Journal of Anthropological Archaeology xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Journal of Anthropological Archaeology

journal homepage: www.elsevier.com/locate/jaa

Optimality models and the food quest in Pleistocene Tasmania

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ARTICLE INFO

Article history:
Received 12 January 2016
Revision received 25 May 2016
Available online xxxx

Keywords:
Ideal free distribution
Diet breadth
Marginal value
Late Pleistocene
Tasmania
Equilibrium

ABSTRACT

The application of behavioural ecology models to deep time archaeological sites in Australia is often rendered difficult by the poor resolution of the archaeological record coupled with the imprecision in reconstructing past environments at regional levels. Here we report on a series of high latitude late Pleistocene sites in south-west Tasmania, where the conjunction of cultural activities and long term environmental change have preserved rich deposits in a number of cave sites. These data are used to test the utility of several models within optimal foraging theory. The data indicate the intensive and selective pursuit of two mid-size mammals, the Bennett's wallaby and the wombat, at the expense of other prey species that were also likely present. Hunting patterns involved the scheduled seasonal use of lowland and upland valley sites underwriting a regional strategy of moving between focal hunting locations to maximise returns. This strategy continued with little change from c. 40,000 BP to 15,000 BP, providing a stable, predictable and secure food source for people through a period of extreme climatic change. The benefits and limitations of the behavioural ecology models used in this study indicate their utility where the data are sufficiently robust.

1. The problem

Jim O'Connell has used optimal foraging theory (OFT) to produce a model of how and why the initial human colonisation of Australia may have occurred (O'Connell et al., 2010; O'Connell and Allen, 2012, 2015). In response, Horton (2012: 21) has argued that OFT produces a 'mechanical' view of subsistence that diminishes the role of human choice and disregards other cultural aspects such as group composition, religious considerations, food preferences and interactions with neighbouring groups, as well as a range of environmental concerns. This criticism follows a common theme. These are some of many aspects of behaviour that are unapproachable in Pleistocene archaeological records, because of their low behavioural resolution. Our view is that while prehistoric decisions about the food quest might not speak directly to all such aspects of past behaviour, it is important to recognise that if food quest decisions can be identified and understood, they separate and isolate what parts of past behaviour might and might not be illuminated by OFT. For example, understanding the food quest might assist in also understanding associated hunting technology, territorial range, group size and external contacts.

In seeking explanations of past human behaviour, archaeologists take advantage of archaeological opportunities that provide rare insights into the past, especially the Pleistocene past. The conjunction of past climatic and human cultural events in Southwest (SW) Tasmania has presented us with a well-preserved and rich record. In this paper we use various aspects of OFT to consider elements of the food quest in Pleistocene SW Tasmania preserved in the archaeological data. Our objective is to consider the utility of OFT in this context, by using it to examine the extent of strategy, structure and choice in the foraging behaviour of Pleistocene Tasmanians.

2. Background geography

Tasmania is a high latitude island between 40°S and 43°S, now separated from the Australian mainland by Bass Strait. It is approximately 90,000 sq. km in area. Environmentally it can be divided into western and eastern halves. The west comprises an exposed maritime coastline rising to steep and rugged mountain ranges trending north to south. Although the highest mountain is only c. 1600 masl, winter frost and snow are frequent above 500 masl (Colhoun and Shimeld, 2012). Temperatures vary with altitude; at Lake St Clair, altitude c. 750 masl, the present mean annual range is 2.8–13.2 °C. Minimum recorded temperatures for all 12 months of the year are colder than −2.4 °C.

Westerly winds bring more than 3 m of rain annually to the western mountains. Generally infertile siliceous soils dominate and together with rainfall and temperature determine the complex

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http://dx.doi.org/10.1016/j.jaa.2016.07.009
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vegetation pattern. The treeline in the SW mountains varies around 750 masl and above this, alpine heaths, herbfields and coniferous shrubs dominate. Below the treeline temperate rainforest is extensive, but poor drainage, infertile soils and fire have created large areas of wet mixed forests of rainforest and eucalypt species (Colhoun and Shimeld, 2012). Poorly drained acid soils in dry locations carry heath and shrubs, but extensive wet peaty areas are dominated by buttongrass moorland, a vegetation low in nutrient value. Native mammals do feed on it (Driessen, 2006), but field studies indicate only low density presence of these animals (Cosgrove et al., 1994; Cosgrove, 1995a: 98–9).

In contrast eastern Tasmania is environmentally less extreme. Rainfall is lower, average temperatures higher and the argillaceous soils more fertile. Here the dominant vegetation is dry sclerophyll *Eucalyptus* forest and woodland. *Poa* sp. grasslands are also prominent, usually associated with sparse tree cover. Native animals are plentiful. The fact that European farming is today confined to the east and the northern coastal fringe facing Bass Strait clearly illustrates this east-west environmental dichotomy.

2.1. In the late Pleistocene

Late Pleistocene SW Tasmania was cooler and drier than at present, but was fed by the same westerly maritime system that brought important rain to the west. From c. 40,000 BP to c. 14,000 BP the climate changed significantly with concomitant changes in the environment. SW Tasmanian vegetation at 40,000 BP is thought to have been mostly alpine/sub-alpine herb, heath and shrub species with larger tree species confined to lower altitudes than today, a downward trend in the treeline that continued to the Last Glacial Maximum (LGM), here taken to be 23,000 ± 4000 BP (Clark et al., 2009).

Cosgrove (1995a: 96–100) examined two models for Tasmanian late Pleistocene vegetation, one based on palynological records and the other on the behaviour of endemic plants across glacial and interglacial cycles. For present purposes we can characterise the dominant vegetation pattern in the SW Tasmanian valleys, following Kirkpatrick (1986), as stunted woody sedge and heath taxa growing on local infertile siliceous soils, with softer herb and grass patches restricted to more fertile alluvial soils on limestone substrate formations on the valley floors. At the LGM in this area, vegetation was generally alpine (Colhoun and van der Geer, 1986).

In contrast, SE and NE Tasmania at the LGM were glacial-arid (Macphail, 1975). Despite more widespread fertile soils carrying grasses, the climate in the east was drought-prone and windy. This led to land surface destabilisation and sand dune development by 29,000 BP, growing more extensive during the LGM (Colhoun and Shimeld, 2012: 320). The eastern environment was thus variable and the presence of prey animals irregular and dispersed.

Around 19,000 BP, temperatures began to rise markedly. Coupled with increasing rainfall, temperature increase drove the re-establishment of wet forests in the western half of Tasmania that eventually resulted in the contemporary vegetation patterns described above. By 13–14,000 BP the vegetation patterns largely excluded game animals and humans abandoned the inland SW valleys.

2.2. A palaeoecological model of subsistence procurement

Cosgrove (Cosgrove et al., 1990; Cosgrove, 1995a, 1995b) developed a palaeoecological model to distinguish the structure of subsistence procurement in the SW Tasmanian valleys from that in SE Tasmania. The model argued that in the SW, moist, grassy valley-bottom patches formed discrete micro-habitats, set in an otherwise infertile landscape, concentrated prey animals in predictable locations. These patches grew on the limestone substrate that also produced caves, offering hunters shelter and prey in close proximity. In contrast, resources in SE Tasmania were scattered and variable. This model has been modified over time as new data have appeared. Its newest iteration appears here as Fig. 1.

3. Ideal Free Distribution (IFD) and human settlement in Pleistocene Tasmania

IFD proposes that habitats can be ranked in terms of their potential to favour an occupant's reproductive success. Other things being equal, individuals moving into empty landscapes should favour the 'best' places first (Fretwell and Lucas, 1970; Fretwell, 1972). But since the optimality of particular habitats depends in part on the density of the population, habitat suitability declines with population increase. When available resources decrease to the level to be found in the next most suitable habitat, that habitat should also be occupied, and so on in a cascading demographically-driven pattern of habitat occupation.

In modelling the colonisation of Australia O'Connell and Allen (2012), following Elston (1992), referred to these primary habitats as sweet spots and attributed the rapid occupation of the continent from the far north to the south - an archaeologically instantaneous event (O'Connell and Allen, 2015: Fig. 1) - to the procedure of occupying distant sweet spots before occupying adjacent or intermediate less suitable habitats. However the occupation of Tasmania – later in time than the Australian mainland - is not attributed to lower habitat suitability, despite its extreme high latitude environment. Rather, Tasmania was inaccessible until falling sea levels exposed the 240 km-wide Bassian sill that connected it to mainland Australia sometime after 43,000 BP (Lambeck and Chappell, 2001). Humans entered Tasmania soon after, occupying Warreen, a cave in SW Tasmania, by 39,906 ± 879 cal BP (Allen, 1996a) and Parmerpar Meethaner, a rock-shelter in northern Tasmania, by 39,310 ± 1151 cal BP (Cosgrove, 1995b).

3.1. A Tasmanian sweet spot?

The question of whether SW Tasmania was a Pleistocene sweet spot is most easily addressed by considering the known distribution of all Tasmanian sites. Williams et al. (2013) suggested that the SW region favoured Pleistocene settlement, although the correlation between their geospatial analysis and the known site distribution is an imperfect fit. In the interior SW valleys 79 sites have been discovered, of which 21 have been excavated and 15 dated (Brown et al., 1991; Cosgrove, 1999; Allen, 1996c). Discounting a near-modern date for several stone artefacts recovered from a land-slip near the mouth of the Denison River (Kiernan et al., 1983) and never fully described, 109 ^{14}C estimations from all dated sites in these valleys yielded Pleistocene ages with one exception: a near-surface mid-Holocene date from the Mackintosh site, where 16 other dates are all Pleistocene. This young date was subsequently rejected by Holdaway and Porch (1996) on associational evidence.

If inland SW Tasmania has many Pleistocene but no Holocene sites, the contrast with the remainder of Tasmania is stark. Among perhaps hundreds of known Holocene sites, there is currently one accepted Pleistocene site in SE Tasmania and another in northern Tasmania, both bordering SW Tasmania (see below). However, it must be allowed that this pattern might still reflect the greater fieldwork focus and more intensive dating of sites in SW Tasmania, rather than any total lack of late Pleistocene occupation in the east. As the palaeoecological model shows, the subsistence strategies are predicted to be different between the two zones and thus produced dissimilar archaeological patterns.

Please cite this article in press as: Allen, J., et al. Optimality models and the food quest in Pleistocene Tasmania. J. Anthropol. Archaeol. (2016), http://dx.doi.org/10.1016/j.jaa.2016.07.009