-9).

[15]This is harsh. An _a priori_ case can be made, assuming a regular four year Te cycle (but cf.Waddell 1972a:62,118), in contrast to 7-10 years for central Chimbu pig festivals. Further Feachem's data (1973), and that of Feil (1976:445), generally support Waddell's pig:human ratio. However, we have not yet subjected estimates of cycle periodicities - whether festivals or exchange events - to critical assessment given post-contact influence, nor begun to consider thoroughly the relations between the differing kinds of exchange forms and production levels. How commensurable, for instance, are a Chimbu-type pig festival, with extended hosting of dance groups etc., and a Chimbu-type 'food-pile' exchange, with Te-type events? I am also sceptical of Waddell's suggestion, on the basis of a difference between theoretical and actual levels of sweet potato production, of a maximum or optimum pig:human ratio (for a small Raiapu Enga sample) of 3.3:1 (1972a:117-20), in that estimating the former value as he does (continued over page)

information not only on pig:human ratios, but also on 'stocking rates' (i.e. pig:area ratios[16]), as well as discrimination on the size of animals, the kinds and amounts of land used for foraging (swamps and forest fringes, in particular, seem important; see Feachem 1973; Malynicz 1976; Waddell 1972a; Walker 1972), and per pig and per person inputs and outputs.[17] However, differences in the conditions and consequences of colonial incorporation mean that recovery of such data for a pre-colonial baseline is virtually impossible. Husbandry adaptations to changes in production contexts and goals introduce major new dimensions of variation partly demonstrated in this and other studies (Allen 1968; Brookfield 1973b; Malynicz 1976; Potter nd(a),nd(b); Strathern 1976), and intra-highland comparisons must recognize these limitations to the available data.

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[15](Continued from previous page) (yield times area under cultivation), smooths over differences in the age of crops in different parts of the 'area under cultivation' and thus runs the risk of inflating the estimate of potential production.

[16]Using Waddell's data, for instance, Chimbu emerges with a higher figure than Enga on this count.

[17]Cf. the discussion of the complexities of evaluating the intensity of cultivation in Melanesia in Brookfield with Hart (1971: 89-92), also Brookfield (1972). Bayliss-Smith's examination of the energy 'costs' and 'values' of pigs in three New Guinea locations is useful, though limited by the lack of data on pig production and a little cavalier in its disregard of the byproduct nature of substandard tubers (1977).

APPENDIX 1

The conditions and methods of research

Research conditions

Residence in Koge began on 17 September 1971 and continued until 8 May 1973. For the first two weeks while our house (a modified version of Koge houses), was under construction the Waula councillor kindly made his house available to us. With the exception of 10 days (between April 1972 -April 1973) spent working among the neighbouring Dom at Kagul (where my host was Aulakua Wemin of Dom Kumgau Barikane), two nights at Kundiawa during documentary research, and two nights at Koglai in central Chimbu, my residence at Koge was continuous throughout this period.

Members of Waula living at Koge and, to a lesser extent, those at other settlements, therefore took the brunt of our presence. The tightly packed clustering of houses, with our own adjacent to the men's house, meant that relations were close : neighbours included us in both their daily intercourse of visiting, discussion, and food-sharing, and in their participation in a dense web of inter-group (and inter-personal) relationships involving members from all the major Sinasina tribes, as well as some belonging to more distant ones. The extent of these relations outstripped our ability to compensate or return for every kindness or approach made to us. Certainly we tried : our house was, in the main, open, and most visitors could expect to share a cup of tea and probably a smoke. With immediate neighbours, our food sharing was intensive, we occasionally acted as letter writers, and we contributed small amounts of money and food for bride payments, compensations, and other purposes. Major gifts (i.e. of pork), were, whenever possible, balanced.

However, our resources and the characteristics of Koge restricted the returns we were able to make (at least by comparison with researchers working either in more isolated areas or with greater resources). In the first place we had no transport, a major disappointment to some. Secondly, the ready availability of aid-posts, or clinics, rendered any medical service, beyond the odd daub of Gentian's Violet and the occasional plaster, redundant. Thirdly, since the twice-weekly market at Koge offered a conveniently regular and wide-ranging variety of fresh foods, members of Waula did not enjoy a monopoly of supply to us. Further, in pursuit of a broad quantitative base for certain information, I frequently visited Waula members living outside Koge. To ensure finding someone 'at home', these visits were usually made in the early morning or late afternoon, hence coinciding with the preparation or consumption, of food, and it was the rare visit when food, and usually the best to hand, was not offered to me. By my standards, a twist of tobacco seemed little more than a token return for the readiness with which Waula families opened their concerns, and their larders, to a relative stanger (albeit a curious and, at least theoretically, powerful, yakru or European).

The major language used during research was pidgin english, since I did not acquire more than a shaky ear for the Nimai dialect of Sinasina at conversational speed. Although I necessarily used an increasing number of Nimai terms as research continued, the lack of a sound working knowledge of the language was nevertheless a major disadvantage. As a general rule, most men under 50 years of age, and women under 25, spoke or understood pidgin. However, with the exception of all communication with Europeans and persons from outside Chimbu, and council meetings, pidgin was not the everyday language.

Three Waula assistants were employed for the duration of research. Two men, Mui Kimin and Aina-Yauma Kora, worked alternate weeks with me as interpreters, guides, tutors and general assistants. A young woman, Anna Kiage Kawage, the first Waula member to attend high school, worked with us continuously throughout the 18 months, primarily as an interpreter and assistant to my wife. She was largely responsible for translating our extensive collection of taped materials. No domestic staff were employed. The only regular domestic task for which additional labour was 'hired' was water collection. This was undertaken by children, on an *ad hoc* basis, who were paid with marbles, when they were in fashion, or biscuits.

Relations with persons and institutions outside Waula were extensive. Other Nimai, and members of other Sinasina groups, presumably viewed us, on the basis of residence and participation, as affiliated with Waula. Visits were made to most Nimai men's houses for discussion of the general purpose of my work,recording of some historical and other oral material, and other general data collection. Individuals occasionally visited me at Koge. Close relations were maintained with the Catholic Mission at Yoba : these involved mutual visiting, meals and discussion. In addition, mission staff provided much invaluable assistance with transport, mail, and banking. Cordial relations were also enjoyed with the officer in charge at Kamtai (also, usually, the council advisor). He and other administration staff from Kamtai and Kundiawa occasionally visited us at Koge. I attended most of the monthly meetings of the Sinasina council, and came to know many of the 36 councillors, at least slightly. My acquaintance with the Sinasina MHA, Kobale Kale from the neighbouring Dinga, was closer, since he frequently passed through Koge, usually visiting the Waula men's house on our doorstep. During the course of visits to Kundiawa for documentary research, I met the staff of several administration departments and the manager of the Coffee Society : some, in turn, later visited us in Koge, usually during the course of their work in Sinasina. Other foreigners, whose visits to Koge would probably not have occurred without our presence there, included speliologists, anthropologists, a geographer, zoologists, a veterinarian, and an Australian Member of Parliament (the latter, and several others, was bedded down in the Waula men's house for the night, hopefully affording him a closer look at highland realities than is usual for parliamentary whistle-stop tours).

Besides participation, in the role of 'resident foreigner', in the social life of Waula at Koge, my active involvement, in public affairs, other than general discussion with many participants, was minimal. A few exceptions may be noted. In one case, following an early morning 'raid' by an armed police riot squad during which our neighbours' houses were, in my opinion, summarily entered and searched, I visited, in the company of Mui Kimin, police headquarters at Kundiawa to inquire whether such action had been authorised. I doubt if our visit did nore than add a further minor irritation to the already troubled waters of Police-Administration relations. In other cases, I offered (usually when asked) my opinions, on the basis of research in progress, on such matters as a council proposal to charge an entry fee to Koge market (not possible, I thought, since average takings were so low), an investigation into a site for the proposed high school (I argued against an offer by some Waula of some of their best level land at Iremil), and DASF inquiries about a proposed census of coffee-growers and the effects of the 1972 drought in Sinasina (concerning the latter, my comments at the time suggested less influence than was indicated by later, closer, analysis of some of my data though I do not think they presented an over-optimistic description of the Nimai situation).

Methods

In general I attempted to collect information at four hierarchical levels : household, clan, tribe and region. Nimai and Waula provided 'type' cases of the tribal and clan levels. At the regional and tribal levels I was nost dependent on documentary sources, especially for comparative and time-series data concerning demography, environment, economy and general historical change during the colonial period. Field research at the regional level was restricted to short visits through most of Sinasina, attendance at parts of the 1972 Tabari and Dom pig festivals and at the large food exchanges (komina bire) held between Kere and Dinga and within Tabari, surveys of Koge market (the largest within the region), and some study of the working of the Sinasina council. In addition, more detailed information from the three lower levels of organisation provided a partial basis for understanding the articulation of groups and individuals through marriage and exchange.

For the Nimai as a whole, field investigation was more extensive, including general mapping (using air photography and on the ground surveys of all settlement), visits to all men's houses to inquire into aspects of marriage relations and land use, the collection of botanical specimens from parts of the whole territory (see Hide _et al_.1979), and the keeping of 18 months of climatic records. The market study also allowed close analysis of Nimai marketing activity, both for the whole tribe, and, disaggregated, by clan. More fragmentary historical information was also collected on tape from selected individuals.

However, the major thrust of field research was devoted to members of the Waula clan (supplemented, as regards pig husbandry, with brief work among the Dom Kumgau Barikane). At this level, besides gathering material in a relatively _ad hoc_ manner as events occurred, I made use of a number of semi-formal surveys, some covering the whole clan, others focused on samples, to investigate specific topics.

APPENDIX 2

Nimai and Waula population data

The age-sex pyramids in Figs.3.1 and 3.2A and B are based on the data shown in Table A2.1. The Nimai data were taken from Sinasina population registers (for the period 1958-1969) held at the Muaina office of the Sinasina LGC. The total Waula population is based on my field census (which updated and revised the extant DDA material). The DDA estimated ages for persons born before 1969 were taken from the same register as the Nimai data. Ages for post-1969 immigrants and births were taken either from the subsequent DDA census (1971, register also held at Muaina) [1] or other sources (maternal health clinic cards, personal records, etc.). My estimated ages for Waula use the same data for post-1969 immigrants and births, and, for the pre-1969 period, are based on a review of the DDA estimates in the light of both personal information collected during household interviews (primarily estimates based on sociological time), and other, documentary material (Catholic Mission records).

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[1] Presumably created following temporary loss of the pre-1969 registers.

TABLE A2.1 <u>Nimai and Waula age distributions</u>

Age classes (yrs.)	Nimai 1969			Waula 1972 DDA estimate			Waula 1972 RH estimate			Waula Absentees		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
65+	26	16	42	4	4	8	4	3	7	–	–	–
60–64	30	20	50	4	3	7	10	3	13	1	–	1
55–59	57	51	108	13	5	18	14	12	26	4	2	6
50–54	73	52	125	14	12	26	13	11	24	2	–	2
45–49	76	78	154	11	12	23	7	9	16	–	1	1
40–44	79	90	169	10	7	17	9	7	16	2	–	2
35–39	63	45	108	5	9	14	8	8	16	3	1	4
30–34	41	40	81	4	5	9	4	12	16	2	–	2
25–29	48	53	101	16	15	31	13	8	21	6	2	8
20–24	127	95	222	16	9	25	14	8	22	7	2	9
15–19	92	73	165	12	10	22	14	11	25	5	3	8
10–14	107	94	201	22	15	37	20	14	34	2	1	3
5–9	123	125	248	15	16	31	16	16	32	1	3	4
0–4	142	130	272	21	13	34	21	13	34	2	2	4
	1084	962	2046	167	135	302	167	135	302	37	17	54

APPENDIX 3

Bride payment data

Information on the composition of 142 bride payments was collected during general interviews with adult men and women (the latter by C.Hide) of Nimai Waula. All were asked details of the payments made at their various marriages, which were approximately dated using sociological time during the interview. The 142 payments for which adequate data are available therefore include a mixture of first, second, and other marriages. Since payments for some marriages made by women before they married their present Waula husbands are included, the payments are not restricted to those made by Waula, but include transactions between several Sinasina groups. In the case of extant marriages, for which both spouses were available, information on the payments made was available from both. The two accounts, collected separately, usually showed reasonably close agreement. For the purposes of this analysis, they were combined and divided by two. In all other cases the source was a single partner only.[1]

For quantitative analysis of the changing occurrence of valuables the payments were grouped in five year periods (in some instances later aggregated to decades). Two measures of occurrence per period were used : the percentage (or, in some instances, the number) of payments including a particular valuable or category of valuables, and the average number of a valuable or category per payment. Table A3.1

[1] With the exception of four marriages during 1972-73. Information on their payments was obtained both by observation and interview.

TABLE A3.1 Occurrence of major items and categories of items in Sinasina bride payments

	Periods	1925-33	1934-38	1939-43	1944-48	1949-53	1954-58	1959-63	1964-68	1969-73
	No. of payments	8	25	26	24	16	11	12	10	10
Pigs	No. of payments including pigs	8	22	23	24	14	11	12	9	10
	Total no. of pigs	17	47	93	94	87	88.5	97	42.5	51
	Mean per payment	2.1	1.9	3.6	3.9	5.4	8.0	8.1	4.2	5.1
	Standard deviation	1.5	1.6	4.8	3.4	6.1	5.8	6.7	3.0	3.2
Plumes	No. of payments including plumes	2	4	8	8	7	9	11	8	6
	Total no. of plumes	3	7	31.5	24.5	17.5	64	68	75	138.5
	Mean per payment	0.4	0.3	1.2	1.0	1.1	5.8	5.7	7.5	13.8
	Standard deviation	0.7	0.8	3.1	2.0	1.5	10.4	4.4	6.5	14.0
Shell	No. of payments including shell	5	20	25	24	15	11	11	2	1
	Total shell items	9	75	201.5	164.5	172	116.5	140.5	2	0.5
	Mean per payment	1.1	3.0	7.8	6.8	10.8	10.6	11.7	0.2	-
	Standard deviation	1.1	2.6	6.2	4.5	11.0	6.9	11.3	0.5	-
Stone Axes	No. of payments including stone axes	5	22	13	8	5	1	-	-	-
	Total stone axes	10	41.5	20	10.5	7.5	1	-	-	-
	Mean per payment	1.2	1.7	0.8	0.4	0.5	0.1	-	-	-
	Standard deviation	1.7	1.4	1.0	0.8	0.9	0.3	-	-	-
Salt	No. of payments including salt	1	-	3	1	-	-	-	-	-
	Total salt	3	-	9	10	-	-	-	-	-
	Mean per payment	0.4	-	0.3	0.4	-	-	-	-	-
Fur	No. of payments including fur	2	-	2	1	-	-	-	-	-
	Total fur	2	-	4	1	-	-	-	-	-
	Mean per payment	0.2	-	0.2	-	-	-	-	-	-

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TABLE A3.1 Continued from previous page

	Periods	1925-33	1934-38	1939-43	1944-48	1949-53	1954-58	1959-63	1964-68	1969-73
	No. of payments	8	25	26	24	16	11	12	10	10
Steel Axes	No. of payments including steel axes	-	-	5	6	7	7	9	4	2
	Total steel axes	-	-	4.5	15	20.5	12	18.5	10	3.5
	Mean per payment	-	-	0.2	0.6	1.3	1.1	1.5	1.0	0.4
	Standard deviation	-	-	0.5	2.0	2.5	1.1	1.3	1.5	0.8
Bushknives	No. of payments including bushknives	-	-	3	4	7	6	5	4	2
	Total bushknives	-	-	3	8	7.5	14.5	9	11	2
	Mean per payment	-	-	0.1	0.3	0.5	1.3	0.8	1.1	0.2
	Standard deviation	-	-	0.3	1.0	0.7	1.4	1.1	1.7	0.4
Shovels	No. of payments including shovels	-	-	-	-	1	4	5	7	1
	Total shovels	-	-	-	-	1	3	10	17	1
	Mean per payment	-	-	-	-	0.1	0.3	0.8	1.7	0.1
	Standard deviation	-	-	-	-	0.2	0.4	1.2	1.5	0.3
Blankets	No. of payments including blankets	-	-	-	-	2	4	7	6	3
	Total blankets	-	-	-	-	2.5	8.5	13	18	8.5
	Mean per payment	-	-	-	-	0.2	0.8	1.1	1.8	0.8
	Standard deviation	-	-	-	-	0.4	1.4	1.0	1.9	1.4
Money	No. of payments including money	-	-	-	1	1	9	11	10	10
	Total money ($)	-	-	-	2.0	10.0	475.0	786.0	626.0	793.0
	Mean per payment	-	-	-	0.1	0.6	43.2	65.5	62.6	79.3
	Standard deviation	-	-	-	-	-	66.6	52.7	19.5	32.2

shows the basic data for all major items or categories, while Tables A3.2 and A3.3 provide breakdowns of the two composite categories of shell and plumes into species subdivisions.

There are several reasons why these data should be interpreted cautiously. Faulty recall is an obvious possibility in the case of recollected payments (cf.Goody 1969), perhaps increasing with the time lapsed since the payment was made. Further, the reliability of persons who as young grooms or brides may have played only minor public roles in the collection, transfer and distribution of the valuables composing a payment, may be questioned. I believe, but cannot demonstrate, that the influence of such factors on memory are probably diminished by the salience of marriage as an event in an individual's life, the continuing significance of affinal exchanges, and the importance, especially to a young man, of the state of his debts and credits amongst fellow group members.

The discreteness of a recollected payment may also be questioned. While it is true that most marriages are marked by a distinct bride payment, these usually form only one of a sequence of transfers between the two sets of relatives. It is therefore possible that an informant might aggregate a number of items which were, in fact, given over a considerable period of years. Though this is a possibility, it did not appear to be a significant problem.

The form of some valuables is clearly problematic for accurate quantitative analysis. Some, like pigs, large plumes, axes, and large shells, generally present no difficulties for enumeration as units.

TABLE A3.2 Occurrence of shell items in Sinasina bride payments

	Periods	1925-33	1934-38	1939-43	1944-48	1949-53	1954-58	1959-63	1964-68	1969-73
	No. of payments	8	25	26	24	16	11	12	10	10
Pearl shell	No. of payments including shell	4	15	23	21	15	10	10	2	1
(Pinctada maxima)	Total shell items	4	23.5	65	70.5	77.5	66	95.5	2	0.5
'ogan'	Mean per payment	0.5	0.9	2.5	2.9	4.8	6.0	8.0	0.2	-
	Standard deviation	0.5	1.1	2.1	2.9	4.5	5.3	6.6	0.5	-
Dog whelks	No. of payments including shell	3	11	19	16	11	10	7	-	-
(Nassa spp.)	Total shell items	3	20	67.5	46.5	49	34	42.5	-	-
'nin'	Mean per payment	0.4	0.8	2.6	1.9	3.1	3.1	3.5	-	-
	Standard deviation	0.5	1.1	4.4	2.4	4.6	2.7	6.0	-	-
Cowries	No. of payments including shell	1	11	19	19	7	4	-	-	-
(Cypraea spp.)	Total shell items	1	22.5	57.5	40.5	24	7	-	-	-
'mare'	Mean per payment	0.1	0.9	2.2	1.7	1.5	0.6	-	-	-
	Standard deviation	0.4	1.4	2.5	1.6	3.0	1.3	-	-	-
Green snail	No. of payments including shell	1	7	9	7	10	5	1	-	-
(Turbo marmoratus)	Total shell items	1	8	11.5	7	18.5	9.5	2.5	-	-
'derna'	Mean per payment	0.1	0.3	0.4	0.3	1.2	0.9	0.2	-	-
	Standard deviation	0.4	0.6	0.7	0.5	1.5	1.2	0.7	-	-
Baler shell	No. of payments including shell	-	1	-	-	1	-	-	-	-
(Melo spp.)	Total shell items	-	1	-	-	3	-	-	-	-
'maidibe'	Mean per payment	-	-	-	-	0.2	-	-	-	-

TABLE A3.3 **Occurrence of plumes in Sinasina bride payments**

	Periods	1925-33	1934-38	1939-43	1944-48	1949-53	1954-58	1959-63	1964-68	1969-73
	No. of payments	8	25	26	24	16	11	12	10	10
Red Bird of Paradise	No. of payments including plume	-	2	7	4	6	7	10	4	2
(*Paradisaea raggiana*)	Total no. of plumes	-	2.5	27.5	15	15	26	45	9.5	2
'baune'	Mean per payment	-	0.1	1.1	0.6	0.9	2.4	3.8	1.0	0.2
	Standard deviation	-	0.4	3.0	1.6	1.4	2.4	2.7	1.5	0.4
Black and Brown Sicklebills	No. of payments including plume	-	1	-	3	1	1	5	2	6
(*Epimachus* spp.)	Total no. of plumes	-	1	-	3	0.5	1	6	3	13
'sine'	Mean per payment	-	-	-	0.1	-	0.1	0.5	0.3	1.3
	Standard deviation	-	-	-	0.3	-	0.3	0.7	0.8	1.9
Princess Stephanie's Bird of Paradise	No. of payments including plume	1	-	-	2	-	3	4	6	6
(*Astrapia stephaniae*)	Total no. of plumes	1	-	-	3.5	-	14.5	15.5	36	48
'mile'	Mean per payment	0.1	-	-	0.2	-	1.3	1.3	3.6	4.8
	Standard deviation	0.4	-	-	0.6	-	2.8	2.0	3.6	4.3
Yellow Bird of Paradise	No. of payments including plume	-	1	1	1	-	-	-	1	3
(*Paradisaea minor*)	Total no. of plumes	-	2	2	1	-	-	-	2	5
'yobale'	Mean per payment	-	0.1	0.1	-	-	-	-	0.2	0.5
King of Saxony Bird of Paradise	No. of payments including plume	-	-	-	-	-	-	-	-	2
(*Pteridophera alberti*)	Total no. of plumes	-	-	-	-	-	-	-	-	8
'sirua'	Mean per payment	-	-	-	-	-	-	-	-	0.8
Lories	No. of payments including plume	-	-	-	-	-	1	-	3	5
'kal'	Total no. of plumes	-	-	-	-	-	20	-	22.5	39.5
	Mean per payment	-	-	-	-	-	1.8	-	2.2	4.0

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TABLE A3.3 Continued from previous page

	Periods	1925-33	1934-38	1939-43	1944-48	1949-53	1954-58	1959-63	1964-68	1969-73
	No. of payments	8	25	26	24	16	11	12	10	10
Hawks	No. of payments including plume	-	-	1	1	1	-	2	-	-
'siba'	Total no. of plumes	-	-	2	1	1	-	1.5	-	-
	Mean per payment	-	-	0.1	-	0.1	-	0.1	-	-
Parrot	No. of payments including plume	1	1	-	-	-	1	-	1	4
'kawale'	Total no. of plumes	1	1	-	-	-	2.5	-	2	18
	Mean per payment	0.1	-	-	-	-	0.2	-	0.2	1.8
Other (cassowary, hornbill)	No. of payments including plume	1	1	-	1	1	-	-	-	2
	Total no. of plumes	1	1	-	1	1	-	-	-	5
	Mean per payment	0.1	-	-	-	0.1	-	-	-	0.5

[(1)] Note to Table A3.3

Nimai bird names are not of course always identical with zoological species. The Nimai terms listed here and elsewhere (Fig. 4.4, Tables 4.2, 4.3) are, I believe, the terms most commonly used by Nimai when referring to plumes or skins used for self-decoration or transferred in prestations and trade, at least in conversation with myself. As Bulmer has noted, informants are likely to respond at the level of knowledge shown by the investigator (1969:11), and it is therefore relevant that my ornithological knowledge is limited and ethno-zoology was not a major focus of research. The glosses given Nimai terms here should thus be considered provisional only, and the following points may be useful for clarification of their status.

I am confident that the terms mile (Princess Stephanie's Bird of Paradise), kenil (Superb Bird of Paradise), sirua (King of Saxony Bird of Paradise), baune (Red Bird of Paradise), and yobale (Yellow Bird of Paradise) are glossed accurately, though additional terms are applied by Nimai, for instance in the case of mile and baune, to distinguish sexes and mature from immature specimens. In the cases of (kure)bal and (kure)bire, kure is a prefix meaning roughly 'plume used as ornament'. It is fairly common, but I believe optional, before mile, baune, and other terms, but seems to appear invariably before -bal and -bire. While the latter is the only term heard applied to the hornbill, the former is only one of several used for cassowaries, depending upon (I think) their origin (the south or the Jimi, via Wahgi groups), maturity and colour. While -bal seems to be applied invariably to cassowary headdresses, obekobia is the more common collective term for them as birds. Both the Black and Brown Sicklebills are (I think) included in the term sine and, again, there are a number of additional terms which contrast such characteristics as tail length and colouring. Just as Sinasina often pair the names of social groups to refer to a wider grouping, so too are the long black tails (Princess Stephanie's Bird of Paradise and the Sicklebills) often referred to jointly as sine-mile. My uncertainty increases with the terms kal and kawale. Though each is applied respectively to the Papuan Lory and the Pesquet's Parrot, each, almost certainly, can refer to the skins and feathers of other lories and other large parrots. In the case of kawale this may be related to the ways in which parrot feathers are used in headdresses. Small, soft, red (breast?) feathers, sewn on strips of bark cloth (today cotton cloth), are used as a forehead fringe and referred to as kure-, or kawale-, mabile, the latter term meaning forehead. Above this fringe, a cane-based circlet holds either red or black parrot wing feathers protruding horizontally, usually referred to as kawale-ogale. This circlet may also however be decorated with the yellow crest feathers of the Sulphur-crested Cockatoo (anga, in Nimai). The final term siba is also problematic. It does not include all the raptors. Informants say there are two kinds of siba, one which is occasionally seen over the high forest in Sinasina, and a larger one restricted to areas south of the Wahgi, from where its plumes are traded. A better gloss might be "eagles or large hawks".

Others, especially small shells such as cowries and dog whelks, are of course another matter, since they could be given in various forms ; i.e. as varying quantities sewn on strips of bark, or other, cloth, or ready-made as ornaments. I have taken no account of such complexity here, and have simplified drastically by treating any mention of, for instance, dog whelks, whether in the form of a forehead bandeau or a simple cloth 'rope', as a single 'unit' of this particular species. The only other items of which the units may have been subject to some variation [2] are probably some of the plumes given as prepared head-dresses (i.e. hawk and parrot feathers). Occasionally an informant said that he, or she, did not remember the quantity of an item given, or mentioned only that there had been many. All such cases I again treated as a single unit of the item in question.

This account of some of the difficulties involved in creating time-series data from recollected evidence indicates that it would be unwise to place too great weight on the accuracy of some of the averages. Nevertheless, I believe that if the material is seen in relative rather than absolute terms, the reconstruction is worthwhile.

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[2] Leaving aside questions of size and quality (i.e. several Waula pointed out that pearlshell in the early payments was not whole shells but only pieces).

APPENDIX 4

The effects of interbreeding on pig productivity

The present Sinasina stock displays considerable variation in such characteristics as colouring, shape, and numbers of teats (see Table A4.2 below). Interbreeding between local stock and introduced 'British' [1] pigs held by government and missions began in a small way in the 1930s and continued, on an increasing scale, throughout the colonial period. Whether cross breeding has altered such basic productive parameters of pig husbandry as growth rates, litter size, and mature weight, and, if so, to what extent, are questions which, although of obvious significance, are by no means easy to answer on the basis of present information. A brief discussion of some of the issues may help to clarify the apparent contradictions in the existing literature and justify my opinion that marked change in performance has not occurred.

Firstly, the extent of interbreeding in the Chimbu area can be briefly reviewed.[2] Although there were no Agricultural Officers in Chimbu before the war, some European breeds of pig were imported by the Missions and by Administration officers (Downs,MR,December 1939,p.3). Until at least 1940 the government was apparently dependent for fresh meat upon trade with Chimbu producers. In 1938, 5 months of records

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[1] This label is borrowed from Malynicz (1973a). The breeds most commonly mentioned are Tamworth and Berkshire in the early years (see below), with the addition of Large Black later (Malynicz ibid.,16).

[2] Malynicz (1973a:16,20) briefly describes official Government policy and action following World War 11, but does not mention earlier interbreeding.

indicate that Kundiawa was purchasing as many as 220-230 pigs annually (Table A4.1). Two years later station requirements, excluding patrol consumption, were estimated at 240 pigs annually (Downs, MR October 1940,p.2). In December 1939, however, Downs started a pig farm at Koge in the territory of the Sinasina Nimai (see pp.213-7) with the aim of making the government self-sufficient in meat (Downs,MR December 1939, p.3). Two Tamworth sows and a Berkshire boar, the latter from D.J.Leahy at Hagen, were obtained, to be crossbred with local stock (Downs,MR December 1939;p.3,MR October 1940,p.2;PR,23 Sept.-17 Oct.1940,p.6). "It has", Downs noted, "been established that the crossbred pig grows to a large size in a very short time and is a very hardy animal" [3] (Downs,MR October,1940 p.2).

Local stock were obtained by trade (Downs,PR 1-9 July,1940,p.6) as 'tribute', for which the government gave a return, and were also impounded as a group sanction to punish fighting (PR 19-31 May 1940 p.5). By May 1940, some 53 pigs were held on the pig farm (Downs,MR May 1940, p.1). Five months later, not only was Kundiawa "completely self-supporting" in food crops, but "the number of pigs on the station, at the 3 base camps (i.e.Chuave, Gogolme, Awagl), at the pig farm in Numai (i.e.Koge), and farmed out to individual natives" totalled 158 (Downs,MR October 1940,pp.1-2). By this date apparently none of the

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[3] By the missions, Leahy at Hagen, or both ? Nilles, who reported that pre-1943 Catholic imports were also Berkshire and Tamworth breeds, noted that crossing with local pigs was "...a great success, the offspring being both larger and stronger. After about three years the natives were anxious to obtain the service of the white boar, for the 'cross' was larger and would more easily withstand the epidemics" (1943:2). Nilles was based at the head of the Chimbu valley.

TABLE A4.1 Government pig stocks, purchase and slaughter rates at Kundiawa, (March - June 1938). (1)

Date Month/Week		Pigs on hand (means) (2)	Purchased	Killed	Lost	Sold
Feb.	28	19	-	-	-	-
March	1-7	18.7	4	3	-	-
	8-14	17	3	4	-	-
	15-21	13.5	2	3	-	6 (3)
	22-28	10.7	5	3	-	-
	29-31	9	2	2	1	-
April	1-7	13	7	4	-	-
	8-14	13.5	3	1	-	-
	15-21	9.7	1	4	-	-
	22-28	9	2	2	-	-
	29-30	7	-	3	-	-
May	1-7	5	-	3	-	-
	8-14	1.7	2	2	1	-
	15-21	2.7	2	3	-	-
	22-28	4.2	7	4	-	-
	29-31	7.5	6	-	-	-
June	1-7	9.6	5	4	-	-
	8-14	12	3	4	-	-
	15-21	12.3	10	5	-	-
	22-28	13.3	12	21	-	-
	29-no data					
(July	18	16)				
1 Mar.-28 June	Total	10.2	76	75	2	6
	Weekly Mean		4.4	4.4	0.1	0.3
	Month Mean		18.7	18.7	0.5	1.5
	Annual (projected)		229	229	5	16

Notes over page.

TABLE A4.1 (notes)

(1) Source: Kundiawa Station Diary 1938. Titled "Pig Account", these data were recorded at the back of the 1938 Diary in 6 columns; date, "No. on hand", bought, killed, sold, and balance. The "No. on hand" column recorded (usually) the circumstances of a transaction, i.e. the name of the group from which a pig was purchased. There were a total of 66 entries not counting the first and last "on hand" figures. With the exception of a missing 3 pigs in March the record seemed complete.

(2) The February 28 and July 18 figures are single entries of stock on hand only; all the others were calculated by summing the balance figures for the period concerned and dividing by the number of entries.

(3) Sold to the Catholic Mission at Dimbi (known as Mingende).

crossbred boars had been sent out from Kundiawa to either the outlying base camps or Koge (ibid.), and it is unclear whether they ever were sent for Downs left Chimbu on 15 November (Kundiawa Station Diary 1940). In short, given the size of the population concerned, the numbers of pigs, and the duration of breeding by both sexes before slaughter, it is unlikely that crossbred pigs were common before the early 1940s, except perhaps in the immediate vicinity of mission stations.

Government self-sufficiency lapsed during the war (Dennis CPR 11, 1944/45,p.2; Costelloe,Special Report 2,1947/48,p.5; Kelaart,CPR 2, 1951/52,p.16), and whatever interbreeding occurred until the late 1940s was probably the result of pre-war introductions. From the early 1950s, however, crossbred stock became increasingly available. Colman, who visited both the Catholic Mission at Koge and the SDA station at Kumul (8 km to the east) in 1954, noted seeing "some very good pigs...particularly the cross between the native and the European pig" (CPR 4,1954/55,p.7). Three years later, in the upper Chimbu Valley Montgomery, an agricultural officer, reported that the pigs showed "strong indications of improved breeding by European strains, particularly Berkshires" (1960:7). Purchases from missions are reported by Brookfield and Brown (1963:57), though they were probably not common until cash from coffee sales became increasingly available in the early 1960s. In Sinasina there is little information on the early 1950s, but records for 1963-71 from the Catholic Mission at Koge show a total of 84 sales over 9 years (Agricultural Returns). Even if these were all sold in Sinasina, and all used for breeding purposes (which is unlikely), this is still not a large influx into a region of some 25,000 people, with almost as many pigs. By 1972, some Sinasina pig owners also took their sows to be mated with Mission boars. By the late 1960s the Government programme of distributing either purebred or crossbred pigs (with at least three-quarters 'British' blood, according to Malynicz 1973a:20), to rural owners was an additional, though probably smaller, source of new stock.

Observers differ strongly in their views of the effects of such interbreeding. According to Brookfield and Brown,

> "In recent years the Agriculture Department and the missions have kept boars of superior stock, and also charge for their services. Missions sell piglets of European varieties for £5 or more. As a result there has been a considerable improvement in the type, size and weight of Chimbu pigs since pacification" (1963:57).

Shannon, however, discussing a village adjacent to the town of Goroka considers that "...the position of the pig has not changed markedly, genetically (or) in husbandry methods..." (1971:14). These two views roughly approximate "nature" and "nuture" positions. For Brookfield and Brown, an infusion of "superior" blood results automatically in "improvements" in pig type, size and weight. Husbandry is irrelevant. Shannon finds little change in either factor, and implies a relationship between them. To pursue the question further I badgered Bergmann and Nilles, both missionaries with over 30 years experience in Chimbu, for their opinions.

For Nilles, interbreeding has been so extensive that today "hardly any" pure native stock remains (pers.comm.,12 Aug.1974).[4]

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[4] Cf. Williams (1975:12) "A new boar arrived at Denglagu every year and after a few years there were no 'pure skinny native pigs' in that area" (perhaps citing Nilles?).

Pure-bred imported stock, he stressed, did poorly in Chimbu due to a lack of protein. Bergmann, on the other hand, interpreted his failure to introduce, and maintain, pure-bred stock as due to the husbandry practices of the Chimbu (pers.comm.,14 Sept.1974). Those who obtained imported sows "...bred them with their old boars and if they had (imported) boars they soon castrated them. I have seldom seem a good boar bigger than 120-150 lbs (54-68 kg)". Given the undeniably poor performance of pure imported stock under conditions of village husbandry (Malynicz 1973a), it is possible to interpret such actions more positively as evidence of Chimbu understanding that pure breeds simply lacked the hardiness to cope with their husbandry conditions. What though of the resulting cross-bred animals ? Did they represent an "improvement" ?

Definitely, according to Nilles, who cites their better "quality" and faster growth (ibid.), and their greater size, strength, and resistance to disease (1943:2). For Bergmann, however, there was no "marked difference", though he considered that growth was "perhaps speeded up a little but not much" (ibid.), and noted elsewhere that litter size increased (1971,Vol.2,p.113). As regards mature size, the present interbred pig, in Nilles' view, grows to a larger size than the original native stock, and he notes that he "never saw a native pig killed of 400 lbs (181 kg), possibly 300 lbs (136 kg), 6-7 years old" (ibid.). Bergmann, however, disagrees, stating that Chimbu pigs were larger in the 1930s than in more recent years : "(a)s it is the pride of a man to offer the biggest pig, they saw to it that they were big. I never really measured them, but...(the) biggest pigs I ever saw...(were) in the years 1935-1936. The biggest ones were well over 200 kg" (ibid., and see also 1971,Vol.2,p.110). Allowing for the imprecision of visual weight estimates, it is possible to reconcile these two views by reference to the circumstances of each man's location in Chimbu. Bergmann preceded Nilles into the region by four years and was based at c.1500 m among the Kamanuku. Nilles on the other hand was resident high up the Chimbu valley at Denglagu at c.2400 m, and it is not unreasonable to expect that fattened animals could have achieved greater final weights at the lower altitudes as a result of larger sweet potato yields (and warmer temperatures ?). Trials in the 1960s, for instance, suggest yields of 22-26 tonnes/ha/year from below 2286 m, by comparison with only 15-17 tonnes from above this altitude (TPNG 1967:10; see also Nilles' own comment on this contrast, 1943:106).

What then can we conclude about "improvements"? Whether inter-breeding has been as extensive as Nilles suggests, resulting in almost no pure native stock remaining today, is a question only genetic research can answer in detail. As a partial substitute, some information on the present type of Sinasina pig, as indicated by the colouring and teat numbers of a small non-random sample of Waula female pigs, is given in Table A4.2. This,however, is evidence, not of the existence of "pure native stock", but of the distance separating current Sinasina stock from commercial standards : three-quarters of the sample had less than 12 teats whereas the U.K.National Pig Breeders' Association insists on a minimum of 12 before registration, although most farmers consider 14 as desirable (Godwin 1973:86). It reveals little or nothing about "improvement" from a pre-colonial base.

TABLE A4.2 Teat numbers, and colouring, of 53 Waula female pigs:(1) compared with a small sample from the British Solomon Island Protectorate(2)

	Waula pigs								B.S.I.P. pigs	
Colour	Agoutie		Patchy		Black		Totals		Total	
Teat Numbers	no.of pigs	%	no.of pigs	%	no.of pigs	%	no.of pigs	%	no.of pigs	%
9	1	5	-	-	-	-	1	2	-	-
10	14	70	9	56	7	41	30	57	17	68
11	2	10	3	19	4	24	9	17	-	-
12	3	15	3	19	5	29	11	21	5	20
13	-	-	1	6	1	6	2	4	1	4
14	-	-	-	-	-	-	-	-	2	8
Totals	20	100	16	100	17	100	53	100	25	100

(1) A non-random sample of 38 percent of all females owned in April 1973.

(2) Source: de Fredrick 1971:57, Table 8.

A distinction between potential and performance, the former determined by genetic inheritance, the latter resulting from the relationship between biological potential and husbandry conditions, must be emphasised. Interbreeding has certainly altered the potential of New Guinea pigs, according to experimental research, which has shown increases in litter size, and in growth rates (Anon.1970, Purdy 1971, Malynicz 1973b, Malynicz n.d.). Such 'improvements', however, have been realised under conditions of commercial husbandry, in particular feeding regimes including large daily quantities of energy and protein foods. The significance of this for evaluating contemporary Sinasina performance is obvious : unless it can be shown that husbandry methods, in particular feeding regimes, were improved between the 1930s and the early 1970s, it is unlikely that, despite a possible change in average potential, a change in average performance can be sustained. This is a position essentially similar to that taken by Kerridge in his discussion of the origins of the English farming 'countries', "...the character of a country was formed largely through its livestock. What these originally were and later became depended on the way they were managed and mostly on the way they were fed. This is what farmers meant when they said, 'All breed is put in at the mouth' " (1970:70). Dr.R.Barrett, who has conducted field studies of feral pigs in California and northern Australia, writes similarly, "(e)ven if there was a significant influx of introduced breeds I doubt very much whether such would, or could, react any differently to the severe nutritional stresses which are so obvious in your situation" (pers.comm.,6 March 1975). Malynicz also concludes that "(c)onsiderable changes in nutrition and management will be required before exotic pigs can be expected to be more productive than their indigenous contemporaries" (1973a:21; cf.Purdy 1971).

Nevertheless I should note that this assessment runs contrary to ethnographic orthodoxy, as exampled by Brookfield and Brown (above). Some other examples from, respectively, the New Guinea Highlands, Bougainville, and Tahiti, may be cited. According to Meggitt (pers. comm. 17 November 1974),

> "In 1955 Enga herds were relatively unaffected by interbreeding with European pigs. The nearest 'foreign' breeding stock was then in Hagen, not yet connected by road with Wapenamanda/Wabag, and few Enga at that time had money or the inclination to buy European pigs. I estimate that then there were fewer than 50 European pigs in the central Enga area, that is, among a local pig population that must have exceeded 30,000. Enga pigs then struck me as markedly small and thin in general, scrofulous, and apparently slow growing -(they) seemed to be riddled with worms and other parasites (Enga Medical Assistant's judgement)-(and) anthrax was endemic. Now in (the) 1970s, following DASF and Lutheran programs of disseminating European or 'half-breed' (from Goroka ?) stock, one can see a marked increase in overall size and fatness, but the 'foreign' pigs remain highly vulnerable to local influences and death rates among them are high."

On Bougainville according to Oliver (1973:59), "Older people recall those times with feeling : how great was the excitement that prevailed upon first sight of the superior animals and how longingly every adult tried to obtain one of its offspring....It is certainly obvious that the new mix-breed animal is a great improvement in size and succulence over the old...".

In the case of Tahiti, both Oliver (1974:271) and Maude (1968: 178) note that early reports comment on the small size of Tahitian pigs. Seven years after discovery in 1767, Boenechea left some fine hogs on the island as a present from the King of Spain and later observers remarked upon the greatly improved breed (Cook), or the disappearance of the old breed (Bligh, only 10 years later). When the pork trade to Sydney started in 1793 the new type of hog, weighing up to 200 lbs, was admired, and by 1793, pigs of up to 340 lbs are reported.

A similar debate, in a different historical context, appears in the discussion concerning the effects of imported stock on pigs in the American South before the Civil War. Contra Genovese, who, finding little intensification of husbandry, argues the negative case (1962: 147), Hilliard sees an overall rise in pig quality (1972:97).

APPENDIX 5

Nimai marriage relations

This appendix supplements the summary evidence (Table 4.6) in Chapter 4. Table A5.1 shows the natal group, or region of origin, of the spouses of both male and female members of Waula clan, with three time-periods distinguished. The range of intermarrying groups, or regions, is divided into four major subcategories : Nimai (i.e.intra-tribal), 'close' groups (tribes whose borders adjoin Nimai territory), 'far' groups (those whose territories are separated from the Nimai by one intervening group), and a residual category of more 'distant' regions. In terms of straight-line distance, all intra-tribal and most 'close' marriages fall within a radius of 6 kms (Gunangi being the major exception since much of their territory lies just outside this distance), most marriages with 'far' groups fall within 10-15 kms, and those with 'distant' regions over 15 kms.

Table A5.2 presents similar data, though restricted to extant wives only, for all Nimai clans. Whereas the Waula information is complete, that for the other clans is not, covering approximately 70-75 per cent of their total members.(The non-Waula data was collected during evening visits to all the mens' houses of other Nimai clans, and though no attempt was made to take a random sample there is no reason to think that it is systematically biased).

There are two other sets of published data on the distribution of marriages in the central and northern part of the Chimbu Province (Brown 1964:340-343, also reproduced in Brown 1969: Table 1,pp.86-7;

TABLE A5.1 Waula marriage relations in historical perspective: natal origins of Waula spouses.

Groups/ regions	WIVES MARRIED BY WAULA MEN						HUSBANDS MARRIED BY WAULA WOMEN					
	1900-1944		1945-73		Extant 1973		1900-1944		1944-73		Extant 1973	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Nimai	-	-	8	13.3	8	10.1	-	-	9	15.8	9	11.0
Dinga	27	26.7	10	16.7	10	12.7	17	25.0	6	10.5	12	14.6
Kere	8	7.9	8	13.3	9	11.4	7	10.3	2	3.5	5	6.1
Tabari	27	26.7	9	15.0	11	13.9	6	8.8	9	15.8	12	14.6
Dom	20	19.8	9	15.0	14	17.7	15	22.0	10	17.5	16	19.5
Gunangi	17	16.8	5	8.3	15	19.0	11	16.2	1	1.7	4	4.9
Close groups subtotal	99	98.0	41	68.3	59	74.7	56	82.3	28	49.1	49	59.8
Kebai	-	-	1	1.7	1	1.3	-	-	-	-	-	-
Chuave/Elimbari	-	-	1	1.7	1	1.3	-	-	1	1.7	1	1.2
Yongamugl	-	-	-	-	-	-	-	-	1	1.7	1	1.2
Kia/Golun	2	2.0	3	5.0	5	6.3	10	14.7	-	-	3	3.7
Other South Wahgi (groups)	-	-	4	6.7	3	3.8	2	2.9	1	1.7	2	2.4
Far groups subtotal	2	2.0	9	15.0	10	12.7	12	17.6	3	5.3	7	8.5
Other Chimbu	-	-	1	1.7	1	1.3	-	-	5	8.8	5	6.1
East. H'lands	-	-	-	-	-	-	-	-	1	1.7	1	1.2
West. H'lands	-	-	-	-	-	-	-	-	2	3.5	2	2.4
Coast	-	-	1	1.7	1	1.3	-	-	9	15.8	9	11.0
Distant regions subtotal	-	-	2	3.3	2	2.5	-	-	17	29.8	17	20.7
Totals	101	100.0	60	100.0	79	100.0	68	100.0	57	100.0	82	100.0

TABLE A5.2 Natal origins of wives of Nimai men: by clan of husband (1972-73)

Clan of Husband	Bomai		Dugul		Waula		Ogole		Total Nimai	
Wife's group/region of origin	No.	%	No.	%	No.	%	No.	%	No.	%
Nimai clans										
Bomai	-	-	13	9.1	8	10.1	2	4.5	23	5.4
Dugul	14	9.0	-	-	-	-	3	6.8	17	4.0
Waula	7	4.5	-	-	-	-	-	-	7	1.7
Ogole	2	1.3	3	2.1	-	-	-	-	5	1.2
Nimai subtotal	23	14.7	16	11.2	8	10.1	5	11.4	52	12.3
Dinga	18	11.5	29	20.3	10	12.7	6	13.6	63	14.9
Kere	24	15.4	17	11.9	9	11.4	5	11.4	55	13.0
Tabari	20	12.8	16	11.2	11	13.9	11	25.0	58	13.7
Dom	25	16.0	40	28.0	14	17.7	6	13.6	85	20.1
Gunangi	26	16.7	8	5.6	15	19.0	3	6.8	52	12.3
Close groups subtotal	113	72.4	110	76.9	59	74.7	31	70.4	313	74.2
Kebai	1	0.6	2	1.4	1	1.3	-	-	4	0.9
Chuave/Elimbari	2	1.3	1	0.7	1	1.3	-	-	4	0.9
Yongamugl	2	1.3	-	-	-	-	-	-	2	0.5
Kia and Golun	6	3.8	5	3.5	5	6.3	6	13.6	22	5.2
Other S. Wahgi (groups)	1	0.6	7	4.9	3	3.8	2	4.5	13	3.1
Far groups subtotal	12	7.7	15	10.5	10	12.7	8	18.2	45	10.7
Other Chimbu	6	3.8	1	0.7	1	1.3	-	-	8	1.9
East.Highlands	-	-	1	0.7	-	-	-	-	1	0.2
West. Highlands	2	1.3	-	-	-	-	-	-	2	0.5
Coast	-	-	-	-	1	1.3	-	-	1	0.2
Distant regions subtotal	8	5.1	2	1.4	2	2.5	-	-	12	2.8
Totals	156	100.0	143	100.0	79	100.0	44	100.0	422	100.0

and Hatanaka 1972:19). Hatanaka's Sinasina data includes 105 marriages of some members (19 F,86 M) of one Gunangi subclan (total population 300) in 1969. Although of particular interest in the present context since it refers to south Sinasina, her information unfortunately cannot be directly compared with that from Waula since the marriages of female members are clearly incomplete, it is not stated whether the marriages are extant, and a large number of marriages classed as with "Kere" could refer either to the northern Sinasina group of that name or to the similarly named group immediately south of the Gunangi across the Wahgi. However, it may be noted that 39 (45.3 per cent) of the 86 marriages of male members were intra-tribal, a far higher proportion than among the Nimai (but Gunangi is a much larger tribe).

Brown's data are much more extensive, including 656 marriages of male members of three clans belonging to the Naregu tribe. The marriages are divided, for two of the clans, into two categories : those contracted by "previous" generations, and those by the "present" one (the data refer to 1958-64). Totalling all marriages, Brown found a high proportion (44.1 per cent) of intra-tribal marriages, and a similar proportion (46.3 per cent) with 'near' tribes. The major change between the two generations was an increase in recent intra-tribal marriages (1964:340). Marriages within these two categories mostly fell within a distance of six miles (9.6 km). Unions with "other" Chimbu groups were few for both generations (6.7 per cent overall), and those with more distant groups rare (2-3 per cent for both generations). At this relatively early date she reported "...a few - often temporary - marriages of local women to men from other parts of Papua New Guinea who work in Chimbu" (ibid., 343). It would be particularly interesting to have some updated figures from Naregu to determine the extent of change in the past 15-20 years.

To complete this summary of materials, and as background documentation for the pattern of pig exchange described in Chapter 8, Table A5.3 shows the distribution of the wives of 29 members of the Barikane subclan of Dom Kumgau at Kagul.

TABLE A5.3 Natal origins of wives of Dom Kumgau Barikane men (1972)

Wife's group/ region of origin	No. of wives	Per cent
Dom (Sinasina)	3	10.3
Dom (west Waghi)	2	6.9
Era	4	13.8
Kia	2	6.9
Gunangi	2	6.9
Nimai	5	17.2
Dinga	3	10.3
Close groups subtotal	18	62.1
Yongamugl	1	3.4
Tabari	4	13.8
Kere (north)	2	6.9
Golun	1	3.4
Far groups subtotal	8	27.6
Totals	29	100.0

APPENDIX 6

The Koge sample: Household characteristics and survey details

For intensive investigation of labour allocation, production, distribution, cash use, and other socio-economic questions, a small sample of ten households belonging to the Nimai Waula clan was used. The size of this sample, and the form of the activity survey, were modelled on earlier work by Waddell (Waddell and Krinks 1968; Waddell 1972a). This appendix describes in detail the sample and the methods used during the survey. It is divided into eight sections:

1. General demographic composition.
2. The composition of sample households, and their pig holdings.
3. Was the sample representative of Waula clan?
4. Food crop gardens; cultivated areas and other characteristics.
5. Sweet potato production.
6. Activity survey methods.
7. Days lost to production and time away from Koge.
8. Marketing and retail purchasing.

1. General demographic composition

Table A6.1 shows the general population structure of the sample (cf. Waddell 1972a:221-2). This is not a count of all persons present in Nimai territory on a particular day, but it includes all persons belonging to the sample households who were present for a substantial part of the survey. It does not include three long-term absentees,

TABLE A6.1 General population structure of the sample

	Males	Females
Married	9	10
Bachelor (50 + years)	1	-
Unmarried (17-24 years)	2	2
Youths (10-15 years)	2	4
Children (0-9 years)	9	3
Totals	23	19

consisting of two young men both engaged in paid employment, and one young woman training as an hospital assistant, none of whom returned, except for brief visits, to Koge between June 1972 and May 1973. One of these men was single, and was killed accidentally in the Western Highlands during October 1972. The other brought his recently acquired wife back to Koge in the same month, following which (after his re-departure) she joined his elderly parent's household. Although included in the figure of 10 married women here, she was only included as a member of the survey during the last month.

Of the total of 18 children and youths under the age of 15 years, only 4 males aged 8, 9, 13 and 14 years, were attending school. The oldest two completed Standard 6 at the end of 1972, and were out of school during the final month of the survey. The figure of 9 male children under the age of 9 years excludes one born in late November

1972. A further 4 children, two of each sex, born to households of the sample but adopted by, and living with, other non-sample households are also excluded. The general demographic changes occurring during the year are summarised in Table A6.2. The sample population was distributed among 10 households (described more fully below), giving an average household size of 4.2 persons.

TABLE A6.2 Demographic changes (June 1972-May 1973)

June 1972		Births	Deaths	Married in	May 1973	
Present	Absent				Present	Absent
42	3	1	1	1	43	2

In strictly quantitative terms, this Koge sample is similar to that described by Waddell (1972a:221-2) in his study of a Raiapu Enga community: i.e. both consisted of 10 households, with 42-45 persons in the Enga case, 42-43 in the present study. However, any comparison between them must take account of one major difference: the ratio of persons aged more than 15 years to those aged less. If the latter are considered as dependents (D), and persons over 15 years as adults (A), then Waddell's Modopa ratio of D/A was 11/34, or 0.32, which contrasts with the Koge figure of 18/24, or 0.75 (if absentees are included, the ratios fall respectively to 0.29 and 0.67). Thus the Koge "dependency ratio", as crudely measured by this means, was roughly two and a third times higher than that at Modopa, making any comparison on a per capita basis difficult. For instance, the area under subsistence crops at Modopa was 0.14-0.17 ha per person (Waddell 1972a:43), or almost double the comparable Koge figure of 0.08 ha (see Table 6.18). Recalculated on the basis of adults only, however, the difference between them is significantly, though by no means completely reduced (Modopa 0.19-0.22 ha, Koge 0.15).

2. The composition of sample households, and their pig holdings

Given the importance of such gross demographic differences, a fuller description of household composition, including pigs which share the staple sweet potato, is necessary. Basic age and sex details of household members are given in Table A6.3, and information on the average number and size of pigs cared for by each household is presented in Table A6.4. For purposes of comparison and calculation, the raw human age and sex categories, and pig size classes, are converted to three simpler, more generalized measures: human consumer units (HCU), worker units (WU), and pig units (PU). The HCU and WU values used for various age-sex categories are shown in Table A6.5, and the PU values for pig size categories in Table A6.6.

A number of different age/sex equivalents have been used in the Melanesian literature as a basis for HCU and WU (Boyd 1975; Rappaport 1968: 282-3, 233; Waddell 1972a:221). While HCU values usually vary little, since they are based on suggested caloric requirements, WU, because they differ according to cultural expectations and practice concerning the work responsibilities of persons of differing age, sex, and marital status, are subject to considerable variation. For the HCU used here, I follow (with slight adjustments) those used by

TABLE A6.3 Age and sex composition of Koge sample households

Age in years	Households E	A	B	C	F	J	G	D	H	I	Total Sample
Males											
0- 4	1(1)	2	-	-	-	-	2	1	-	2	7
5- 9	-	1(2)	1(2)	-	-	-	-	-	-	-	2
10-14	1(2)	-	-	-	-	-	1(2)	-	-	-	2
15-19	1	-	1	-	-	-	-	-	-	-	2
20-24	-	-	-	1	-	-	-	-	-	-	1
25-54	1	1	-	-	1	-	1	1	-	1	6
55-59	-	-	1	-	-	1	-	-	-	-	2
60+	-	-	-	-	-	-	-	-	1	-	1
subtotal	3	4	3	1	1	1	4	2	1	3	23
Females											
0- 4	1	-	-	-	1	-	-	-	-	-	2
5- 9	-	-	-	-	-	-	-	1	-	-	1
10-14	1	-	-	-	-	-	1	1	-	1	4
15-19	-	-	-	-	-	-	-	-	1	-	1
20-24	-	-	1(3)	-	-	-	-	-	1(4)	-	3
25-54	1	1	1	-	1	-	1	1	1	1	8
subtotal	3	1	2	1	2	-	2	3	3	2	19
Total	6	5	5	2	3	1	6	5	4	5	42
Consumer units(5)	4.5	3.1	3.8	1.8	2.2	0.8	4.0	3.4	3.2	3.3	30.1
Worker units(5)	3.2	2.0	2.4	2.0	2.0	0.7	2.5	2.5	3.0	2.5	22.7
Ratio CU:WU	1.41	1.55	1.58	0.90	1.10	1.14	1.60	1.36	1.07	1.32	1.32

(1) Born 22 November 1972 (not counted in column and row totals, as sister (aged 4 years) absent during Period III).

(2) Attending school, not counted as possible 'worker', but included as 'consumer'.

(3) Not counted as 'worker unit' as engaged in research activity.

(4) Present during third period only.

(5) For 'consumer' and 'worker' values, see Table A6.5.

TABLE A 6.4 Mean size of household pig herds, Koge sample (June 1972 - March 1973)

Households	Number of pigs (mean of three censuses)						Pig units[1]	Ratios of	
	Size categories (live weight kg)								
	-10	11-25	26-50	51-75	76 +	Totals		Pigs:people	PU + HCU:WU
E	2	3	1.3	-	-	6.3	2.8	1.05	2.28
A	2	2	3	0.3	-	7.3	3.8	1.46	3.45
B	5	0.3	4	1.7	-	11.0	5.7	2.20	3.96
C	1.7	2	2	-	1.0	6.7	3.9	3.35	2.85
F	-	0.7	1.3	-	-	2.0	1.3	0.67	1.76
G	0.3	1.0	1.7	1.0	-	4.0	2.8	0.67	2.72
D	-	-	0.7	-	1.0	1.7	1.8	0.34	2.08
H[3]	1.6	1.0	1.4	-	-	4.0	1.8	1.00	1.67
I	-	0.3	0.7	1.3	0.3	2.6	2.3	0.52	2.24
Totals	12.6	10.3	16.1	4.3	2.3	45.6	26.2	-	-

[1] See Table A6.6 for conversion factors.

[2] See Table A6.3 for values for household size and composition.

[3] Pig numbers halved due to household sharing pig care following a death in Period II.

TABLE A6.5 Human consumer unit (HCU) and worker unit (WU) values[1]

Consumer units			Worker units		
Age (yrs.)	M	F	Age (yrs.)	M	F
55+	0.8	0.7	60+	0.5[2]	0.5[2]
20-54	1.0	0.8	55-59	0.7	0.7
15-19	0.9	0.8	25-54	1.0	1.0
10-14	0.7	0.7	15-24[4]	0.7[3]	0.5[3]
5- 9	0.5	0.5	10-14[4]	0.2	0.5
0- 4	0.4	0.4	0- 9[4]	0	0

(1) See pp. 603, 607 for derivation.
(2) or 0 if entirely incapacitated.
(3) or 1.0 if married
(4) or 0 if attending school.

TABLE A6.6 Pig consumer unit (PU) values[1]

Pig size categories		Pig Units
Girth (ins)	Live weight (kg)	
-19	-10	0.2
20-26	11-25	0.5
27-34	26-50	0.7
35-39	51-75	1.0
40-	76-	1.3

(1) See p. 607 for derivation

Rappaport. My WU, which take married adults, of both sexes, aged 25-54 years, as the standard, are based on observation and assumptions about Sinasina practice.

The task of establishing consumer equivalents is more problematic for pigs than for humans because pigs acquire varying amounts of food from foraging and hence are not entirely dependent on human production. Further, their growth potential, in response to increased food inputs, is considerable and therefore their food consumption is, theoretically, dependent on the aims of their producers as well as on objective measures of nutritional requirements. In other words, whereas human consumer units can, subject to allowance for body weights, be used cross-culturally with fair expectation of their relevance, no such universality is permissible in the case of pig unit values. Ideally, values used in this study should be based on Sinasina husbandry practices, but it was not possible to weigh the rations of a sufficient number of individual pigs under varying husbandry conditions (including, most importantly, the following variables: stage of pig cycle, season, size of household herd, human composition of household, age/size and sex of pigs, and management strategy) for statistical adequacy. Instead, extrapolating from a small number of measurements (Chapter 7), which indicated that pigs in the size range 51-75 kg received approximately the same weight of sweet potato daily as an adult human male, I have used this size of pig as a reference animal with a pig unit value of 1.0. Relative to this standard, I have established three categories of smaller, and one of larger size, and have assigned them estimated values as shown in Table A6.6. These estimates are approximate, based partly on extrapolation from weighed rations, and partly on inspection of Brody's tables of calorific requirements for resting metabolism of different sized pigs (Brody 1945: Tables 14:4A, 14:16).

I noted in Section 1 (above) that a few possible 'members' of sample households were excluded from calculations of the total sample size. They were also excluded from the column and row totals in Table A6.3, and from measures of household composition using HCU and WU. Other partial exclusions are also explained in notes to this latter Table. Such 'loose ends' are inevitable in any attempt to hold stable over a period of months the compositions of units whose members (and indeed the units themselves, c f. Brown and Brookfield 1967), are frequently highly mobile. Further, the actual day-to-day composition of households during the survey was considerably more variable than the relatively tidy summations of Table A6.3 indicate, as a result of temporary inward and outward movements by both household members and visitors. Such short-term fluctuations pose obvious difficulties to analysis of the micro-processes of household economies. To what extent, for instance, should they be taken into account when calculating, on a per capita basis, such quantities as cultivated areas, production and consumption? My pragmatic answer is that, given the relatively short duration of most visiting (short, that is to say, relative to the several months investment made in gardens), little or no account need be made, as a general rule, in respect to land. The quantity of food harvested daily, is, however, another matter. Admittedly a small shortfall between the quantity harvested and a temporary increase in the number of persons to be fed can be (and apparently often was during the survey), made up by either market purchases of staples or retail purchases of rice and fish (or both), but it is reasonable to expect that the presence of visitors results in larger than usual harvests. In some cases, of course, visitors themselves bring food to their hosts. It would be a mistake, I think, to assume that every household necessarily visits others as often as it is visited. In the long run, and perhaps ideally, this may be so, but it seems unlikely in the shorter run of a few months or a year. A certain amount of visiting is, in fact, made deliberately in response to short-term fluctuations in the availability of staple foods, over and above the many visits specifically related to the seasonal availability of such special foods as peanuts, and both nut and oil pandanus. For these reasons the more complete accounting of household composition in Table A6.7 is necessary.

3. Was the sample representative of Waula clan?

Sample households were not selected randomly. They were chosen, after seven months residence at Koge, on the basis of such factors as the proximity of their major residences to my house (given the need for regular evening interviews), their size, the ages of their members, and the willingness of the latter to tolerate intensive enquiries concerning their daily activities. To assess the extent to which the sample was representative of Waula clan, comparison can be made along several dimensions.

TABLE A6.7 The composition of sample households (in person-days and consumer unit days) during each survey period

Households	Period I					Period II					Period III				
	Person days				CU days	Person days				CU days	Person days				CU days
	Household members		Visitors	Total	Total	Household members		Visitors	Total	Total	Household members		Visitors	Total	Total
	Present	Absent				Present	Absent				Present	Absent			
B	99	41	41	140	102.1	140	0	77	217	159.3	140	0	31	171	132.5
A	96	44	10	106	72.8	35	105	0	35	22.7	137	3	9	146	88.1
E	132	36	20	152	120.9	133	35	3	136	111.6	191	5	1	192	133.3
G	123	45	0	123	76.2	158.2	9.7	17	175.2	113.4	164	4	2	166	111.0
D	130.5	9.5	0	130.5	87.7	112	28	0	112	67.2	119	21	0	119	76.6
C	37	19	19	56	47.4	52	4	6	58	52.6	50.5	5.5	4	54.5	48.5
I	132	8	16	148	97.2	140	0	0	140	92.4	-	-	-	-	-
H	79.7	4.2	32	111.7	92.1	83	1	0	83	66.4	109.5	2.5	1	110.5	88.1
F	79	5	0	79	57.4	76	8	1	77	57.8	81	3	2	83	61.8
Totals	908.2	211.7	138	1046.2	753.8	929.2	190.7	104	1033.2	743.4	992	44	50	1042.0	739.9

Sex and age distribution.

Table A6.8 shows that the sample had a greater imbalance of males than Waula (respective sex ratios of 141 and 124), and also had a younger population (42 per cent aged 25 years and over, compared to 51 per cent).

Pig herds.

With 14.2 per cent of the clan's human population, the sample held, during 1972-73, an average of 19.1 per cent of the clan's pigs (18.5 per cent in terms of pig units). The size distribution of their animals was generally similar to those of the clan as a whole (Table A6.9).

Coffee holdings.

The sample's total of 0.9 ha under coffee (Table 6.18), or 13.5 per cent of the Waula total of 6.8 ha (Table 6.14), was proportional to the sample size. Comparison of distributions of the sample's holdings, with those for the whole clan, by both altitude (Table 6.15, p.289) and distance from major residences (Table 6.16, p.290) showed them to be broadly similar.

4. Food crop gardens: cultivated areas and other characteristics

Cultivated areas

Although site movement is intrinsic to most highland cultivation, the problems this raises for definition of the "area under cultivation" have received little attention in the literature even when, as in the single area of northern Chimbu, a considerable amount of variation has been reported (Table 6.19). Where there is a marked annual

TABLE A6.8 Comparison of sample's age and sex distribution with total Waula population[1]

Age categories (years)	Waula			Sample		
	Males (n=167)	Females (n=135)	Total (n=302)	Males (n=24)	Females (n=19)	Total (n=43)
0 - 14	34.1	31.8	33.1	41.7	36.8	39.5
15 - 24	16.8	14.1	15.6	16.7	21.0	18.6
25 - 54	32.3	40.7	36.1	29.2	42.1	34.9
55+	16.8	13.3	15.2	12.5	-	7.0
	100.0	100.0	100.0	100.0	100.0	100.0

[1] In both cases, total population at January 1972 (including absentees).

TABLE A6.9 Comparison of size distribution of sample's pigs with total Waula pig population[1,2]

Size categories (live weight kg)	Waula Pigs				Sample Pigs			
	Pigs		Pig Units		Pigs		Pig Units	
	No.	%	No.	%	No.	%	No.	%
- 10	48.7	22.9	9.74	7.3	8.50	20.9	1.70	6.9
11 - 25	48.3	22.7	24.15	18.1	10.90	26.8	5.43	22.0
26 - 50	74.0	34.7	51.80	38.8	14.35	35.3	10.05	40.7
51 - 75	22.3	10.5	22.30	16.7	4.55	11.2	4.55	18.4
76	19.7	9.2	25.61	19.2	2.30	5.7	2.99	12.1
Totals	213.0	100.0	133.60	100.0	40.60	100.0	24.72	100.0

[1] In both cases, numbers of pigs looked after (i.e. ecological population).

[2] Mean of three censuses (May 1972, November 1972, April 1973)

agricultural cycle, with new gardens cleared and planted during a definite season, the definitional problems are of course reduced (though decisions concerning the inclusion of parts of older gardens containing longer-lived or slower maturing plants may still be difficult). However, in systems lacking such a distinct cycle, where the duration of fallow and cultivation periods varies widely (within, as well as between, gardens), and where the staple crop is commonly replanted several times, there are significant problems in determining both how much land has been "cultivated" in a given time period, and what is, at any one time, the "area under cultivation". Add widely dispersed gardens (Map 6.1), several gardens per household (Table 6.20), and the need to have the main cultivator present on the site if planting details are to be recorded, and it can be seen that the practical problems increase rapidly with every additional household under survey.

Starting in June 1972 and continuing until March 1973, I measured (by chain and compass) the foodcrop gardens of nine households of the sample (the bachelor, J, had none). I began by updating an oral record made during the earlier general household survey (Appendix 1), then measured the majority of the gardens between 19 June and 10 July, completing some isolated sections during the following month. I was not able to arrange to have the main cultivator (i.e. each household's most senior woman) present at each garden at the time of survey with the result that I measured, generally, the gross area under crop - newly planted, producing, and older areas. In some cases the crop in a whole garden was of similar age. In others this was not the case, and undoubtedly some older, perhaps exhausted, portions (particularly in the case of household I, Table A6.10), were included. Information collected daily during the first activity period in June - July, and questioning, provided valuable information for determining the current status of gardens, but not of areas within them. This initial survey provided the cultivated areas, as of June 1972, shown in Table A6.10.

During the second and third activity survey months (and, to a more limited extent, at other times), I updated this record. New gardens and plantings were measured, for instance, on nine days between 23 October and 18 November, and a further fourteen days between 26 December and 19 March. These areas are shown as "area planted between June 1972 and March 1973" in Table A6.10. However, it is almost certain that these measurements were incomplete as regards the replanting of areas within gardens already under cultivation in June 1972. The only way to have monitored these successfully would have been to do what Mitchell (1976) did in his Nagovisi survey - be present every time a garden was visited. Given the number of households, the number, and dispersal, of gardens, and the frequency of garden visits[1], this was out of the question. I therefore failed to achieve an accurate figure of the "area planted" during a given time period.

To determine the "area under cultivation at March 1973" (Table A6.10), I included all new plantings and those older gardens

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[1]Mitchell's Nagovisi women visited their gardens, on average, only two or three days a week, however, whereas Waula women harvest daily.

TABLE A6.10 Cultivated land (ha): Koge sample, by household

Households	Food crop gardens[1]									Cash crop cultivation
	Area cultivated At June 1972			Area planted June 1972-March 1973			Area cultivated At March 1973			Coffee[2] (1972-73)
	Sw. Pot.	Other	Total	Sw. Pot.	Other	Total	Sw. Pot.	Other	Total	
E	.3849	.0410	.4259	.1759	.0104	.1863	.4878	.0514	.5392	.0922
A	.3655	–	.3655	.1682	–	.1682	.4527	–	.4527	.0735
B	.7075	.0015	.7090	.4534	.0157	.4691	.8006	.0173	.8179	.1249
C	.2495	.0290	.2785	.1748	.0048	.1796	.3321	.0048	.3369	.0421
F	.1385	.0046	.1431	.0754	–	.0754	.1694	–	.1694	.1069
J	–	–	–	–	–	–	–	–	–	.1270
G	.4190	.0664	.4854	.1523	.0070	.1593	.4715	.0070	.4785	.1276
D	.3200	.0072	.3272	.1030	–	.1030	.3621	.0072	.3693	–
H	.2696	.0045	.2741	.0657	.0243	.0900	.2291	.0243	.2534	.1607
I	.4641	.0075	.4716	.0852	.0149	.1001	.2476	.0149	.2625	.0529
Totals	3.3186	.1617	3.4803	1.4539	.0771	1.5310	3.5529	.1269	3.6798	.9078

(1) 'Sw. pot.' = sweet potato predominant crop; 'Other' = kitchen gardens and other plots primarily planted with crops other than sweet potato.

(2) Coffee plots surveyed in Jan. - Feb. 1972. Assumed unchanged during year.

(from June 1972) still producing during the last activity survey month (5 February - 4 March), subtracting only those June gardens which were not harvested from during the latter period and which had not been replanted. While reasonable, this procedure would have benefited from follow-up research during the next twelve months to ensure that replanting did not occur after brief fallow spells of a few months.

Given the posssible inaccuracies in the June and March figures, it seemed sensible to determine the "area under cultivation" during the whole period by calculating their means. These appear in Table 6.18, and are used in later calculations (i.e. Figs. 6.3, 6.5, 6.6, 7.3).

Other characteristics

Tables A6.11, 12, 13, 14, and 15 provide information on the altitudinal zonation, slope distribution, tenurial status, and distance from operator's residence of the food crop areas belonging to the Koge sample. Some of this data is directly referred to in the text (Chapter 6), the rest is included both for more exact description, and for comparative purposes (see, for instance, Hughes 1966; Waddell 1972a).

5. Sweet potato production by sample households

During the months of the labour survey, an attempt was made to weigh, as often as possible, the agricultural production of the sample households, with the aim of relating such quantities to particular cultivated areas, labour inputs etc. This proved considerably more difficult than expected. It was frequently impossible to weigh the

TABLE A6.11 Percentage of sweet potato cultivation by altitude class (Koge sample)

Altitude (m)	At June 1972				Planted June 1972-March 1973				At March 1973			
			Cumulative				Cumulative				Cumulative	
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
1601-1700	.47	14.2	.47	14.2	.02	1.3	.02	1.3	.17	4.8	.17	4.8
1701-1800	.07	2.1	.54	16.3	-	-	.02	1.3	.10	2.8	.27	7.6
1801-1900	.82	24.7	1.36	41.0	.35	23.6	.37	25.0	.71	20.0	.98	27.6
1901-2000	.71	21.4	2.07	62.3	.35	23.6	.72	48.6	1.07	30.1	2.05	57.7
2001-2100	.38	11.4	2.45	73.8	.60	40.5	1.32	89.2	.96	27.0	3.01	84.8
2101-2200	.62	18.7	3.07	92.5	.04	2.7	1.36	91.9	.34	9.6	3.35	94.4
2201-2300	.17	5.1	3.24	97.6	.12	8.1	1.48	100.0	.14	3.9	3.49	98.3
2301-2400	.08	2.4	3.32	100.0	-	-	-	-	.06	1.7	3.55	100.0
	3.32	100.0			1.48	100.0			3.55	100.0		

TABLE A6.12 Percentage of sweet potato cultivation by slope class (Koge sample)

Slope (°)	At June 1972				Planted June 1972-March 1973				At March 1973			
			Cumulative				Cumulative				Cumulative	
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
0- 4.9	.04	1.2	.04	1.2	.01	0.7	.01	0.7	.01	0.3	.01	0.3
5- 9.9	.35	10.5	.39	11.7	.01	0.7	.02	1.3	.10	2.8	.11	3.1
10-14.9	.79	23.8	1.18	35.5	.45	30.4	.47	31.8	.98	27.6	1.09	30.7
15-19.9	.92	27.7	2.10	63.2	.35	23.6	.82	55.4	.66	18.6	1.75	49.3
20-29.9	.65	19.6	2.75	82.8	.48	32.4	1.30	87.8	.96	27.0	2.71	76.3
30-39.9	.58	17.5	3.32	100.0	.18	12.2	1.48	100.0	.84	23.7	3.55	100.0
	3.32	100.0			1.48	100.0			3.55	100.0		

TABLE A6.13 Percentage of sweet potato cultivation by tenure

Primary rights to land held by member of	At June 1972				Planted June 1972–March 1973				At March 1973			
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
Extended family			2.20	66.4			1.04	70.3			2.33	65.6
Same subclan												
same mens' house	.31	9.3			.17	11.5			.38	10.7		
other mens' house	.16	4.8							.11	3.1		
subtotal			.47	14.2			.17	11.5			.49	13.8
Other subclan												
same mens' house	.24	7.2			.11	7.4			.29	8.2		
other mens' house	.04	1.2							.02	0.6		
subtotal			.28	8.4			.11	7.4			.31	8.7
Same clan: subtotal			.75	22.6			.29	19.6			.80	22.5
Other clan												
Ogole	.09	2.7							.09	2.5		
Bomai	.14	4.2			.04	2.7			.16	4.5		
subtotal			.23	6.9			.04	2.7			.25	7.0
Other tribe			.13	3.9			.12	8.1			.18	5.1
Totals			3.32	100.0			1.48	100.0			3.55	100.0

TABLE A6.14 Percentage of mixed vegetable cultivation by altitude (Koge sample)

Altitude (m)	At June 1972		Planted 1972-1973		At March 1973	
	ha	%	ha	%	ha	%
1601-1700	.007	4.3	-	-	-	-
1801-1900	.111	68.5	.069	89.5	.118	92.9
1901-2000	.044	27.2	.001	1.3	.001	0.8
2001-2100	-	-	.005	6.5	.005	3.9
2301-2400	-	-	.002	2.6	.003	2.4
	.162	100.0	.077	100.0	.127	100.0

TABLE A6.15 Percentage of mixed vegetable cultivation distant from major residence (Koge sample)

Distance from house (m)	At June 1972		Planted 1972-1973		At March 1973	
	ha	%	ha	%	ha	%
0- 100	.093	57.4	.059	76.6	.096	75.6
101- 250	.006	3.7	-	-	.001	0.8
251- 500	-	-	-	-	-	-
501-1000	.044	24.7	.001	1.3	.001	0.8
1001-2000	.012	7.4	.012	15.6	.024	18.9
2001-	.007	4.3	.005	6.5	.005	3.9
	.162	100.0	.077	100.0	.127	100.0

total amount harvested in one day by a household. Several factors were responsible. Where the members of a household divide their residence between a central settlement and a distant garden-, or pig-, house, a single day's production is often not brought together at one place, but may be harvested, cooked, and consumed separately. In addition, division and distribution of part of a day's harvest, either raw or cooked, occurs daily in the form of gifts and food-sharing between neighbours, relatives and visitors. Although such distribution commonly takes place after cooking at either a settlement or a garden-house, it may be made at a garden site or during return to a residence. Thus a netbag of food on return to a settlement may include gifts from other households, and exclude some production eaten at the garden, given to others, or fed to pigs. Further, more than one garden is frequently harvested on the same day, and their produce mixed, thus preventing assignment of quantities to particular areas. None of these difficulties are of couse insuperable[2], but they are particularly problematic if most weighing, as in this case, is done at a settlement. The alternative would have been to accompany members of each household throughout the course of a day, but resources were not available for such an intensive survey given the number of households included. The result is that production by the sample households was adequately measured on only a scatter of days throughout the three months. Since sweet potato is by far the most important crop, I have concentrated

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2 More problematic would be instances of theft, and other factors leading to inaccurate reporting and evasion. To my knowledge, these were insignificant during this survey.

on detailing the quantities of this crop alone[3]. Table A6.16 shows the aggregated figures for the whole survey, and Tables A6.17A, B, C give the one-month period totals from which the estimates of total production were made.

6. Activity survey methods

As described in Chapter 6, the activities of sample members were surveyed during three months. Information was collected by both observation and interview. The latter were held, whenever possible, every evening at the home of each household, or in the men's house. When individuals stayed over-night at their garden or pig houses, they were either visited the next morning or as soon as possible thereafter. This procedure was only upset during the third month, when the movement of households G and E to dispersed houses meant their interviews became more sporadic. C. Hide conducted half of the interviews, and also participated fully in other recording and analysis of the material.

The interviews were loosely structured, but centred on a narrative account of each individual's sequence of activities during the day (i.e. activity, where, when, duration, with whom, etc.). Also recorded as fully as possible were details of crop harvesting (crop, which garden), exchange (labour, gifts and food given and received),

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[3]The very occasional small amounts of irish potatoes and taro which were also harvested (Table 7.2) were in some instances (i.e. when represented by one or two tubers in the middle of a netbag of sweet potato), not separated from the sweet potato. Thus these figures perhaps exaggerate sweet potato by a small amount.

TABLE A6.16 Sweet potato production by Koge sample households during whole survey

Households	Number of days			Production weighed (kg)	Estimated total production[1] (kg)	Market estimates (kg)[2]	
	Household present	Household harvested	Harvest weighed			Sales	Purchases
B	84	82	37.7	1011.8	2241	-	51
A	59	47	13	325.1	1059	55	12
E	84	79	43	680.0	1218	61	66
G	82	78	30	464.3	1185	26	44
D	82	70	40	491.2	898	16	-
C	79	67	41	544.3	846	-	28
I	56	49	11.5	135.4	581	2	23
H	82	70	33.5	402.6	841	-	72
F	77	62	16	121.3	491	-	5
Totals	675	604	267	4176.0	9360	160	301

(1) Total production for whole survey estimated by adding each period's estimates (from Tables A6.17 A, B, and C).

(2) Converted from prices, see notes to Tables A6.17 A, B, and C).

TABLE A6.17A Sweet potato production by Koge sample households during Period I (19 June-16 July 1972)

Households	Number of days			Production weighed (kg)			Estimated total production[2] (kg)	Market estimates (kg)[3]	
	Household present	Household harvested	Harvest weighed	Total	Mean harvest	SD		sales	purchases
B	28	28	10[1]	317.1	31.7	NA	888	-	9
A	24	21	5	158.1	29.1	6.9	537[2]	39	9
E	28	28	18	338.6	18.8	7.5	492[2]	61	-
G	26	25	5.5[1]	73.7	13.4	NA	335	-	30
D	26	25	9	128.8	14.3	6.3	357	9	-
C	25	17	6	50.1	8.3	2.6	141	-	18
I	28	24	8	93.4	11.7	1.8	281	-	23
H	26	24	13	158.5	12.2	6.3	293	-	36
F	27	19	3	17.7	5.9	1.2	112	-	5
	238	211	77.5	1336.0	145.4	-	3436	109	130

(1) These are adjusted figures due to several partial weighings. In B's case, 10 is adjusted downwards from an actual 14 days (unadjusted mean harvest, 22.6 kg, SD 11.9), while G's figure of 5.5 was adjusted down from 6 actual days (unadjusted mean harvest 12.3 kg, SD 5.1).

(2) Estimated totals for households D, C, I, H, and F are all direct extrapolations (mean harvest x number of days household harvested). Estimates for households B and G are based on adjusted mean harvest figures (described in note 1). Estimates for households A and E could not be based on the raw mean harvest figures appearing in the table because their weighed harvests included a disproportionate number of large harvests made prior to marketing sweet potato. In both cases estimated total production is therefore based on adjusted mean harvests: of 25.6 kg in the case of A, and 17.6 for E.

(3) Converted from prices (at an estimated average 4.4 cents/kg).

TABLE A6.17B Sweet potato production by Koge sample households during Period II (23 October-19 November 1972)

Households	Number of days			Production weighed (kg)			Estimated total production[2] (kg)	Market estimates (kg)[3]	
	Household present	Household harvested	Harvest weighed	Total	Mean harvest	SD		sales	purchases
B	28	26	11.2[1]	281.7	25.1	NA	653	-	33
A	7	4	3	58.1	19.4	2.3	78	4	-
E	28	26	17	214.1	12.6	2.1	328	-	36
G	28	28	22	350.2	15.9	6.3	445	9	9
D	28	23	11	144.0	13.1	4.9	301	7	-
C	27	26	14	196.4	14.0	4.5	364	-	9
I	28	25	3.5[1]	42.0	12.0	NA	300	2	-
H	28	18	7	81.2	11.6	3.3	209	-	18
F	24	23	11	83.2	7.6	3.0	175	-	-
Totals	226	199	99.7	1450.9	131.3	-	2853	22	105

[1] Adjusted due to some partial weighings. B's 11.2 is adjusted down from 16 actual days (unadjusted mean harvest 17.6 kg, SD 10.1), and I's 3.5 down from an actual 4 (unadjusted mean harvest 10.5 kg, SD 2.8).

[2] Estimates for households B and I are based on adjusted mean harvest figures (see note 1). All other households' estimates are direct extrapolations (mean harvest x number of days household harvested).

[3] Converted from prices (at an average of 5.5 cents/kg).

TABLE A6.17C Sweet potato production by Koge sample households during period III (5 February-4 March 1973)

Households	Number of days			Production weighed (kg)			Estimated total production[2] (kg)	Market estimates (kg)[3]	
	Household present	Household harvested	Harvest weighed	Total	Mean harvest	SD		sales	purchases
B	28	28	16.5[1]	413.0	25.0	NA	700	-	9
A	28	22	5	108.9	21.8	10.5	444[2]	12	3
E	28	25	8	127.3	15.9	5.9	398	-	30
G	28	25	2.5[1]	40.4	16.2	NA	405	17	14
D	28	22	20	218.4	10.9	7.0	240	-	-
C	27	24	21	297.8	14.2	4.4	341	-	1
I	-	-	-	-	-	-	-	-	-
H	28	28	13.5[1]	162.9	12.1	NA	339	-	18
F	26	20	2	20.4	10.2	6.8	204	-	-
	221	194	88.5	1389.1	126.3	-	3071	35	75

(1) Adjusted figures, due to some partial weighings. B's 16.5 is adjusted down from an actual 19 days (unadjusted mean harvest 21.7 kg, SD 8.3); G's 2.5 from an actual 3 (unadjusted mean harvest of 13.5 kg, SD 6.8); and H's 13.5 from 16 (unadjusted mean harvest of 10.2 kg, SD 3.2).

(2) Estimates for households B, G, and H based on adjusted figures as described in note 1. Household A's raw mean harvest figure exaggerates the "true" mean since its weighed harvests included a large pre-marketing harvest: its estimated total production is therefore based on an adjusted mean harvest figure of 19.7 kg.

(3) Converted from prices (at an average of 6.6 cents/kg).

retail purchasing (item, value, store), marketing (sales and purchases, by item, value, and trading partner), consumption (kinds of food eaten), and visiting. In an attempt to increase the accuracy of time estimates, some watches were distributed. This, however, was not particularly successful amongst older sample members since, rather than wear them, they preferred to pack them safely in the bottom of netbags where they tended to remain for most of the day.

Observation was partially structured. During the morning and evening of each survey day, regular periodic visits were made to all households to provide accurate departure and arrival times. Sample members also co-operated extensively by calling out, dropping by, or sending a message by a child, when leaving or arriving at the settlement. The latter was particularly important since, following a return from either foodcrop gardens or coffee plots, it allowed weighing of produce. Members were also usually asked each evening what they intended to do the next day. This allowed planning of daytime visits to observe (and participate in) as full a round of activities, and involving as many members, as possible. Throughout the day, both my wife and myself, and occasionally Anna Kawage, recorded, by time, all observations of sample members. By these means a relatively comprehensive framework of time co-ordinates for each individual was established (and fed back into the interview, i.e. who saw who, when and where).

These two main bodies of information, on return from New Guinea, were transferred on to needle cards (one per day, per individual), which were printed to allow compressed recording of the quantitative data.

The process of transferral allowed calculation of the duration of activities (which were defined broadly as starting and finishing with departure from, and return to, either a house, or to the start of a subsequent activity; travel time was included - though separated for analytic purposes - within the activity time, but was a slow, burdensome, labour. Analysis was all done by hand, involving a series of analysis sheets (by individual, by sex, by week, by period etc.). With forethought, a computer should have been used.

The workload of both data collection and analysis was beyond the capacity of a single researcher (when combined with surveys of cultivation etc.). It would have been impossible without the full participation of my wife, who conducted half of the interviews, kept time diaries, participated in the activities of the households during the three months, probably weighed by hand half of the produce surveyed (i.e. c. 0.5 tonnes of coffee and 2 tonnes of sweet potato), and shared the many hours of collating and transferring the information to cards. Equally, the task could never have been accomplished without the active co-operation of the members of the households themselves. Three months, even though broken by intervals, is a long time to continue such intensive exposure of one's concerns to outsiders. It may be noted that Johnson's far less labour intensive method of random visits during the course of a day (Johnson 1975) would have yielded the information necessary for a general account of the allocation of time. It would not, however, have provided much of the kind of information which I wished to collect for inter-household comparisons.

7. Days lost to production and, time away from Koge

Although the Koge sample included a total of 27 persons, the number present at any one time varied both between periods and from day to day, as members arrived from and departed for visits, employment, and other periods of absence from Nimai territory. In addition, one household was joined by a new bride during the course of the survey. While most absences involved only some members of a household there were occasional exceptions when either a whole household departed for a brief visit elsewhere, or when the extended absence of the wife of a household head resulted in the dispersal of the remaining members to other households and thus the temporary dissolution of the household as a normal unit of production and consumption.

As a result of sickness, mourning, employment elsewhere, and other temporary absences (Table A6.18), the 2099 potential activity days covered by the survey were reduced to 1714 actual days (i.e. available for local production).

Although sickness resulted in a loss of 131 days, or a high 6.2 per cent of potential activity time (cf. Waddell 1972a:83-4), two-thirds of this figure was accounted for by members of two households (A and I) caring for sick infants at Kundiawa hospital. The actual incidence of sickness amongst adults was low (Table A6.19).

The considerable amount of time spent in mourning during the second and third weeks of Period II followed the accidental death of one of the longterm absent sons of household H. Although mourning and the arrangements for his funeral briefly affected the work routine of

TABLE A6.18 Potential activity days, and days lost through sickness, mourning, and absences from Nimai territory (Koge sample)

Week	Potential days	Days lost: by cause					
		Sickness		Mourning	Wage labour	Other temporary absences	Totals
		at home	hospital				
1	175	-	-	-	14	11	25
2	175	0.7	-	-	14	7	21.7
3	175	2.7	-	-	14	18.7	35.5
4	174	0.7	-	-	14	33	47.7
5	175	8.7	5	-	-	19	32.7
6	175	5	12	31.5	-	13.7	62.2
7	175	2.7	7	13	-	7	29.7
8	175	5	14	1.4	-	7	27.0
9	175	3	10	-	-	11.5	24.5
10	175	-	14	-	-	14	28
11	175	0.5	14	-	-	4	18.5
12	175	4.7	21	-	-	6	31.7
Total	2099	34.0	97	46	56	152	385

TABLE A6.19 Days lost through sickness, by cause (Koge sample)

Cause	Men	Women	Total Days	Total Per cent
Upper respiratory tract infection (URTI)	1	15.5	16.5	12.6
Pregnancy	-	9	9	6.9
Pig goring	4	-	4	3.0
Misc. (earache/toothache etc.)	1.5	10.2	11.7	8.9
Subtotal	6.5	34.7	41.2	31.4
Care of sick children (at hospital)	17	73	90	68.6
Total	23.5	107.7	131.2	100.0

the whole sample following the return of his body to Koge, only members of his immediate family suspended most activities for several days. They declined my suggestion that they withdraw from the survey.

Temporary absences from home (besides those related to sickness and employment, and defined as an absence of at least one night from Koge) occupied a total of 152 days (7.2 per cent of potential activity time),and are analysed in more detail in Table A6.20). They are separated from days spent based at home since it was not possible to collect equally complete information on them. They ranged from visits of a single day and night to assist a relative with a specific task or

TABLE A6.20 Person-days absent from Koge by cause (Koge sample)

Cause of Absence	Period I Days	Period I %	Period II Days	Period II %	Period III Days	Period III %	Total Days	Total %	Percentage of all days
Food production									
Fencing	-	-	-	-	7.0	7.7	7.0	2.3	
Taro/yam harvest	2.2	1.8	-	-	-	-	2.2	0.7	
Pandanus harvest	-	-	-	-	7.0	7.0	7.0	2.3	
Subtotal	2.2	1.8	-	-	14.0	14.8	16.2	5.3	0.8
Commercial									
Wage Labour	56.0	44.5	-	-	-	-	56.0	18.3	2.7
Modern Agency									
Church (baptism)	-	-	4.0	4.7	-	-	4.0	1.3	0.2
Health (hospital)									
Pregnant	-	-	7.0	8.3	-	-	7.0	2.3	
Care of sick child	-	-	31.0	36.6	59.0	62.4	90.0	29.5	
Subtotal	-	-	38.0	44.8	59.0	62.4	97.0	31.8	4.6
Social/Ceremonial									
Marriage	14.0	11.1	-	-	-	-	14.0	4.6	
Visiting	53.5	42.5	42.7	50.4	21.5	22.7	117.7	38.6	
Subtotal	67.5	53.7	42.7	50.4	21.5	22.7	131.7	43.2	6.3
Total	125.7	100.0	84.7	100.0	94.5	100.0	305.0	100.0	14.5
Total person-Days Present at Koge	573.2		615.2		605.5		1794.0		85.5

to attend a ceremony, to, at the other extreme, an extended absence of several weeks. In many cases, identification of a single major reason for such visits was impossible, thus the large number of days assigned to the general category of 'visiting'. In terms of locations, 3 of the 152 days were spent with non-sample Waula households residing elsewhere in Nimai territory (i.e. away from Koge), 58 with other Sinasina groups (26.5 in Gunangi, 14 in Dinga, 11 in Kere, 4 in Dom, and 2.2 in Tabari), 57 in other parts of the Chimbu province (48 at Awagl near Kerowagi, and 9 in the Gumine area south of the Waghi), and 48 in the Eastern Highlands at Kainantu. Balancing this hospitality received was that offered by the sample households: in all, a total of 153 adult 'person-days', and 141 child 'days'. The distribution of these 153 adult visiting days, according to the origins of the visitors, was a little different to the pattern of the sample's visiting: 44 were accounted for by fellow Waula clansmen, 1 by a member of Nimai Bomai clan, 104 by members of other Sinasina groups (51 Dom, 24 Gunangi, 20 Kere, and 9 Tabari), and 4 by persons from other parts of Chimbu (3 from Gumine, and 1 from Awagl).

8. Marketing and retail purchasing

Although market articulation is not discussed in detail in this study it is necessary, in order to contextualise the material presented in Chapters 6, 7, and 8, and to provide the basis for calculations in Chapter 7, to give some information on the sample's use of the market and of retail stores.

Marketing

Information on marketing is available from surveys of sellers and goods on 11 market days at Koge between May 1972 and April 1973, and from Koge sample members during the three survey Periods. Analysis of the market figures showed that Nimai sellers comprised 46 per cent of the market total, and offered for sale some 42 per cent of the total value of all goods offered for sale. Waula clan members, with 14 per cent of the Nimai population, constituted 22 per cent of Nimai sellers, and offered for sale 18 per cent of the value of goods offered for sale by Nimai sellers. Table A6.21 compares the patterns of sales and purchases made by members of Koge sample, with the overall distribution of goods offered for sale in the market. It may be noted that sweet potato constituted 92 per cent of the 'tuber' total in the latter listing. Table A6.22 provides a breakdown of the sample's marketing activity by Period. Further information on sales and purchases of sweet potato by sample households is shown in Tables A6.16 and A6.17.

Retailing

Data on retailing were also collected from Koge sample members during the three survey Periods. In addition, information from the

TABLE A6.21 Comparison of the Koge sample's market sales and purchases with the general pattern of goods offered for sale at Koge market

Categories (1) of Goods	Market Total (2) Goods for sale (n= $1076.70) Per cent	Koge Sample (3) Goods sold (n= $10.50) Per cent	Koge Sample (3) Goods purchased (n= $33.40) Per cent
Tubers	35.9	66.7	55.1
Leafy greens	10.1	0.9	5.7
Legumes	3.6	-	3.6
Other vegetables	5.4	-	0.9
Fruits	9.3	20.0	5.7
Nuts	1.3	-	3.6
Meat/eggs	7.6	-	4.5
Cooked food	0.4	8.6	6.0
Stimulants	5.7	-	5.1
Firewood	1.6	1.9	0.9
Rope/cordage	1.3	1.9	-
Self-decoration	15.6	-	9.0
	100.0	100.0	100.0

(1) Food categories after Platt (1972)
(2) 11 market days between May 1972 and April 1973.
(3) As recorded during three survey periods.

TABLE A6.22 Marketing by Koge sample (3 survey Periods)(1)

	Goods taken to sell		Goods sold		Goods purchased	
	Value	Number of households	Value	Number of households	Value	Number of households
Period I	7.20	4	5.50	4	14.40	8
Period II	4.40	7	2.00	5	8.10	7
Period III	4.90	6	4.10	5	11.30	10
Total survey	16.50	8	11.60	8	33.80	10

(1) All trading at Koge market except for $1.10 worth of goods taken to, and sold at Nebare market (Dom) by one household during Period III, and $0.40 worth of goods bought on the same occasion.

two largest stores in the Koge-Yoba area (one run by a mission, the other by a Goroka based company), was kindly provided by their managers.

Comparison between the three sets of figures (Table A6.23) suggests that the monthly distribution of retail purchasing by the Koge sample was not dissimilar to that of the general population using these two major stores. It may be noted that 40 per cent by value of the sample's purchases were made from the company-owned store (which lay within 200 m of the Waula hamlet), 6 per cent from that of the mission (just over one km away). Information on the distribution of expenditure between major categories of retail goods is not available from the former store. By comparison with the mission store where food constituted 60 per cent, tobacco 30 per cent, clothing 8 per cent and hardware and toiletries 5 per cent of the 1972 trading figures, the Koge sample spent proportionally more on food (75 per cent), less on tobacco (8 per cent), a similar proportion on clothing (8 per cent), and slightly more on hardware and toiletries (9 per cent). It is possible that evening gifts of tobacco to sample members during the survey interviews affected their more usual purchasing pattern. Their food purchases, however, revealed a broadly similar distribution to that shown by figures from the mission store; i.e. the sample spent 42 per cent on protein and fat-rich foods (the store figure was 45 per cent), 51 per cent on starchy items (the store 40 per cent), and 8 per cent on condiments and snacks (the store 15 per cent). The two major items were canned fish (sample 28 per cent, store 38 per cent), and rice (sample 31 per cent, store 36 per cent).

TABLE A6.23 Variation in retail trading during three 4-week periods

Periods[1]	Percentage of retail trading		
	Koge sample (n= $82.78)	Company store (n= $6174.30)	Mission store (n= $9599.90)
June/July 1972	43.3	45.5	36.9
October-November 1972	38.5	32.9	38.3
February 1973	18.2	21.6	24.8
Totals	100.0	100.0	100.0

[1] To make the figures from the two stores as comparable as possible with those of the Koge sample, the four week period totals were calculated from the calendar month store figures as follows:

June and July were summed and divided by two; one-quarter of the October figures were added to three-quarters of the November ones.

Tables A6.24 and 25 show breakdowns of the sample's retail purchasing by period and by household.

TABLE A6.24 Average retail expenditure (cents/week/person): Koge sample, by period, and week

Period	Week	Total expenditure $	Person weeks	Mean expenditure (cents/week/person)								
				Food items								
				Protein	Starch	Other	Subtotal	Clothes	Stimulants	Toiletries	Hardware	Total
June-July	1	9.10	35.7	11	11	1	22	-	3	-	-	25
	2	9.20	36.3	8	12	2	21	1	2	1	-	25
	3	7.35	34.3	5	7	-	12	5	3	1	1	21
	4	10.20	32.6	7	10	-	18	-	1	1	10	31
Period I mean week		8.96	34.7	8	10	1	19	1	2	1	2	26
October-November	1	9.52	38.1	9	5	3	17	4	2	1	-	25
	2	13.25	34.8	9	13	3	25	7	3	3	-	38
	3	6.13	34.0	6	2	2	16	-	1	-	-	18
	4	3.00	34.0	4	3	1	8	-	1	-	-	8
Period II mean week		7.98	35.2	7	7	2	17	3	2	1	-	23
February-March	1	4.00	38.2	3	4	1	8	-	2	1	-	10
	2	3.17	38.0	2	5	1	8	-	-	-	-	8
	3	4.81	39.0	5	6	1	11	-	-	1	-	12
	4	3.05	38.0	3	3	-	6	-	1	1	-	8
Period III mean week		3.76	38.3	3	5	1	8	-	1	1	-	10
Total survey mean		6.90	36.1	6	7	1	14	2	2	1	1	19

TABLE A6.25 Average retail expenditure by Koge sample households

Households	Total expenditure	Person weeks	Mean expenditure (cents/week/person)								
			Food items								
			Protein	Starch	Other	Subtotal	Clothes	Stimulants	Toiletries	Hardware	Total
F	0.70	36	1	1	-	2	-	-	-	-	2
J	1.20	12	2	7	1	9	-	1	-	-	10
D	6.26	54	1	3	1	5	-	1	-	6	12
G	9.40	65.1	4	4	1	9	4	2	-	-	14
E	11.00	67.1	5	7	1	12	1	2	1	-	16
I	8.65	43.2	6	6	1	13	5	-	-	-	20
B	11.75	54.3	6	11	1	18	-	2	2	-	22
A	9.20	40.6	9	10	1	20	-	1	1	-	23
H	10.60	40	10	12	3	24	1	1	1	-	27
C	14.02	21.7	26	17	4	46	4	10	4	1	65

APPENDIX 7

Estimating the weight of pigs

> "The only possible way to ascertain the weight of such a restless creature is to place it in a bag, tie the bag to a scale, and read the record in haste" (Mellen 1952:88)

Although Mellen's "bag, scale, and hasty record' has much to recommend it to the fieldworker - the two hundred or so direct pig weights gathered during this study were all achieved by this means - it does have some obvious disadvantages. Large pigs resist bagging violently and noisily, and their objections disturb other pigs which become difficult if not impossible to catch. Since free-ranging pigs usually only return to their owner's house in the evenings, this may well result in a fruitless wait for the animals to relax again. A census, including weighing, of a large pig population under such conditions would be a full-time research task. It would also be unnecessarily risky for both man and beast, as may be appreciated by anyone who has tried to remove one pig from a yard full of hungry animals in the rain at dusk.

Such lessons were quickly learnt during the first few months of periodic weighing of piglets in selected litters. Seeking an alternative, indirect, method of estimating pig size, I wrote to G.L.Malynicz, then head of the Tropical Pig Breeding and Research Centre at Goroka to ask whether any work had been done with linear measurements for conversion to weight (see Petrusewicz and Macfadyen 1970:50-51). He suggested heart girth, and kindly supplied me with some data from Kasena and Bena villages near Goroka (Table A7.1; these will be

TABLE A7.1 Heart girth measurements and weights : Waula (Sinasina) and Goroka pigs [1]

Heart girth ins	Waula pigs				Goroka pigs		Metric conversion		
	N=	Weight lbs			Weight lbs		Girth cms	Mean weight kg	
		Mean	SD	Range	Mean	SD		Waula	Goroka
9	5	3.2	.8	2.0-4.0	-	-	23	1.4	-
10	7	3.7	.2	3.5-4.2	-	-	25	1.7	-
11	6	4.5	.7	3.7-5.5	-	-	28	2.1	-
12	14	5.5	.5	4.5-6.5	5.0	.5	30	2.4	2.3
13	17	7.5	1.2	5.2-10.0	8.0	-	33	3.3	3.6
14	13	8.2	.7	7.0-9.5	10.5	2.6	36	3.7	4.8
15	22	11.0	1.6	9.0-14.5	12.0	1.3	38	5.0	5.4
16	18	13.5	2.1	11.0-18.5	14.5	2.9	41	6.1	6.6
17	17	16.2	1.6	13.2-19.0	-	-	43	7.3	-
18	16	18.0	2.4	15.0-23.0	19.0	-	46	8.2	8.6
19	28	23.5	2.4	28.0-28.5	22.5	4.3	48	10.7	10.2
20	11	26.0	2.0	22.5-29.0	26.5	5.4	51	11.8	12.0
21	13	28.5	3.3	24.0-36.0	32.5	5.0	53	12.9	14.7
22	12	32.7	3.5	26.0-36.0	34.5	5.6	56	14.8	15.6
23	7	40.0	3.7	34.0-44.0	40.5	4.6	58	18.1	18.4
24	6	45.2	5.0	38.0-54.0	47.5	6.5	61	20.5	21.5
25	9	50.2	4.5	44.0-58.0	47.5	5.8	63	22.8	21.5
26	7	55.7	3.5	52.2-63.0	54.0	8.6	66	25.3	24.5
27	1	(61.0)	-	-	58.5	8.5	69	(27.7)	26.5
28	2	65.0	-	65.0	70.0	13.6	71	29.5	31.7
29	3	73.7	-	71.0-79.0	71.0	8.0	74	33.4	32.2
30	1	(75.0)	-	-	83.5	-	76	34.0	37.9
31	-	-	-	-	86.0	-	79	-	39.0
32	2	89.0	-	83.0-95.0	95.0	12.0	81	40.4	43.1
33	-	-	-	-	102.0	12.6	84	-	46.3
34	1	(129.0)	-	-	-	-	86	(58.5)	-
36	-	-	-	-	110.0	-	91	-	49.9
40	-	-	-	-	220.0	-	102	-	99.8
47	-	-	-	-	260.0	-	119	-	117.9
48	-	-	-	-	270.0	-	122	-	122.5
51	-	-	-	-	325.0	-	129	-	147.4
56	-	-	-	-	(454.0)	-	142	-	205.9
59	-	-	-	-	(483.0)	-	150	-	219.1

[1] Source for Goroka data, G.L.Malynicz, pers.comm. 27 March 1972. Weights in parentheses are for single measurements.

referred to as Goroka A data hereafter to distinguish them from later Goroka figures). A few measurements of Nimai pigs showed them to be closely similar to Goroka ones (Table A7.1), and I decided to use this method.

In practice, measuring heart girths was relatively simple and quick (a good illustration of the technique, applied to a cow, can be found in Brody 1945: Fig.16.62b, p.561). Since no lifting, or other undue, handling of the pigs was necessary, measurement could be made with minimum disturbance. If, as occurred in some instances, a pig reacted strongly to the approach or touch of a stranger (myself or assistant), the owner or keeper was quickly shown what was required, and he or she could usually slide the tape around the pig's girth while soothing the animal, pinch it at the mark, and pass it over for reading. Most people understood well what was being measured, were tolerant of my activity, and many were interested in knowing the relative increase made by their pigs.

Girth measurements provide an indirect and therefore approximate means of estimating the live weight of a pig, providing that a direct relationship between the two quantities can be demonstrated. In the case of US cattle, Brody (1945:365-6, 398-403, 631-6), using large samples, showed that their weight varied with approximately the cube of their girth, allowing him to give exact values to the regression equation

(1) log Weight = log a + b log Girth (where a is a constant, the ratio of $\frac{W}{G^b}$, and b is the exponent of increase in weight for each percentage increase in girth)

and thus calculate conversion tables for weight from girth. Although my data are far inferior, my purpose is similar, and the following description is based on his explanation.

Table A7.1 lists the means of the heart girth and weight measurements I was able to collect for Waula pigs, and the data from villages near Goroka kindly supplied by Malynicz. I was not able to weigh large Sinasina pigs. Since the Sinasina and Goroka means for pigs with girths under 27 inches were closely similar (rarely differing by more than one kg, or two lbs - all weights were originally in pounds), I therefore decided to treat the two sets of data as a single set. Accordingly, all the mean weights in Table A7.1 were plotted on log log paper. Their distribution was essentially linear, indicating that a regression formula was applicable.

To discover the value of b in equation (1), I drew in by inspection an average line, plotting the shape of log weight against log girth. The intersects of this line at 1000 lbs/75 inches and 1 lb/6.25 inches were then used to calculate the value of b by means of the equation

$$(2) \quad b = \frac{\log 1000 - \log 1}{\log 75 - \log 6.25}$$

$$b = \frac{3}{1.8751 - 0.7959}$$

$$b = 2.8$$

The value of log a can then be found by means of the equation

$$(3) \quad \log a = 3 - (2.8 \times 1.8751)$$

$$\log a = -2.25$$

Retaining the logarithmic form, equation (1) now reads

(1) log Weight (lbs) = 2.8 log Girth (ins) -2.25

This was used to calculate the estimated weights given in the conversion table (Table A7.2) which were used throughout the study.

This calculation has two obvious weaknesses - the data on which it is based, and the crude "eye-balling" of an average line. The major problem with the data is the lack of weights and measurements of large (27 inches +) Waula pigs, or at least ones from Sinasina, and the consequent reliance upon the (relatively) few data on large pigs from Goroka. Use of the latter meant assuming that Goroka pigs are similar to Sinasina ones which, while reasonable, is certainly not established. After analysis of the main body of pig data described in this study, I received some additional weights and measurements on large pigs, also from Goroka, from Malynicz (pers.comm. 18 October 1974; hereafter Goroka B; see Table A7.3). Armed with these, and with greater

TABLE A7.3 Girth and weight measurements of 18 large Goroka pigs(1)

Sex	Girth cms	Weight kg	Sex	Girth cms	Weight kg
M	92	65.8	F	119	114.3
F	95	69.0	F	120	111.1
F	97	74.8	M	122	115.2
M	99	69.4	F	122	115.7
F	110	86.2	F	132	130.2
F	110	92.5	F	132	142.9
F	116	103.9	F	145	161.5
M	118	131.5	M	151	221.4
F	119	99.8	F	158	215.5

(1) Source : G.L.Malynicz, pers.comm. 18 October 1974. Weights originally in lbs.

familiarity with regression equations, I reanalysed, (with the invaluable assistance of Dr John Meaney and Stephen Black) all the

TABLE A7.2 Conversion table for estimating weight from heart girth[1]

Heart girth ins	Weight[2]		Heart girth ins	Weight		Heart girth ins	Weight	
	lbs	kg		lbs	kg		lbs	kg
9	2.7	1.0	26	51	23	43	211	96
10	3.5	1.5	27	57	26	44	225	102
11	4.5	2.0	28	63	29	45	239	108
12	6.0	2.5	29	70	32	46	254	115
13	7.5	3.0	30	77	35	47	270	123
14	9.0	4.0	31	84	38	48	287	130
15	11.0	5.0	32	92	42	49	304	138
16	13.2	6.0	33	100	45	50	321	146
17	15.7	7.0	34	109	49	51	340	154
18	18.5	8.0	35	118	54	52	359	163
19	21.5	10.0	36	128	58	53	378	172
20	24.7	11.0	37	138	63	54	399	181
21	28.2	13.0	38	149	68	55	420	190
22	32.2	15.0	39	160	73	56	442	200
23	36.5	17.0	40	172	78	57	464	210
24	41.2	19.0	41	184	84	58	487	221
25	46.0	21.0	42	197	89	59	511	232

(1) Using the equation log weight (lbs) = 2.8 log girth (ins) - 2.25

(2) Calculated in lbs (rounded to nearest ¼ lb in column one, nearest lb in columns 2 and 3) ; kg converted from calculated lbs and rounded.

available sets of weight and measurement data by computer to remove any bias due to the earlier graphical method of calculation. In these analyses, individual values for the Waula pigs were used, not the means listed in Table A7.1.

At this stage I had three sets of data. Those from the Waula pigs, subdivided by sex (134 males, 104 females), the early Goroka (A) data (N=28, most of which were means), and the later measurements on 18 large Goroka (B) pigs. Six regressions were run, with results as shown in Table A7.4. (All values were converted from lbs and ins. to kg and cms before calculation). For comparison the metric values for equation (1) above, i.e. those established by inspection only, were a = -3.73, b = 2.8. A simple comparison of the weights predicted for a few selected heartgirths by equations using the different values for a and b given in Table A7.4 is made in Table A7.5. These differ in expected directions, i.e. the first three, all based solely on the Waula measurements of mainly small pigs "exaggerate" weights of larger animals. This is particularly noticeable by comparison with predictions based on measurements of the large Goroka (B) pigs, Column 5, which, since they included no animals weighing less than 66 kg, exaggerate the weights of smaller pigs.

For my purposes, I am pleased by the close similarity between Columns 4 (the Goroka (A) data above), 6 (all Waula and Goroka (B) pigs), and 7 (from the "eye-balled" average line drawn from the Waula means and the Goroka (A) data). While the overall fit in no way makes up for the lack of measurements on large Sinasina pigs, it suggests that the values used in this study (Table A7.2) are not seriously awry.

TABLE A7.4 Results of six regressions of log weight (kg.) against log heart girth (cms).

Data	N=	Multiple R	R^2	St. Error	F	Constant (a)	Exponent (b)
1. Waula pigs - total	238	0.98863	0.97740	0.05286	10205.999	-3.9396	2.9274
2. Waula pigs - female	104	0.99243	0.98492	0.05002	6663.633	-3.8706	2.8856
3. Waula pigs - male	134	0.98309	0.96646	0.05470	3803.353	-4.0490	2.9947
4. Goroka pigs A	28	0.99756	0.99512	0.03776	5298.904	-3.6204	2.7518
5. Goroka pigs B	18	0.97654	0.95363	0.03443	329.044	-2.6431	2.2616
6. Waula + Goroka B	256	0.99270	0.98546	0.05484	17213.723	-3.7773	2.8270

TABLE A7.5 Pig weights (kg) predicted for selected heart girths (cms) by 7 equations. (1)

Heart girths cms	Weights (kg) predicted by seven equations						
	1.	2.	3.	4.	5.	6.	7.
25	1.4	1.5	1.4	1.7	3.3	1.5	1.5
35	3.8	3.8	3.8	4.2	7.1	3.9	4.0
40	5.6	5.6	5.6	6.1	9.6	5.6	5.7
50	10.8	10.8	10.9	11.3	15.8	10.6	10.7
75	35.4	34.7	36.8	34.6	39.6	33.4	33.3
100	82.2	79.5	87.2	76.4	75.9	75.3	74.8
125	158.1	151.4	167.0	141.2	125.7	141.5	139.4
150	269.6	256.3	293.6	233.2	189.8	237.0	232.9

(1) Equations 1-6 from Table A7.4. Equation 7 = Equation 1 in text, p.646, 648

In the interests of other possible users, Table A7.6 gives a full set of conversions predicted by the equation (No.6 in Table A7.4) using values derived from the combined Waula and Goroka (B) pigs.

TABLE A7.6 Estimated weight (kg) from heart girth (cms) when Log Weight (kg) = 2.82696 Log Girth (cms) - 3.7773

Girth	Weight	Girth	Weight	Girth	Weight	Girth	Weight
25	1.5	60	17.8	95	65.1	130	158.0
26	1.7	61	18.6	96	67.1	131	161.5
27	1.9	62	19.5	97	69.1	132	165.0
28	2.1	63	20.4	98	71.1	133	168.6
29	2.3	64	21.3	99	73.2	134	172.2
30	2.5	65	22.3	100	75.3	135	175.8
31	2.8	66	23.2	101	77.4	136	179.5
32	3.0	67	24.3	102	79.6	137	183.3
33	3.3	68	25.3	103	81.8	138	187.1
34	3.6	69	26.4	104	84.1	139	191.0
35	3.9	70	27.5	105	86.4	140	194.9
36	4.2	71	28.6	106	88.8	141	198.8
37	4.5	72	29.7	107	91.1	142	202.8
38	4.9	73	30.9	108	93.6	143	206.9
39	5.3	74	32.1	109	96.0	144	211.0
40	5.6	75	33.4	110	98.6	145	215.2
41	6.0	76	34.6	111	101.1	146	219.4
42	6.5	77	36.0	112	103.7	147	223.7
43	6.9	78	37.3	113	106.3	148	228.0
44	7.4	79	38.7	114	109.0	149	232.4
45	7.9	80	40.1	115	111.7	150	236.8
46	8.4	81	41.5	116	114.5	151	241.3
47	8.9	82	43.0	117	117.3	152	245.9
48	9.4	83	44.4	118	120.9	153	250.5
49	10.0	84	46.0	119	123.1	154	255.1
50	10.6	85	47.5	120	126.0	155	259.8
51	11.2	86	49.1	121	129.0	156	264.6
52	11.8	87	50.8	122	132.1	157	269.4
53	12.5	88	52.4	123	135.1	158	274.3
54	13.2	89	54.1	124	138.3	159	279.2
55	13.9	90	55.9	125	141.4	160	284.2
56	14.6	91	57.6	126	144.7	161	289.3
57	15.4	92	59.5	127	147.9	162	294.4
58	16.1	93	61.3	128	151.2	163	299.6
59	16.9	94	63.2	129	154.6	164	304.8
						165	310.0

APPENDIX 8

Data base for retrodicting the composition of past pig populations according to the means by which pigs were acquired (see Chapter 8,p.442)

TABLE A8.1 Pigs owned by Waula (May 1972) and Barikane (July 1972), by mode of acquisiton and size class

Size class kg	Waula Number of pigs acquired by Production	Gift Exchange	Trade	Barikane Number of pigs acquired by Production	Gift Exchange	Trade
101 +	-	-	-	5	4	2
76-100	1	7	9	5	8	4
51-75	2	9	7	7	16	7
26-50	29	27	22	6	7	3
-25	76	19	13	1	1	4
Totals	108	62	51	24	36	20

TABLE A8.2 Observed composition of Waula pig population in 1972, and retrodicted populations in preceding two "years"[(1)]

Year	Production		Gift exchange		Trade		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
1972	108	49	62	28	51	23	221	100
"1971"	32	28	43	38	38	34	113	100
"1970"	3	9	16	46	16	46	35	100

[(1)] "1971" calculated by subtracting the smallest size class pigs in Table A8.1 above from the 1972 totals; "1970" calculated by subtracting the 26-50 kg size class pigs (Table A8.1) from the "1971" figures.

TABLE A8.3 Observed composition of Barikane pig population in 1972, and retrodicted populations in preceeding 4 "years"(1)

Year	Production		Gift exchange		Trade		Total	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
1972	24	30	36	45	20	25	80	100
"1971"	23	31	35	47	16	22	74	100
"1970"	17	29	28	48	13	22	58	100
"1969"	10	36	12	43	6	21	28	100
"1968"	5	45	4	36	2	18	11	100

(1) For method of calculation see note to Table A8.2.

BIBLIOGRAPHY

A. Unpublished reports of field staff of the Papua New Guinea Government, and other unpublished Government, and Council, documents.[1]

I use the following abbreviations : AR Annual Report, CPR Chimbu Patrol Report, MR Monthly Report, PR Patrol Report. All such reports, unless otherwise indicated, refer to 'Chimbu'. Many of the earliest reports from the period 1936 to 1942 have survived only in carbon form, omitting the original designating letters and numbers : in such cases I have given the full dates of the patrol for identification. After about 1950, patrol reports were usually numbered annually from the subdistrict from which they were carried out, thus I think that all reports from the Chimbu area between the mid 1940s until Chimbu became a district in 1966 were on the same numbering system. After 1966, each subdistrict (I presume) numbered its own reports. However, Sinasina remained an administrative part of the Kundiawa division, and thus all post-1966 reports are 'Kundiawa' ones.

Akins, A.J. CPR 18, 1964/65

Bailey, L.W. CPR 1, 1953/54

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[1] Locations of documents : most of the older reports were read at the National Archives in Port Moresby, the main exceptions being those of Downs, Bates, and some of Kyle's, all of which appeared on PAMBU microfilm after leaving the field (PMB rolls 607,616). Others were read at Kam tai (in Sinasina), Kundiawa, and Goroka. Several of the pre-World War II documents (i.e.some of Kyle's reports and the Kundiawa Station Diaries etc.) were still held at Kundiawa in 1972-73. By 1975 some of the former were circulating in re-typed form.

BIBLIOGRAPHY

Bates, C.D.	PR 19-24 February 1936
	PR 2-13 March 1936
	PR 19-24 March 1936
	PR 31 March-4 April 1936
	PR 21-25 April 1936
	PR 20-31 May 1936
Bragge, L.W.	Gumine PR 4, 1962/63
Burfoot, G.R.	CPR 1, 1950/51
Clayton, G.L.	CPR 9, 1966/67
Colman, J.	CPR 4, 1954/55
Costelloe, J.A.	CPR 7, 1946/47
	Special Report 2, 1947/48
Dennis, J.C.	CPR 2, 1944/45
	CPR 6, 1944/45
	CPR 11, 1944/45
	CPR 2, 1945/46
	CPR 5, 1945/46
Downs, I.F.G.	Hagen-Sepik Patrol, 31 August-18 January, 1938/39
	PR 1-10 October, 1939
	PR 13-21 October, 1939
	PR 23-26 October, 1939
	PR 7-21 November, 1939
	PR 2-8 December, 1939
	PR 12-20 December, 1939
	PR 28 March-9 April, 1940
	PR 10-16 May, 1940
	PR 16-19 May, 1940
	PR 19-31 May, 1940
	PR 31 May-2 June, 1940
	PR 1-9 July, 1940
	PR 21 July-1 August, 1940
	PR 23 September-17 October, 1940
	MR December 1939
	MR January 1940
	MR March 1940
	MR May 1940
	MR October 1940
	AR June 1940
Fowler, N.F.	CPR 14, 1952/53
Greaney, R.K.	CPR 14, 1959/60
Grey, M.R.	CPR 7, 1962/63

Grierson, C.R.	CPR 3, 1972/73
Guise, E.M.	CPR 9, 1969/70 CPR 15, 1969/70
Hardie, P.A.	CPR 1, 1964/65
Harris, F.N.	CPR 8, 1953/54 CPR 9, 1953/54
Hayes, B.B.	CPR 5, 1952/53 CPR 12, 1952/53
Haywood, M.R.	CPR 8, 1954/55 CPR 11, 1954/55
Heagney, B.R.	CPR 4, 1950/51
Hibberd, W.J.	CPR 2, 1954/55
Humfrey, J.	CPR 3, 1964/65 CPR 7, 1967/68
Jones, K.W.	CPR 9, 1944/45
Julius, C.	nd.(?1952) "Mission investigation : Sina Sina Area, Chimbu Sub-District, Eastern Highlands District." Report to Director, Department of District Services and Native Affairs, Konedobu (DS 30/16/141).
Kellaart, D.E.	CPR 3, 1950/51 CPR 2, 1951/52
Kelly, W.J.	CPR 6, 1954/55
Keogh, A.M.	CPR 1, 1952/53

Kundiawa Station Diary 1937, 1938, 1939, 1940.

Kundiawa Station, Monthly Reports and Correspondence, November 1936-July 1937.

Kyle, A.K.	PR 23-26 April, 1937 PR 15-18 May, 1937 PR 18-23 June, 1937 PR 7-19 July, 1937 PR 14-22 August, 1937 MR November 1936 MR April 1937 MR May 1937
Lambden, W.J.G.	CPR 1, 1961/62

Lewis, D. CPR 2, 1962/63
CPR 5, 1962/63

McArthur, A.H. CPR 3, 1962/63
CPR 4, 1962/63

McBride, B. 1952 Special Report - Missions (File 32/3-89). Attached to Kelaart, D.E. CPR 3 1950/51.

McBride, B. CPR 4, 1951/52

McCarthy, J.K. Morobe PR 15, 1933/34

Mclay, A.J. CPR 1, 1971/72

Maume, B.J. CPR 4, 1969/70

Parker, F. CPR 5, 1964/65
CPR 9, 1964/65
CPR 10, 1964/65

Pegg, H.S. 1957 Entry in Village Book, Nimai Bomai Naurugau.

Salmon, P.W. CPR 7, 1968/69

Sauka, J.H. CPR 10, 1971/72

Sinasina Local Government Council, Minutes of meetings, and Elections File.

Stott, B.J. CPR 14, 1969/70

Taylor, J.L. 1933, Mt.Hagen Patrol

Wakeford, J.E. CPR 2, 1948/49
CPR 2, 1949/50

Warner Shand, F.N. PR 36, 1940/41
PR M10, 1941/42

Williams, H.L. PR No.C1/46, 1946

Winterford, A.J. PR 3, 1945

B. Published items and non-official documents

Aitchison, T.G. 1960 "The pig and its place in the impact of the New Guinean on vegetation", in UNESCO/TPNG, Symposium on the impact of man on Humid Tropics Vegetation. Goroka: Territory of Papua New Guinea, pp. 158-167.

Allen, M.R. 1968 "The establishment of Christianity and cash-cropping in a New Hebridean community", Pacific History, 3: 25-46.

Anderson, D. 1977 An economic survey of smallholder coffee producers - 1976. Port Moresby: Department of Primary Industry.

Anderson, J.N. 1973 "Ecological anthropology and anthropological ecology", in J.J. Honigman, ed. Handbook of social and cultural anthropology. Chicago: Rand McNally, pp. 143-178.

Anon. 1950 "Highland labour not always the right answer", Pacific Islands Monthly, 21(5): 108.

1953 "Chimbus: shorter term - higher costs", Pacific Islands Monthly, 23(11): 92.

1957 "Plantation work not popular with highlanders", Pacific Islands Monthly, 27(10): 123-4.

1970 "Pigs...breed comparisons", New Guinea Bulletin, 11(1): 29.

1971 75 years in New Guinea: Divine Word Missionaries 1896-1971. Wewak: Wantok Publications Inc.

Aschmann, H. 1965 "Comments on the Symposium 'Man, Culture, and Animals'", in A. Leeds and A.P. Vayda, eds. Man, culture and animals: the role of animals in human ecological adjustments. Washington, D.C.: American Association for the Advancement of Science, pp. 259-270.

Asdell, S.A. 1964 Patterns of mammalian reproduction. Ithaca: Comstock.

Aufenanger, H. 1965 "Kumo, the deadly witchcraft in the Central Highlands of New Guinea", Asian Folklore Studies, 24(1): 103-115.

Bagita, J. 1976 "Chimbu Province", in R.J. May, ed., Research needs and priorities in Papua New Guinea. Port Moresby: IASER Monograph No. 1, pp. 84-6.

Bailey, K.V. 1963 "Nutritional status of East New Guinean populations", Tropical and Geographical Medicine, 15: 389-402.

and J. Whiteman 1963 "Dietary studies in the Chimbu (New Guinea Highlands)", Tropical and Geographical Medicine, 15: 377-388.

Baldwin, J.A. 1978 "Pig rearing vs. pig breeding in New Guinea", Anthropological Journal of Canada, 16(3): 23-27.

Barrett, R.H. 1973 "Bibliography on Sus scrofa age determination", Unpublished ms.

Barrie, J.W. 1956a "Coffee in the Highlands", Papua and New Guinea Agricultural Journal, 11(1): 1-29.

1956b "Population-land investigation in the Chimbu Sub-District", Papua and New Guinea Agricultural Journal, 11(2): 45-51.

Barth, F. 1973 "Descent and marriage reconsidered", in J. Goody, ed. The Character of Kinship. Cambridge: Cambridge University Press, pp. 3-19.

Bennett, J.W. 1976 The ecological transition: cultural anthropology and human adaptation. New York: Pergamon Press.

Bennett, M.K. 1971 "Aspects of the pig", Agricultural History, 44(2): 223-235.

Bergmann, F. 1975 "On the inadequacies of functionalism", Michigan Discussions in Anthropology, 1(1): 2-23.

Bergmann, W. 1971 The Kamanuku. Mutdapilly, Queensland: privately distributed.

Bloch, M. 1953 The Historian's craft. New York: Vintage Books.

Bouchard, J.F. 1973 The impact of roads in the Gumine region of Papua New Guinea. Port Moresby: University of Papua New Guinea, Department of Geography, Occasional Paper No. 5.

Bowers, N. 1968 The ascending grasslands. New York: Columbia University, Ph.D. Thesis.

1971 "Demographic problems in montane New Guinea", in S. Polgar, ed. Culture and population: a collection of current studies. Chapel Hill: University of North Carolina, Carolina Population Center Monograph No. 9, pp. 11-31.

Bowman, R.G. 1946 "Army farms and agricultural development in the Southwest Pacific", Geographical Review, 36: 420-46.

Boyd, D.J. 1975 Crops, Kiaps and currency: flexible behavioral strategies among the Ilakia of Papua New Guinea. Berkeley: University of California at Los Angeles, Ph.D. Thesis.

Braudel, F. 1973 Capitalism and material life 1400-1800. New York: Harper and Row.

Brody, S. 1945 Bioenergetics and growth: with special reference to the efficiency complex in domestic animals. New York: Reinhold Publ. Corp.

Brookfield, H.D. 1966 "But where do we go from here?" in E.H. Hipsley, ed. An integrated approach to nutrition and society: the case of the Chimbu. Canberra: New Guinea Research Bulletin No. 9, pp. 49-66.

1968 "The money that grows on trees: the consequences of an innovation within a man-environment system", Australian Geographical Studies, 6: 97-119.

1969 "Introduction: the market-place", in H.C. Brookfield, ed. Pacific market places. Canberra: Australian National University Press, pp. 1-24.

1972 "Intensification and disintensification in Pacific agriculture: a theoretical approach", Pacific Viewpoint, 13(1): 30-48.

1973a "Explaining or understanding? the study of adaptation and change", in H.C. Brookfield, ed. The Pacific in transition, London: E. Arnold, pp. 3-22.

1973b "Full circle in Chimbu: a study of trends and cycles", in H.C. Brookfield, ed. The Pacific in transition, London: E. Arnold, pp. 127-160.

and P. Brown 1963 Struggle for land. Melbourne: Oxford University Press.

and D. Hart 1966 Rainfall in the tropical Southwest Pacific. Canberra: Australian National University, Department of Geography Publication G/3.

with D. Hart 1971 Melanesia: a geographical interpretation of an island world. London: Methuen.

Brown, M. and J.M. Powell 1975 "Frost and Drought in the highlands of Papua New Guinea", Tropical Geography, 38: 1-6.

Brown, Paula 1960 "Chimbu tribes: political organisation in the Eastern Highlands of New Guinea", Southwestern Journal of Anthropology, 16(1): 22-35.

1962 "Non-agnates among the patrilineal Chimbu", Journal of the Polynesian Society, 71(1): 52-69.

1963 "From anarchy to satrapy", American Anthropologist, 65(1): 1-15.

Brown, Paula 1964 "Enemies and affines", Ethnology, 3(4): 335-56.

1967a "Kondom", Journal of the Papua and New Guinea Society, 1(2): 27-35.

1967b "The Chimbu political system", Anthropological Forum, 2(1): 36-52.

1969 "Marriage in Chimbu", in R.M. Glasse and M.J. Meggitt, eds. Pigs, pearlshells, and women: marriage in the New Guinea Highlands. Englewood Cliffs, N.J.: Prentice-Hall, pp. 77-95.

1970a "Chimbu transactions", Man, 5(1): 99-117.

1970b "Mingge-money: economic change in the New Guinea highlands", Southwestern Journal of Anthropology, 26(3): 242-260.

1972 The Chimbu. Cambridge, Mass.: Schenkman.

1974 "Mediators in social change: new roles for big-men", Mankind, 9(3): 224-230.

1977 "Kumo witchcraft at Mintima, Chimbu Province, Papua New Guinea", Oceania, 48(1): 26-9.

1978 Highland peoples of New Guinea. Cambridge: Cambridge University Press.

1979 "Change and the boundaries of systems in Highland New Guinea: The Chimbu", in P. Burnham and R.F. Ellen, eds. Social and ecological systems. London: Academic Press, pp. 235-251.

and H.C. Brookfield 1959 "Chimbu land and society", Oceania, 30(1): 1-75.

1967 "Chimbu settlement and residence: a study of patterns, trends and idiosyncracy", Pacific Viewpoint, 8(2): 119-151.

and A. Podolefsky 1976 "Population density, agricultural intensity, land tenure, and group size in the New Guinea Highlands", Ethnology, 15(3): 211-238.

and G. Winefield 1964 "Some demographic measures applied to Chimbu census and field data", Oceania, 35(3): 175-190.

Brunton, R. 1971 "Cargo cults and systems of exchange in Melanesia", Mankind, 8(2): 115-128.

Buchbinder, G. 1974 "Where do Maring pigs come from?" Unpublished paper read at 73rd Annual meeting, American Anthropological Association, Mexico City.

Bulmer, R.N.H. 1962 "Chimbu plume traders", Australian Natural History, 14(1): 15-19.

1967 "Why is the cassowary not a bird? A problem of zoological taxonomy among the Karam of the New Guinea Highlands", Man (n.s.), 2: 5-25.

1968 "The strategies of hunting in New Guinea", Oceania, 38: 302-18.

1969 Field methods in Ethno-zoology with special reference to the New Guinea Highlands. Port Moresby: University of Papua New Guinea, mimeo.

1972 "Victims of progress: the plight of ethnic minorities in undeveloped areas", in M.W. Ward, ed. Change and development in rural Melanesia. Canberra: Australian National University and University of Papua New Guinea, pp. 119-129.

1976 "Selectivity in hunting and in disposal of animal bone by the Kalam of the New Guinea Highlands", in G. de G. Sieveking, I.H. Longworth, and K.E. Wilson, eds. Problems in economic and social archaeology. London: Duckworth, pp. 169-186.

and J.I. Menzies 1972/73 "Karam classification of marsupials and rodents", Journal of the Polynesian Society, 81: 472-99, 82: 86-107.

Bulmer, S. 1975 "Settlement and economy in prehistoric Papua New Guinea: a review of the archaeological evidence", Journale Societe des Oceanistes, 31(46): 7-75.

Bureau for Native Affairs 1957 Anthropological Research in Netherlands New Guinea since 1950. Hollandia, New Guinea: Bureau for Native Affairs.

Bureau of Statistics 1969 Territory of Papua and New Guinea, Population census, 1966. Chimbu District. Preliminary Bulletin No. 28. Konedobu: Bureau of Statistics.

1974 Papua New Guinea, Population Census, 1971. Chimbu District. Population characteristics, Bulletin No. 9. Konedobu: Bureau of Statistics.

Burridge, K. 1969 Tangu traditions. Oxford: Oxford University Press.

Chaplin, R.E. 1969 "The use of non-morphological criteria in the study of animal domestication from bones found on archaeological sites", in P.J. Ucko and G.W. Dimbleby, eds. The domestication and exploitation of plants and animals. Chicago: Aldine, pp. 231-245.

Cheeseman, Evelyn 1949 Six-legged snakes in New Guinea. London: G.G. Harrap.

Chinnery, E.W.P. 1934 "Mountain tribes of the Mandated Territory of New Guinea from Mt. Chapman to Mt. Hagen", Man, 34(140): 113-121.

Chisholm, M. 1967(1962) Rural settlement and land use. New York: J. Wiley.

Clarke, W.C. 1977 "The structure of permanence: the relevance of self-subsistence communities for world ecosystem management", in T.P. Bayliss-Smith and R.G. Feachem, eds. Subsistence and survival. New York: Academic Press, pp. 363-384.

Collier, S. and J.P. White 1976 "Getting them young? age and sex inferences on animal domestication in archaeology", American Antiquity, 41(1): 96-102.

Collins and Leahy Ltd. 1972 Collins and Leahy Holdings Limited, Annual Report 1972. Goroka: Highland News.

Cook, E.A. 1967 Manga social organization. New Haven: Yale University, Ph.D. Thesis.

Criper, C. 1965 "The Chimbu Open Electorate", in D.G. Bettison, C.A. Hughes and P.W. Van der Veur, eds. The Papua New Guinea elections 1964. Canberra: Australian National University Press, pp. 120-146.

1967 The politics of exchange: a study of ceremonial exchange among the Chimbu. Canberra: Australian National University, Ph.D. Thesis.

Crosby, A.W. 1976 Epidemic and peace, 1918. Westport: Greenwood Press.

Daika 1949 "Brides join the price spiral", Pacific Islands Monthly, 20(4): 56.

Darling, F.F. 1970(1956) "Man's ecological dominance through domesticated animals on wild lands", in W.L. Thomas, ed. Man's role in changing the face of the earth. Chicago: University of Chicago Press.

de Fredrick, D.F. 1971 Pig raising in the British Solomon Island Protectorate. Honiara: Agricultural Information Service, Department of Agriculture (Hong Kong: Cathay Press).

Deibler, E. and D. Trefry 1963 Languages of the Chimbu Sub-District. Port Moresby: Department of Information and Extension Services and Summer Institute of Linguistics.

Department of Agriculture Stock and Fisheries (DASF) 1971 Indigenous crop and cattle statistics No. 4, 1969-70. Port Moresby.

Dexter, D. 1961 The New Guinea Offensives. Canberra: Australian War Memorial.

Divale, W.T. and M. Harris 1976 "Population, warfare, and the male supremacist complex", American Anthropologist, 78(3): 521-538.

Dornstreich, M.D. and G.E.B. Morren 1974 "Does New Guinea cannibalism have nutritional value?" Human Ecology, 2(1): 1-12.

Drew, J.S. 1962 "Manorial accounts of St. Swithun's Priory, Winchester", in E.M. Carus-Wilson, ed. Essays in economic history Vol. 2. New York: St. Martin's Press, pp. 12-30.

Dubbeldam, L.F.B. 1964 "The devaluation of the Kapauku cowrie as a factor of social disintegration", American Anthropologist, 66(4), Part 2, pp. 293-303.

Dwyer, P.D. 1974 "The price of protein: five hundred hours of hunting in the New Guinea Highlands", Oceania, 44(4): 278-293.

1975 "Observations on the breeding biology of some New Guinea murid rodents", Australian Wildlife Research, 2(2): 33-45.

1978a "Rats, pigs and man: disturbance and diversity in the New Guinea Highlands", Australian Journal of Ecology, 3(2): 213-232.

1978b "A study of Rattus exulans (Peale) (Rodentia: Muridae) in the New Guinea Highlands", Australian Wildlife Research, 5(2): 221-248.

Dwyer, R.E.P. 1954 "Coffee cultivation in Papua and New Guinea", Papua and New Guinea Agricultural Journal, 9(1): 1-15.

Economic Consultants Ltd. 1979 Simbu Province Rural Development Study. Kundiawa: Draft final report, Volume 3.

Egerton, J.R. 1965a "Characteristics of *Bacillus anthracis* isolated from pigs in Papua and New Guinea", Papua and New Guinea Agricultural Journal, 17(4): 136-140.

1965b "Porcine anthrax in Papua and New Guinea", Papua and New Guinea Agricultural Journal, 17(4): 141-4.

Ellen, R.F. 1979 "Introduction: anthropology, the environment and ecological systems", in P. Burnham and R.F. Ellen, eds. Social and ecological systems. London: Academic Press, pp. 1-17.

Emmery, P.F. 1970 "Increasing economic efficiency in production from plantation tree crops", Search, 1(5): 277-278.

Evans, M. 1974 "A note on the measurement of Sahlins' social profile of domestic production", American Ethnologist, 1(2): 269-279.

Feachem, R.G.A. 1973 "The Raiapu Enga pig herd", Mankind, 9(1): 25-31.

1974 "Faecal coliforms and faecal streptococci in streams in the New Guinea Highlands", Water Research, 8: 367-374.

1975 "Pigs, people and pollution: interactions between man and environment in the highlands of New Guinea", South Pacific Bulletin, 25(3): 41-45.

1977 "Environmental health engineering as human ecology: an example from New Guinea", in T.P. Bayliss-Smith and R.G. Feachem, eds. Subsistence and survival: rural ecology in the Pacific. London: Academic Press, pp. 129-182.

Feil, D.K. 1976 "People, pigs and punishment", Australian Natural History, 18(12): 444-447.

Finley, M.I. 1973 The Ancient Economy. Berkeley and Los Angeles: University of California Press.

Finney, B. 1973 Big-men and business: entrepreneurship and economic growth in the New Guinea Highlands. Honolulu: University Press of Hawaii.

U. Mikave and A. Sabumei 1974 "Pearl shell in Goroka: from valuables to chicken feed", Yagl-Ambu, 1(4): 342-349.

Firth, R. 1952 "Notes on the social structure of some south-eastern New Guinea communities. Part 1: Mailu", Man, 52(99): 65-86.

Fisk, E.K. 1962 "Planning in a primitive economy: special problems of Papua-New Guinea", Economic Record, 38(84): 462-478.

1964 "Planning in a primitive economy: from pure subsistence to the production of a market surplus", Economic Record, 40(90): 156-174.

ed. 1978 The adaptation of traditional agriculture: socio-economic problems of urbanization. Canberra: Australian National University, Development Studies Monograph No. 11.

and R.T. Shand 1969 "The early stages of development in a primitive economy: the evolution from subsistence to trade and specialization", in C.R. Wharton, ed. Subsistence Agriculture and Economic Development. Chicago: Aldine Publishing Company, pp. 257-274.

J.B., Hardaker and R.R. Thaman 1976 Food production in the South Pacific. Suva: University of the South Pacific.

Frerichs, A., and B. Frerichs 1969 Anutu conquers in New Guinea. Minneapolis: Augsburg Publishing House.

Friedman, J. 1974 "Marxism, structuralism and vulgar materialism", Man (n.s.) 9: 444-469.

1979 "Hegelian ecology: between Rousseau and the World Spirit", in P. Burnham and R.F. Ellen, eds. Social and ecological systems. London: Academic Press, pp. 253-270.

Gande, J.A. 1974 "Chimbu pig-killing ceremony", Oral History, 2(9): 6-14.

Genovese, E.D. 1962 "Livestock in the Slave Economy of the Old South - a revised view", Agricultural History, 36: 143-9.

Gerritsen, R. 1975 "Aspects of the evolution of rural Papua New Guinea: towards a political economy of the terminal peasantry", Canberra: Canberra Marxist Discussion Group, unpublished paper.

Gitlow, A.L. 1947 Economics of the Mount Hagen tribes, New Guinea. Seattle: University of Washington Press.

Godwin, D.H. 1973 Pig management and production: a practical guide for farmers and students. London: Hutchinson Educational Ltd.

Golla, P. 1971 "A biography", Rondug-Wei, 1(1): 7-10.

Golson, J. 1977 "The making of the New Guinea Highlands", in J.H. Winslow, ed. The Melanesian environment. Canberra: Australian National University Press, pp. 45-56.

Goody, J. 1969 "'Normative', 'recollected' and 'actual' marriage payments among the Lowiili of Northern Ghana, 1951-1966", Africa, 39(1): 54-61.

1973 "Bridewealth and dowry in Africa and Eurasia", in J. Goody and S.J. Tambiah, Bridewealth and dowry. Cambridge: Cambridge University Press, pp. 1-58.

Gross, D.R. 1975 "Protein capture and cultural development in the Amazon Basin", American Anthropologist, 77: 526-549.

Haantjens, H.A. ed. 1970 Lands of the Goroka-Mount Hagen area, Territory of Papua and New Guinea. Melbourne: CSIRO, Land Research Series No. 27.

E. Reiner, and R.G. Robbins 1970 "Land systems of the Goroka-Mount Hagen Area", in H.A. Haantjens, ed. Lands of the Goroka-Mount Hagen area, Territory of Papua New Guinea. Melbourne: CSIRO, pp. 24-65.

Hafez, E.S.E. and J.P. Signoret 1969 "The behaviour of swine", in E.S.E. Hafez, ed. The behaviour of domestic animals. Baltimore: Williams and Wilkins, pp. 349-390.

Hardesty, D.L. 1977 Ecological anthropology. New York: J. Wiley.

Harding, T.G. 1967 Voyagers of the Vitiaz Strait. Seattle: University of Washington Press.

Harris, G.T. 1977 "Focus of change in subsistence agriculture, Papua New Guinea", Port Moresby: University of Papua New Guinea, Department of Economics Discussion Paper No. 31.

1978 "Responses to population pressure in the Papua New Guinea Highlands, 1957-74", Oceania, 48(4): 284-298.

Harris, M. 1959 "The economy has no surplus?" American Anthropologist, 61: 185-199.

1974 Cows, pigs, wars, and witches: the riddles of culture. New York: Random House.

Hatanaka, S. 1972 Leadership and socio-economic change in Sinasina, New Guinea Highlands. Canberra: New Guinea Research Bulletin No. 45.

Healey, C.J. 1973 Hunting of birds of paradise and trade in plumes in the Jimi Valley, Western Highlands District. Port Moresby: University of Papua New Guinea, MA. qualifying essay.

1977 Maring hunters and traders: the ecology of an exploitative, non-subsistence, activity. Port Moresby: University of Papua New Guinea, Ph. D. thesis.

Hide, R.L. 1969 "Worms and sickness: a note on noise-producing worms and mystical belief among the Nimai of the New Guinea Highlands", Mankind, 7(2): 149-151.

1973 The Land Titles Commission in Chimbu: an analysis of colonial law and practice, 1933-68. Canberra: New Guinea Research Bulletin No. 50.

1974 "On the dynamics of some New Guinea highland pig cycles". New York, unpublished paper.

1980a "Seasonality and Chimbu pig husbandry", Mankind, 12(3): in press.

1980b "Cash crop and food crop production in Chimbu: some questions concerning the results and interpretations of Lambert's Jobakogl food intake study", Port Moresby: University of Papua New Guinea/Department of Primary Industry, History of Agriculture Working Paper No. 44, mimeo.

M. Kimin, A. Kora, G. Kua, and K. Kua. 1979 A checklist of some plants in the territory of the Sinasina Nimai (Simbu Province, Papua New Guinea), with notes on their uses. Auckland: University of Auckland, Department of Anthropology Working Paper No. 54.

Hilliard, S.B. 1972 Hogmeat and hoecake: food supply in the old South, 1840-1860. Carbondale, Ill.: South Illinois University Press.

Hipsley, E.H. and Nancy Kirk 1965 Studies of dietary intake and the expenditure of energy by New Guineans. Noumea (New Caledonia): South Pacific Commission Technical Paper No. 147.

Holloway, J.T. 1964 "General trends in forest modification by introduced mammals", Proceedings of the New Zealand Ecological Society, No. 11.

Hope, G.S. 1976 "The vegetational history of Mt. Wilhelm, Papua Guinea", Journal of Ecology, 64(2): 627-663.

Howlett, D., R. Hide, and E. Young, with J. Arba, H. Bi, and B. Kaman 1976 Chimbu: issues in development. Canberra: Australian National University, Development Studies Centre.

Hughes, I. 1966 Availability of land, and other factors determining the incidence and scale of cash cropping in the Kere tribe, Sina Sina, Chimbu District, New Guinea. Sydney: Sydney University, BA. Hons. Thesis.

1969 nd "Some aspects of traditional trade in the New Guinea Highlands", Canberra: Department of Human Geography, Australian National University, unpublished paper.

1970 "Pigs, sago, and limestone: the adaptive use of natural enclosures and planted sago in pig management", Mankind, 7(4): 272-278.

1973 "Stone-age trade in the New Guinea inland: historical geography without history", in H.C. Brookfield, ed. The Pacific in transition. London: E. Arnold, pp. 97-127.

1977 New Guinea stone age trade: the geography and ecology of traffic in the interior. Canberra: Australian National University, Terra Australia No. 3.

1978 "Good money and bad: inflation and devaluation in the colonial process", Mankind, 11(3): 308-318.

Irwin, B. 1974 Salt-Yui Grammar. Canberra: Australian National University, Pacific Linguistics Series B, No. 35.

Ivinskis, V., O. Kooptzoff, R.J. Walsh, and D. Dunn 1956 "A medical and anthropological study of the Chimbu natives in the central Highlands of New Guinea", Oceania, 27(2): 143-157.

Jamieson, G.I. 1968 "Observations in time of maturity of sweet potato (Ipomoea batatas Lam.)", Papua and New Guinea Agricultural Journal, 20(1/2): 15-24.

Johnson, A.W. 1975 "Time allocation in a Machiguenga community", Ethnology, 14(3): 301-310.

Kelly, R. and R.A. Rappaport 1975 "Function, generality, and explanatory power: a commentary and response to Bergmann's arguments", Michigan Discussions in Anthropology, 1(1): 24-44.

Kenneth, J.H. and G.R. Ritchie 1953 Gestation periods. Commonwealth Bureau Animal Breeding and Genetics, Tech. Com. 5.

Kerridge, E. 1973 The farmers of Old England. London: G. Allen and Unwin Ltd.

Kidd, C.H. 1977 "Village water supply in Papua New Guinea", South Pacific Bulletin, 27(1): 37-43.

and W. Guthrie 1975 "Village water supply survey, Chimbu Province", Geological Survey, Papua New Guinea Report 75/9 (unpublished).

Knight, J. 1971 "Koge experiment", Point, 1: 130-148.

nd. "Principles for a pastoral policy for marriage in the Chimbu Catholic community of Papua New Guinea", unpublished paper.

1976 "A case study - Chimbu marriage", Point, 2: 11-23.

Knuttson, J.K.H. 1978 "'Buka Ingu': pig kill ceremony among the Kunanuku of Chimbu", Oral History, 6(7): 1-34.

Koma, J. 1976 "Salt making in the Chimbu Province", Oral History, 4(2): 53-56.

Komba, M. 1978 "Pre-contact and post-contact agriculture of the Kikin people of Gogolme: Gembogl District", Port Moresby" University of Papua New Guinea and Department of Primary Industry, History of Agriculture Working Paper No. 18.

Krider, J.L. and W.E. Carroll 1971 Swine production. New York: McGraw-Hill Book Company.

Kuabal, L. 1976 "Sina Sina Open", in D. Stone, ed. Prelude to self-government: electoral politics in Papua New Guinea 1972. Canberra: Australian National University Press, pp. 350-370.

Kuange, P. 1977 "Omkolai", in J. Conroy and G. Skeldon, eds. The Rural Survey 1975. Port Moresby: IASER/Yagl-Ambu, pp. 121-139.

La Fontaine, J. 1973 "Descent in New Guinea: an Africanist view", in J. Goody, ed. The character of kinship. Cambridge: Cambridge University Press, pp. 35-51.

Lambert, J.N. 1975 A study of nutritional status and economic development in the Chimbu District, Papua New Guinea. Port Moresby: Public Health Department.

1976 "Trends in food consumption patterns in Chimbu, 1956-1975", in K. Wilson and R.M. Bourke, eds. 1975 Papua New Guinea food crops conference proceedings. Port Moresby: Department of Primary Industry, pp. 37-43.

Langness, L.L. 1963 "Notes on the Bena council, Eastern Highlands", Oceania, 33(3): 151-170.

1964 "Some problems in the conceptualization of Highlands social structures", American Anthropologist, 66(4), Part 2, pp. 162-182.

Latukefu, S. 1972 "The place of tradition in modernization", Journal of the Papua New Guinea Society, 6(2): 3-12.

Lea, D.A.M. 1969/70 "Activity studies in New Guinea villages", Papua and New Guinea Agricultural Journal, 21(3/4): 118-126.

and L.H. Lewis. 1975 "Masculinity in Papua New Guinea", Yagl-Ambu, 2(2): 95-115.

Leahy, M. 1930-34 Diaries (MS. National Library, Canberra).

Lindenbaum, S. 1976 "A wife is the hand of man", in P. Brown and G. Buchbinder, eds. Man and woman in the New Guinea Highlands. Washington, D.C.: American Anthropological Association, pp. 54-62.

Lipuma, E. 1978 "The economy of pigs among the Maring of New Guinea", Chicago, unpublished paper.

Mackenzie, S.S. 1934 The Australians at Rabaul: the capture and administration of the German possessions in the Southern Pacific. Sydney: Angus and Robertson.

McAlpine, J.R. 1970 "Climate of the Goroka-Mount Hagen area", in H.A. Haantjens, ed. Lands of the Goroka-Mount Hagen area, Territory of Papua New Guinea. Melbourne: CSIRO, pp. 66-79.

G. Keig, and K. Short. 1975 Climatic tables for New Guinea. Melbourne: CSIRO Division of Land Use Research Technical Paper No. 37.

McArthur, M. 1972 "Food", in Encyclopaedia of Papua and New Guinea, Vol. 1. Melbourne: Melbourne University Press and University of Papua New Guinea, pp. 433-447.

1974 "Pigs for the Ancestors. A review article", Oceania, 45(2): 87-123.

1977 "Nutritional research in Melanesia: a second look at the Tsembaga", in T.P. Bayliss-Smith and R.G. Feachem, eds. Subsistence and survival. London: Academic Press, pp. 91-128.

McArthur, N. 1966 "The demographic situation", in E. Fisk, ed. New Guinea on the threshold. Canberra: Australian National University, pp. 103-116.

McKinnon, J.M. 1976 "Chayanov in the Solomons: a study of socio-economic motives in resource use", Pacific Viewpoint, 17(1): 49-60.

McVinney, P.A. and L.J. Luzbetak. 1954 Tabare Dialect. Volume 1. Grammar. Alexishafen: Catholic Mission.

Maahs, A.M. 1949 "Festival of the pig", Walkabout, 15(12): 17-20.

1950 "Salt-makers of the Wahgi", Walkabout, 16(1): 15-8.

Majnep, I.S., and R.N.H. Bulmer. 1977 Birds of my Kalam country. Auckland: Auckland University Press and Oxford University Press.

Malynicz, G.L. 1970 "Pig keeping by the subsistence agriculturalists of the New Guinea Highlands", Search, 1(5): 201-204.

1971 "Research on pig production", Harvest, 1(2): 71-73.

1973a "The productivity of exotic and indigenous pigs under village conditions", Papua and New Guinea Agricultural Journal, 24(1): 16-19, 20-21.

1973b "Growth and carcass measurements of indigenous and exotic pigs raised in two housing systems in Papua New Guinea", Papua New Guinea Agricultural Journal, 24(1): 23-25.

nd. "A survey of the breeding performance of exotic, indigenous, and crossbred breeds of swine in Papua New Guinea", Goroka, Unpublished paper.

1976 "A demographic analysis of village pig production", Goroka: paper read at Waigani Seminar on Agriculture in the Tropics, mimeo.

Maude, H.E. 1968 "The Tahitian Pork Trade; 1800-1830: an episode in Australia's commercial history", in H.E. Maude, Of islands and men: studies in Pacific History. Melbourne: Oxford University Press, pp. 178-232.

Meggitt, M.J. 1958 "The Enga of the New Guinea Highlands: some preliminary observations", Oceania, 28(4): 253-330.

1960 "Discussion", in UNESCO/TPNG, Symposium on the impact of man on humid tropics vegetation. Goroka: UNESCO/TPNG.

1965 The lineage system of the Mae Enga of New Guinea. New York: Barnes and Noble (Edinburgh: Oliver and Boyd).

1971 "From tribesmen to peasants: the case of the Mae Enga of New Guinea", in L.R. Hiatt and C. Jayawardena, eds. Anthropology in Oceania. Sydney: Angus and Robertson, pp. 191-209.

1972 "System and subsystem: the Te exchange cycle among the Mae Enga", Human Ecology, 1(2): 111-123.

1974 "Pigs are our hearts! The Te exchange cycle among the Mae Enga of New Guinea", Oceania, 44(3): 165-203.

Mellen, I.M. 1952 The natural history of the pig: New York: Exposition Press.

Mitchell, D.D. 1976 Land and agriculture in Nagovisi, Papua New Guinea. Port Moresby: IASER Monograph No. 3.

Montgomery, D.E. 1960 "Patrol of Upper Chimbu Census Division, Eastern Highlands", Papua and New Guinea Agricultural Journal, 13(1): 1-9.

Morren, G.E.B. 1977 "From hunting to herding: pigs and the control of energy in montane New Guinea", in T.P. Bayliss-Smith and R.G. Feachem, eds. Subsistence and survival. New York: Academic Press, pp. 273-315.

1979 "Seasonality among the Miyanmin: wild pigs, movement, and dual kinship organization", Mankind, 12(1): 1-12.

Moylan, T. 1973 "Disequilibrium in a New Guinea Local ecosystem", Mankind, 9(2): 61-70.

Murphy, R. 1970 "Basin ethnography and ecological theory", in E. Swanson ed. Languages and cultures of Western North America. Pocatello: Idaho State University, pp.

Nag, M. 1962 Factors affecting human fertility in non-industrial societies: a cross-cultural survey. New Haven: Yale University, Department of Anthropology.

Neale, W.C. 1971 "Monetization, commercialization, market orientation, and market dependence", in G. Dalton ed. Studies in economic anthropology. Washington, DC.: American Anthropological Association, pp. 25-29.

Nelson, H.E. 1971 "Disease, demography, and the evolution of social structure in Highland New Guinea", Journal of the Polynesian Society, 80(2): 204-216.

Nilles, J. 1943/44 "Natives of the Bismarck Mountains, New Guinea", Oceania, 14(2): 104-124, 15(1): 1-19.

1950 "The Kuman of the Chimbu region, Central Highlands, New Guinea", Oceania, 21(1): 25-65.

1953 "The Kuman people: a study of cultural change in a primitive society in the Central Highlands of New Guinea", Oceania, 24(1): 1-27, 24(2): 119-131.

1969 Kuman-English Dictionary. Kundiawa: Catholic Mission (roneoed).

1977 "Simbu ancestors and Christian worship", Catalyst, 7(3): 163-190.

Oliver, D.L. 1949 "Economic and social uses of domestic pigs in Siuai, Southern Bougainville, Solomon Islands", Papers of the Peabody Museum of American Archaeology and Ethnology, 29(3): v-29.

1973 Bougainville: a personal history. Melbourne: Melbourne University Press.

1974 Ancient Tahitian Society. Honolulu: University Press of Hawaii.

Oomen, H.A.P.C. 1971 "Ecology of human nutrition in New Guinea: evaluation of subsistence patterns", Ecology of Food and Nutrition, 1: 1-16.

Papua New Guinea 1973 Village Directory. Konedobu, Port Moresby: Department of the Chief Minister and Development Administration.

Petrusewicz, K. and A. Macfadyen. 1970 Productivity of terrestrial animals: Principles and methods. Oxford: Blackwell (International Biological Programme Handbook No. 13).

Piddocke, S. 1965 "The potlatch system of the Southern Kwakiutl: a new perspective", Southwestern Journal of Anthropology, 21: 244-264.

Platt, B.S. 1962 Tables of representative values of foods commonly used in tropical countries. London: HMSO, Medical Research Council Special Report Series No. 302.

Pospisil, L. 1963 Kapauku Papuan Economy. New Haven: Yale University Publications in Anthropology No. 67.

1971 Anthropology of Law: a comparative theory. New York: Harper and Row.

Postan, M.M. (with J. Titow) 1973 "Heriots and prices on Winchester Manors", in M.M. Postan, Essays on Medieval agriculture and general problems of the Medieval economy. Cambridge: Cambridge University Press, pp. 150-185.

Potter, J. nd(a) "The pig in a coastal Papuan village - its husbandry, demography, and changing role", Port Moresby/Canberra, unpublished paper.

nd(b) "Some parameters of young pigs raised under a traditional husbandry system in a coastal village and the effect of supplementing coconuts and soya beans on these parameters", Port Moresby/Canberra, unpublished paper.

Purdy, D.J. 1971 "Changing patterns in pig production in Papua New Guinea", Australian Veterinary Journal, 47: 481-484.

Rappaport, R.A. 1968 Pigs for the ancestors: ritual in the ecology of a New Guinea people. New Haven: Yale University Press.

1977 "Ecology, adaptation and the ills of functionalism (being, among other things, a response to J. Friedman)", Michigan Discussions in Anthropology, 2: 138-190.

1979 Ecology, meaning, and religion. Richmond, California: North Atlantic Books.

Read, K.E. 1954 "Cultures of the Central Highlands, New Guinea", Southwestern Journal of Anthropology, 10(1): 1-43.

Reay, M. 1964 "Present-day politics in the New Guinea Highlands", American Anthropologist, 66(4), Part 2, pp. 240-256.

1966 "Women in transitional society", in E.K. Fisk, ed. New Guinea on the threshold. Canberra: Australian National University Press, pp. 166-184.

Robbins, R.G. 1970 "Vegetation of the Goroka-Mount Hagen area, in H.A. Haantjens, ed. Lands of the Goroka-Mount Hagen area, Territory of Papua New Guinea. Melbourne: CSIRO, pp. 104-118.

Rubel, P.G. and A. Rosman. 1978 Your own pigs you may not eat: a comparative study of New Guinea societies. Canberra: Australian National University Press.

Ryan, D.J. 1972 "Mōk-ink", in Encyclopaedia of Papua New Guinea. Melbourne: Melbourne University Press/University of Papua New Guinea, pp. 788-789.

Sahlins, M. 1971 "The intensity of domestic production in primitive ocieties: social inflections of the Chayanov slope, in G. Dalton, ed. Studies in economic anthropology. Washington, DC.: American Anthropological Association, pp. 30-51.

1972 Stone Age Economics. Chicago: Aldine. Atherton Inc.

1976 Culture and practical reason. Chicago: University of Chicago Press.

Salisbury, R.F. 1956 "Asymmetrical marriage systems", American Anthropologist, 58: 639-655.

1960 "Ceremonial economics and political equilibrium", Proceedings of the 6th International Congress of Anthropological and Ethnological Sciences, 2: 255-259.

1962 From stone to steel. Melbourne: Melbourne University Press.

1964 "Changes in land use and tenure among the Siane of the New Guinea Highlands (1952-61)", Pacific Viewpoint, 5: 1-10.

1975 "Non-equilibrium models in New Guinea ecology: possibilities of cultural extrapolation", Anthropologica, 17: 127-147.

Schodde, R. and W.B. Hitchcock 1972 "Birds", in Encyclopaedia of Papua and New Guinea. Melbourne: Melbourne University Press and University of Papua New Guinea, pp. 67-86.

Schwartz, T. 1963 "Systems of areal integration: some considerations based on the Admiralty Islands of Northern Melanesia", Anthropological Forum, 1(1): 56-97.

Schwimmer, E. 1973 Exchange in the social structure of the Orokaiva: traditional and emergent ideologies in the Northern District of Papua. London: C. Hurst.

Scragg, R.F.R. 1972 "Medical demography", in Encyclopaedia of Papua New Guinea. Melbourne: Melbourne University Press/University of Papua New Guinea, pp. 740-746.

Shand, R.T. 1966 "Nutrition and economic progress in the Chimbu", in E. Hipsley, ed. An integrated approach to nutrition and society: the case of the Chimbu. Canberra: Australian National University, New Guinea Research Bulletin No. 9, pp. 67-81.

and W. Straatmans 1974 Transition from subsistence: cash crop development in Papua New Guinea. Canberra: Australian National University, New Guinea Research Bulletin No. 54.

Shannon, R.F. 1971 "A study of the subsistence and cash economics of a village adjacent to the urban area of Goroka". Goroka: Department of Agriculture, Stock and Fisheries, roneoed..

1973 "The 1970 'taim hangri' in Goroka: a study of the subsistence and cash economies near the town, "Extension Bulletin No. 1, Department of Agriculture, Stock and Fisheries, Port Moresby.

Shantzis, S.B. and W.W. Behrens. 1973 "Population control mechanisms in a primitive agricultural society", in D.L. Meadows and D.H. Meadows, eds. Toward global equilibrium. Cambridge, Mass.: Wright-Allen Press, pp. 258-284.

Seifert, W.H. 1975 Adjustment to urbanisation in Papua New Guinea. Washington, DC.: Catholic University of America, Ph. D. Thesis.

Silver, I.A. 1970(1963) "The ageing of domestic animals", in D. Brothwell and E. Higgs, eds. Science in Archaeology. New York: Praeger Books, pp. 282-302.

Simoons, F.J. 1974 "Contemporary research themes in the cultural geography of domesticated animals", Geographical Review 64: 557-576.

Simpson, C. 1954 Adam in plumes. Sydney: Angus and Robertson.

Sinnett, P.F. 1977 "Nutritional adaptation among the Enga", in T.P. Bayliss-Smith and R.G. Feachem, eds. Subsistence and survival. London and New York: Academic Press, pp. 63-90.

Smith, J.M.B. 1977 "Man's impact upon some New Guinea mountain ecosystems", in T.P. Bayliss-Smith and R.G. Feachem, eds. Subsistence and survival. London and New York: Academic Press, pp. 185-214.

Smith, R.B.E. 1971 "Demographic data comparison study", Kundiawa, DASF, unpublished paper.

1975 "Chimbu population density study", Mount Hagen, Central Planning Office, unpublished paper.

Spinks, K.L. 1934 "Mapping the Purari Plateau, New Guinea", Geographical Journal, 84(5): 412-416.

Standish, B. 1979 Provincial government in Papua New Guinea: early lessons from Chimbu. Port Moresby: Institute of Applied Social and Economic Research, Monograph No. 7.

Sterly, J. 1973 Krankheiten und Krankenbehandlung bei den Chimbu im Zentralen Hochland von Neu-Guinea. Hamburg: Ethnomedizin.

Sterly, J. 1978/79 "Bugla kirai, schweinemedizin vom oberen Chimbu, Papua New Guinea", Ethnomedizin, 5(3/4): 385-405.

Stonor, C.R. 1950/51 "The Chimbu tribe: a mountain people of New Guinea", Geographical Magazine, 23(11): 483-490

Strathern, A.J. 1969 "Finance and production: two strategies in New Guinea Highland exchange systems", Oceania, 40(1): 42-67.

1971a "Pig complex and cattle complex: some comparisons and counterpoints", Mankind, 8(2): 129-136.

1971b "Cargo and inflation in Mount Hagen", Oceania, 41(4): 255-265.

1971c The rope of Moka: big-men and ceremonial exchange in Mount Hagen, New Guinea. Cambridge: Cambridge University Press.

1972 One father, one blood: descent and group structure among the Melpa people. Canberra: Australian National University Press.

1976 "Transactional continuity in Mount Hagen", in B. Kapferer ed. Transaction and meaning. Philadelphia: ISHI, pp. 277-287.

1979 Ongka: a self-account by a New Guinea big-man. London: Duckworth.

and A.M. Strathern 1971 Self-decoration in Mount Hagen. London: Duckworth.

Strathern, A.M. 1965 "Axe types and quarries: a note on the classification of stone axe blades from the Hagen area, New Guinea", Journal of the Polynesian Society, 74(2): 182-191.

1972 Official and unofficial courts: legal assumptions and expectations in a Highlands community. Port Moresby/Canberra: New Guinea Research Bulletin No. 47.

Suttles, W. 1960 "Affinal ties, subsistence and prestige among the Coast Salish", American Anthropologist, 62: 296-305.

Taylor, J.L. 1971(1939) "Hagen-Sepik Patrol 1938-39: interim report", New Guinea, 6(3): 24-45.

Territory of Papua New Guinea 1967 Report on intensive agricultural survey in the Chimbu survey area. Port Moresby, unpublished.

Thomas, S. and M. Corden 1970 Tables of composition of Australian Foods. Canberra: Australian Government Publishing Service.

Tomasetti, Friedegard 1976 Traditionen und Christentum im Chimbu-Gebiet Neuguineas: Bebachtungen in der lutherischen Gemeinde Pare. Weisbaden: Steiner.

Turner, C.V. 1966 "Cultural change and the Sinasina Church", Practical Anthropology, 13(3): 103-106.

1968 "The Sinasina 'Big Man' complex: a central cultural theme", Practical Anthropology, 15(1): 16-23.

1970 "The Sinasina stone bowl cult", Practical Anthropology, 17(1): 28-32.

UNESCO/TPNG 1960 Symposium on the impact of man on humid tropics vegetation. Goroka: UNESCO/TPNG.

Vayda, A.P. 1961 "A re-examination of Northwest Coast economic systems", Transactions of the New York Academy of Sciences II, 23(7): 618-624.

1972 "Pigs", in Encyclopaedia of Papua and New Guinea. Melbourne: Melbourne University Press and University of Papua New Guinea, pp. 905-908.

A. Leeds, and D.B. Smith 1961 "The place of pigs in Melanesian subsistence", Proceedings of the 1961 Annual Spring Meeting of the American Ethnological Society. Seattle: University of Washington Press, pp. 69-77.

and B.J. McCay 1975 "New directions in ecology and ecological anthropology", Annual Review of Anthropology, 4: 293-306.

1977 "Problems in the identification of environmental problems", in T.P. Bayliss-Smith and R.G. Feachem, eds. Subsistence and survival. London: Academic Press, pp.411-418.

Venkatachalam, P.S. 1962 A study of the diet, nutrition, and health of the people of the Chimbu area (New Guinea Highlands). Territory of Papua and New Guinea: Department of Public Health Monograph No. 4.

Vial, L.G. 1938 "Exploring in New Guinea", Walkabout, 4(12): 12-23.

1939 "The Kaman", Walkabout, 5(7): 17-22.

1940 "Stone axes of Mount Hagen, New Guinea", Oceania 11(2): 158-163.

1941 "Down the Wagi", Walkabout, 7(9): 16-20.

von Fleckenstein, F. 1976 "Sweet potato in the Goroka market: A Melanesian market?, in K. Wilson and R.M. Bourke, eds. 1975 Papua New Guinea Food Crops Conference Proceedings. Port Moresby: Department of Primary Industry, pp. 351-364.

Waddell, E.W. 1972a The Mound Builders: agricultural practices, environment, and society in the central highlands of New Guinea. Seattle: University of Washington Press.

1972b "Agricultural evolution in the New Guinea Highlands", Pacific Viewpoint, 13(1): 18-29.

1975 "How the Enga cope with frost: responses to climatic perturbations in the Central Highlands of New Guinea", Human Ecology, 3: 249-273

and P.A. Krinks. 1968 The organisation of production and distribution among the Orokaiva. Canberra: Australian National University, New Guinea Research Bulletin No. 24.

Wagner, R. 1974 "Are there social groups in the New Guinea Highlands"? in M.J. Leaf, ed. Frontiers of anthropology: an introduction to anthropological thinking. New York: D. Van Nostrand, pp. 95-122.

1977 "Scientific and indigenous Papuan conceptualisations of the innate: a semiotic critique of the ecological perspective", in T. Bayliss-Smith and R. Feachem, eds. Subsistence and survival: rural ecology in the Pacific. London: Academic Press, pp. 385-410.

Walker, D. 1966 "Vegetation of the Lake Ipea region, New Guinea Highlands. 1. Forest, grassland and 'garden'", Journal of Ecology, 54: 503-533.

1972 "Vegetation of the Lake Ipea region, New Guinea Highlands. 2. Kayamanda swamp", Journal of Ecology, 60(2): 479-504.

Wallerstein, I. 1974 The modern world-system. New York: Academic Press.

Ward, H. 1958 "Infectious disease in the Western Highlands of New Guinea", Oceania, 28(3): 199-203,

Watson, J.B. 1969 "Review of Rappaport 1968", American Anthropologist, 71: 527-529.

1970 "Society as organised flow: the Tairora case", Southwestern Journal of Anthropology, 26(2): 107-124.

1977 "Pigs, fodder, and the Jones effect in Post Ipomean New Guinea", Ethnology, 16(1): 57-70.

Watt, I.R. et al. 1975 Pig handbook. Port Moresby: Department of Agriculture, Stock and Fisheries, Rural Development Series Handbook No. 5.

West, G.K. 1939 "A morning in Mirani", Walkabout, 5(10): 17-24.

1940 "Kumo: New Guinea's brand of sorcery", Walkabout, 6(5): 44.

Westermann, E.D. 1968 The Mountain People: social institutions of the Laiapu Enga. Wapenamanda: New Guinea Lutheran Mission.

Whiteman, J. 1965 "Customs and belief relating to food, nutrition and health in the Chimbu area", Tropical and Geographical Medicine, 17: 301-316.

Williams, D. 1975 "Catholics in Chimbu", Highland News (Special Independence Issue, September), p. 12.

Williamson, G. and W.J.A. Payne 1959 An introduction to animal husbandry in the tropics. London: Longmans Green.

Wilson, L.D. and G.B.A. Evans 1975 Sample survey of smallholder coffee producers. Port Moresby: Department of Agriculture, Stock and Fisheries, Rural Economics and Commodity Marketing Branch.

Winslow, J.H. ed. 1976 The Melanesian environment: change and development. Canberra: Australian National University Press.

Wurm, S.A. 1975 "Eastern Central Trans-New Guinea Phylum languages", in S.A. Wurm, ed. New Guinea Area Languages and Language Study, Vol. 1, Papuan Languages and the New Guinea linguistic scene. Canberra: Australian National University, Department of Linguistics, Pacific Linguistics Series C, No. 38, pp. 461-526.

Yoshida, M. 1972 "Notes on the pig festivals in New Guinea Highlands", Shien (Journal of Historical Studies, Rikkyo University: original in Japanese), 33(1): 68-80.

Young, E.A. 1977 Simbu and New Ireland migration. Canberra: Australian National University, Ph. D. Thesis.