Flinders University

‘A most sacred part of our land’
An exploration of ethnohistory, archaeology, palaeogeography and Narungga knowledges in relation to Point Pearce Peninsula/Burgiyana and adjacent islands on Yorke Peninsula/Guuranda, South Australia

By

Adrian Mollenmans
BArch (Hons)

Thesis
Submitted to Flinders University
for the degree of

Doctor of Philosophy

College of Humanities, Arts and Social Sciences
27 June 2023

‘A most sacred part of our land’

An exploration of ethnohistory, archaeology, palaeogeography and Narungga knowledges in relation to Point Pearce Peninsula/Burgiyana and adjacent islands on Yorke Peninsula/Guuranda, South Australia

PhD Thesis

Adrian Mollenmans

Principal Supervisor: Professor Amy Roberts (Flinders University)

Associate Supervisor: Professor Jonathan Benjamin (Flinders University)

Adjunct Supervisor: Professor Lester-Irabinna Rigney

(Narungga academic, University of South Australia)

Narungga Nation

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

ABSTRACT

This research provides a preliminary chronology for the coastal and island archaeology of Yorke Peninsula/Guuranda, South Australia, with a focus on Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi case study area in Spencer Gulf. Nine marine shell, one sediment sample and one sample of burnt calcrete were collected from five Narungga heritage sites on Point Pearce Peninsula/Burgiyana. Eight marine shell and one eggshell sample were collected from three Narungga heritage sites on Wardang Island/Waraldi. Sample dates for this research, reveal shellfish resource use spanning 8,000 years following the formation of present-day Spencer Gulf as a result of post-glacial marine transgression during the Holocene.

This is the first work that provides any significant work on chronology on Yorke Peninsula/Guuranda and provides significant understanding of the case study area which is particularly significant for Narungga people. These results relate to Narungga knowledges about the formation of Yorke Peninsula/Guuranda and its islands as well as oral histories about places on Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi.

Marine transgression modelling and geomorphological observations undertaken during this research also provide insights into the impact on the Narungga Aboriginal coastal heritage of Yorke Peninsula/Guuranda today and in the past. This is particularly important in light of present-day climate change and predicted future sea-level rise and the impacts this may have on coastal archaeological heritage in the future.

SIGNED DECLARATION

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

Adrian Mollenmans

ACKNOWLEDGEMENTS

Thanks are due to the following people and organisations whose contribution to this research is inestimable:

- Principal Supervisor: Professor Amy Roberts (Flinders University)
- Adjunct Supervisor: Professor Lester-Irabinna Rigney (University of South Australia)
- Associate Supervisor: Professor Jonathan Benjamin (Flinders University)
- Former Associate Supervisor: Dr Mick Morrison.

The Narungga Nation Aboriginal Corporation and the Point Pearce Peninsula Aboriginal Corporation:

- The late Tauto Sansbury (former CEO of the Narungga Aboriginal Corporation Regional Authority)
- Ann Newchurch (chairperson Narungga Nation Aboriginal Corporation)
- Eddie Newchurch (chairperson of Point Pearce Aboriginal Corporation)
- John Buckskin (former chairperson of Point Pearce Aboriginal Corporation)
- Klynton Wanganeen (former chairperson Narungga Nation Aboriginal Corporation)

Narungga and Point Pearce community members who participated in fieldwork:

- The late Lindsay (Tintoe) Sansbury
- Carlo Sansbury
- Michael Walker
- Thomas Wanganeen
- Lynette Newchurch
- Edgar Wanganeen
- Chrissy Stockley
- Selena Angie
- Eddie Newchurch
- Rex Angie
- Peter Turner
- Ian Baker
- Lyle Sansbury

Flinders University Archaeology staff for assistance organising field trips:

- Chantal Wright
- John Naumann
- Simon Hoad
- Scott Castledine

Robert Jones (for his contribution to fieldwork).

Vivienne Wood and Craig Westell (for sharing data from prior archaeological investigations).

The Department of Aboriginal Affairs and Reconciliation (AAR) for assistance with permit applications.

This research was approved by the Flinders University Social and Behavioural Ethics Committee (approval number 7150).

This research was supported by an Australian Government Research Training Program (RTP) Scholarship.

1. INTRODUCTION

This research explores the Narungga Aboriginal cultural heritage of Yorke Peninsula/Guuranda with a particular focus on Point Pearce Peninsula/Burgiyana and adjacent islands as a case study.[1] Yorke Peninsula/Guuranda, South Australia is the traditional country (land and waters) of the Narungga people (Figure 1).

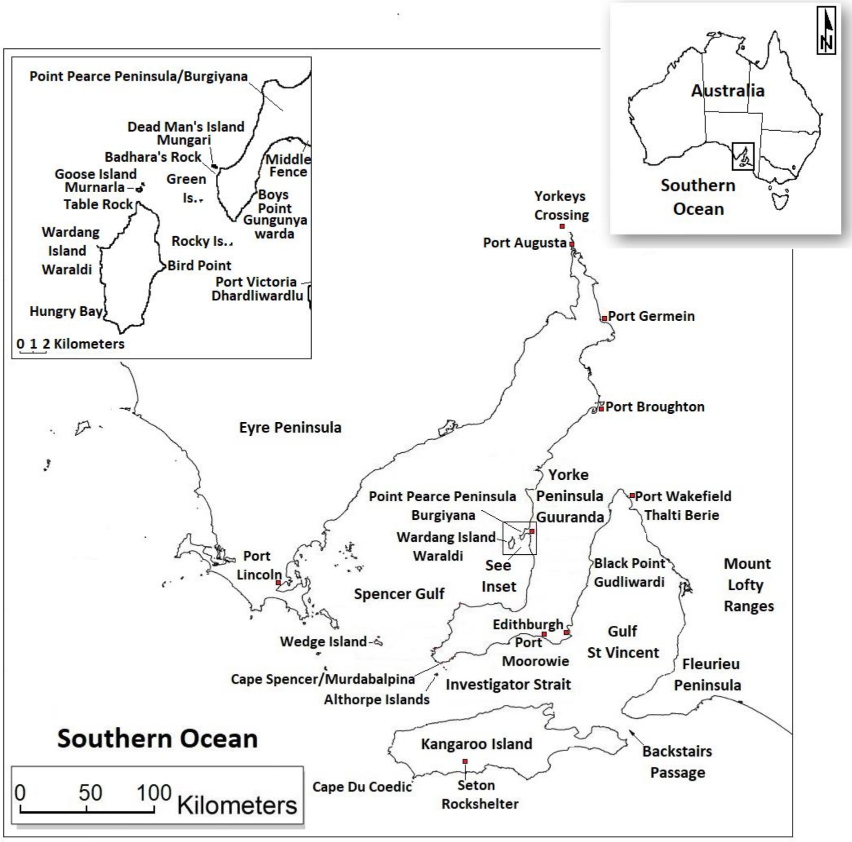


Figure 1: Case study area, Yorke Peninsula/Guuranda, South Australia. Inset: Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi (from Roberts et al. 2019).

Whilst the Narungga economy in the recent and ethnographic period largely reveals a coastal/marine focus and specialisation, the European pre-invasion/contact archaeology in this region has received only limited attention and little published data exists. Further, whilst this formerly landlocked region was significantly impacted by the marine transgression that followed the Last Glacial Maximum (LGM), little consideration has been given to the Aboriginal experience of this change (Lambeck and Nakada 1990; Lewis et al. 2013; Roberts et al. 2019). To fill this gap, a community-based approach has been

[1] Narungga Nation have expressed the desire for the use of traditional Narungga place names for locations referred to in this research and as such Narungga toponyms are included throughout this document together with the European/Europeanised place names. The spelling of Narungga words and toponyms varies between sources. In general, to avoid confusion, this thesis adopts the orthography as outlined in NAPA (2006).

employed to explore the ethnohistory, archaeology, paleogeography and Narungga knowledge and perspectives in relation to Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi on the west coast of Yorke Peninsula/Guuranda, South Australia (see Figure 1 inset).

The following methods are employed to investigate this past: Archaeological survey, geomorphological observations, marine transgression modelling and surface sampling for chronology. These strands of evidence are synthesised to provide a preliminary outline of the path taken to Narungga society observed at contact. Importantly an exploration of Narungga narratives about land and seascapes are also explored and are considered in a dialogical manner in relation to the other strands of evidence.

The passage of marine transgression in this region means that much of the former landscape has been submerged by rising sea levels. The present-day coastline is also impacted by contemporary weather patterns that contribute to erosion or sedimentation along the coastline and may impact the preservation or visibility of Narungga heritage today. Farming and mining activities are also assessed to understand these impacts on the Aboriginal cultural heritage of the region. Based on these data, a model for site location and preservation relating to the coastal environments of wider Yorke Peninsula/Guuranda is also outlined (after Rick et al. 2013; Tait Elder et al. 2014).

1.1 Research Question and Aims

Point Pearce Peninsula/Burgiyana and its adjacent islands is important for undertaking this research as it provides a microcosm of the range of environments and coastal landforms that are found on wider Yorke Peninsula/Guuranda. Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi are also part of the lands of the Point Pearce Aboriginal Corporation which include Point Pearce/Burgiyana township a former mission established in 1868 and thus the Narungga community has a strong and continuing attachment with this region spanning the pre- and post-contact period (Graham and Graham 1987; NAPA 2006; Wanganeen 1987).

Prior to this research a total of 49 archaeological sites had been recorded within the diverse landform settings that exist in the case study area (Mollenmans 2014; Roberts et al. 2016b; Roberts et al. 2019; Wood and Westell 1998; Wood et al. 2013). Known archaeological site types within the case study area included coastal middens, coastal campsites, fish traps and other places of cultural/spiritual significance associated with the sea. Known sites are varied with respect to size, lithics, other features (hearths, earth ovens, fish traps, fresh water sources), faunal remains and environment. The surface geology also provides evidence of the deeper earth history of the region including periods of volcanic activity and glaciation which feature in Narungga creation narratives (see later sections).

The case study area also includes a range of landforms and geological formations that reflect the history of climate change and sea-level rise spanning the period of human occupation in this region.[2] Landforms include evidence for the last inter-glacial shoreline c.120 kya; relict landforms dating from the LGM 20 kya (e.g., Pleistocene seif dunes reflecting arid zone conditions at the time of the LGM when the region was landlocked); an early to mid-Holocene sea-level high stand when sea levels were higher than at present; and mid-Holocene coastal dunes developed following sea-level stabilisation (Bourman et al. 2016; Corbett 1973; FGCSA 1973; Shepherd et al. 2014; Wynne 1980; Zang et al. 2006).

Given the above, the following primary question was posed:

> *What do changes in the archaeology and natural history of Point Pearce Peninsula/Burgiyana and adjacent islands reveal about the emergence of the Narungga Holocene coastal and marine economy on Yorke Peninsula/Guuranda, South Australia?*

To provide additional exegesis to this main question the following subsidiary questions were also posed:

1. *Ethnohistory*
   What collection and capture methods were used by Narungga people to harvest coastal and marine resources in recent times?
2. *Coastal and Island Archaeology*
   What is the chronology of known coastal sites including on islands? Can changes in the archaeological record be correlated with environmental changes or are there other factors e.g., social, cultural or demographic at play?
3. *Natural History*
   What physical landscape, hydrological and geomorphological processes are found in the case study area that provide evidence for the nature and timing of climate and

[2] DNA research by Tobler et al. (2017) which included participants from the Point Pearce/Burgiyana community suggest the region encompassing Yorke Peninsula/Guuranda was first settled ca 49–45 kya (Tobler 2017—see also Nagle et al. 2016; Taylor et al. 2012). However archaeological research on Yorke Peninsula/Guuranda has so far been limited (see later sections).

environmental changes in the Yorke Peninsula/Guuranda region during the Holocene and at what time scales?

4. *Narungga Perspectives*

What can a dialogical exploration of Narungga narratives and knowledge allow us to consider about land and seascapes and what do such knowledges reveal about how Aboriginal people managed resource needs and adapted to environmental and climate change at different scales?

Investigating these questions is important for mapping the pre-contact trajectory (including possible Pleistocene occupation) that leads to the Narungga society and economy observed at European invasion. The data collected as part of this research thus go towards achieving the following aims:

- To describe/consider the nature of specialised coastal economies on Yorke Peninsula/Guuranda.
- To consider temporal issues relating to the Yorke Peninsula/Guuranda coastal economy.
- To contextualise the Yorke Peninsula/Guuranda coastal economy more broadly by comparison with other regions (locally, nationally, internationally).
- To add new data to the archaeological discourse to further inform general theories relating to Indigenous Australian coastal and island use and seascapes.

In particular, the research aims to appropriately incorporate and contextualise Narungga knowledges about the use and significance of the sea and islands including contemporary perspectives.

1.2 Thesis Chapters Outline

1.2.1 Literature Review

The literature review chapter provides an overview and contextualisation of Indigenous coastal resource use studies. The chapter starts with a review of research into coastal and marine resource use that has taken place elsewhere in Australia and internationally e.g., Barker 1991, 2004; Bowdler 1995, 2014; Campbell and Butler 2010; Cherry et al. 2010; Draper 1991, 2015; Fullagar 2015; Lampert 1981; MacArthur and Wilson 1967; McNiven 2003; Meehan 1982; Memmott et al. 2006; Morrison 2014; Moss et al. 2015; O'Connor 1987, 1992; Rick et al. 2013; Rosendahl 2015; Rowland 2018; Rowland et al. 2015; Sim and Wallis 2008; Tait Elder et al. 2014; Waselkov 1987).

Research that has focussed on the dynamic nature of coastal environments (geomorphology) and the impacts on and transformations to landscapes as a result of climate change and marine transgression following the LGM are also assessed (see for example Cherry et al. 2012; Rick et al. 2013; Tait Elder et al. 2014). The range of approaches and methods that other researchers have employed set the scene for the methods and approaches adopted in this research.

1.2.2 Regional Overview

Chapters 3 and 4 provides the necessary background and regional context for this project. Chapter 3 summarise the natural history of Yorke Peninsula/Guuranda; the geology and geomorphology, flora and fauna and coastal environments (including the environment of the intertidal zone). Chapter 4 describes the Narungga Nation as recorded in ethnohistorical and archival sources as well as contemporary community perspectives in relation to Narungga attachment to country, the sea, the marine environment and islands. Archaeological sites recorded in prior archaeological surveys are also outlined. Narungga heritage sites that have been documented include campsites, middens, earth mounds, hearths, fish traps, stone and ochre quarries, burial sites, fresh water sources, rock art, rockshelters and stone arrangements (Campbell and Walsh 1947; Hill and Hill 1975; Mollenmans 2014; Mountford 1936, 1952; Priess 1962a, 1962b; Roberts et al. 2019; Tindale 1936; Wood and Westell 1998; Wood et al. 2003).

1.2.3 Methods

The methods chapter outlines the methodology adopted for each of the components of this research. Methods pertaining to ethnohistorical research are outlined noting such sources may incorporate the cultural biases of non-Indigenous observers. The chapter also outlines GIS methods adopted during this research to model landscape history, post-glacial marine transgression and hydrological modelling. Archaeological site survey and sampling methods together with radiocarbon dating methods are also outlined. Geomorphological observations are also summarised. Collaborative methods are detailed as well as approval processes for this research which included Flinders University ethical approvals and government permits for sample collection from archaeological sites.

1.2.4 Results

The results chapter is structured with the research questions in mind. The chapter outlines the data that was collected during for the case study area including details of archival research; archaeological site surveys, sample collection and chronology; environmental survey; and benefits flowing from community-based research. Results from the GIS modelling of archaeological data and environmental data are also outlined.

1.2.5 Discussion

The discussion chapter revisits the research aims in light of the data collected in this research. This chapter considers what the data can tell us about broader research themes such as coastal and island use and specialisation, responses to climate change, chronology, seascapes and contemporary significance.

1.2.6 Conclusion

The conclusion chapter provides a summary of what has been achieved. The initial research questions are revisited and areas for future research are outlined.

2. LITERATURE REVIEW

Coastal and island archaeological research has focussed on the material culture and intangible heritage for peoples living by and from the sea (Fitzpatrick 2015). In this regard, Rick and Waselkov (2015) stated that the 1960s–1980s were an important period for the development of coastal and island archaeological research (e.g. Meehan 1982; Waselkov 1987; Yesner 1980). Yesner et al. (1980), for example, recognised: 'maritime hunter-gatherers—those that in some manner exploit the seas—are a specialized subset of hunting-and-gathering people'.

Interest in coastal and island archaeological research also expanded in Australia during this time (see for example Beaton [1985]). Research into Indigenous coastal and island archaeology considered the economic and technological aspects of resource use for Indigenous communities who live by the sea including the role of shellfish, near shore marine resources, the development of watercraft and the use of islands (e.g., Beaton 1985, 1995; Yesner et al. 1980). A number of themes, discussed in the next sections, have arisen out of this research:

- The timing for the onset of shellfishing and midden formation in coastal environments (Bailey et al. 2013; Cane 1998; Meehan 1982; Morrison 2014:1–2; Rick and Waselkov 2015; Waselkov 1987).
- The extension of coastal resource use to encompass near shore marine environments—often with the associated development of specialised skills and knowledge (e.g., knowledge of fish behaviour and tides) and technologies (e.g., the development of fishhooks, fish nets and fish traps) (Beaton 1985, 1995; Colley 1987; Gerritsen; Hiscock 2008).
- Marine expansion to utilise offshore marine resources and islands (with the associated considerations regarding the development of sea-going watercraft and island biogeography to support permanent and/or seasonal populations on islands) (McNiven 2003; Sim and Wallis 2008).

Researchers have also contextualised coastal and marine resource use by considering the wider social, cultural and spiritual domains (e.g., seascapes) in which such resource use takes place for peoples who live by the sea (e.g., Clarke and Torrence 2003; McKinnon et al. 2014; McNiven 2013).

The impact of climate change on Aboriginal lifeways has also been a focus of this wider research in Australia and overseas. The often-Holocene focus of coastal and island archaeological research is in large part a consequence of the impact of post-glacial sea-level rise in which former Pleistocene coastlines have become submerged by the impacts of post-glacial marine transgression—the present-day Australian coastline and islands generally formed c.6,000 BP after sea-level stabilisation (Beaton 1995; Belperio et al. 2002; Benjamin et al. 2020; Lambeck and Nakada 1990; Lewis et al. 2013).[3]

2.1 Shellfish and the Tidal Zone

Shellfish were (and continue to be) important food resources for Indigenous coastal communities (e.g., Bailey et al. 2013; Cane 1998; Gunn 1845; Meehan 1982; Morrison 2014; Rick and Waselkov 2015; Waselkov 1987). In addition to being an important food resource, shell were/are often utilised as vessels or knives and also used for ornamentation such as pierced shells being strung together like beads to form a necklace (Cane 1998; Curr 1886:143; Morse 1988, 1993). Shell middens as evidence of past shellfish gathering have long been a focus of coastal archaeological research (Waselkov 1987—see also Meehan 1982; Rick and Waselkov 2015)

Waselkov's (1987; Rick and Waselkov 2015) survey of shellfish gathering from around the world described methods and themes relating to shell middens research including formation processes, post-depositional effects, sampling strategies, differential preservation and zoo-archaeological analysis of midden shell. Waselkov (1987:95) defined a shell midden as 'a cultural deposit of which the principle visible constituent is shell'. Middens may vary in size and have a number of forms (typology) and the distinction between middens and other types of assemblages may not always be clear depending on the relative composition of shell remains compared to other artefacts in the assemblage (Bailey et al. 2013; Waselkov 1987).

Australian archaeologists have also considered the role of shellfish in the coastal economies of Australian Aboriginal societies (see for example Beaton 1985, 1995; Cane 1998; Hiscock 2008; Meehan 1982; Morrison 2014). Cane (1998—see also Hiscock 2008) summarised that coastal middens are frequent and extensive along the southern, eastern and northern coasts of Australia, but are sparse and infrequent along the western and south-western coasts.

Ethnohistorical sources record the important role of shellfish as a resource for some of Australia's coastal Aboriginal communities. Gunn (1845), for example, provides an early record of shellfishing and the widespread distribution of shell middens he observed along the coastline of Tasmania. Gunn

[3] Coastal archaeological sites from the late Pleistocene has been recorded preserved at some locations, for example, Blombos Cave, South Africa (ca 100 kya – 70 kya) and Mandu Mandu Creek, Western Australia (ca 30 kya), where the present day coastline is within 6 kilometres of the former coastline at the time of the LGM.

(1845) also observed evidence for the decomposition of the shell he observed in middens (due to age since deposition as well as their partial calcination as a consequence of being roasted during cooking).

Gunn (1845) documented methods of shellfish collection, species collected, and their cooking and consumption. Comparatively, many shell species referenced in Gunn (1845) are distributed broadly across the more temperate waters of the southern Australian coastline. Gunn (1845) observed that women generally collected shellfish such as *Haliotis* spp. and *Ostreidae* spp. wherever diving was required. These species were pried from the rocks to which they adhered by means of a wooden spatula-shaped instrument and brought to the surface in baskets formed from various sedge-leaved plants (Gunn 1845). Gunn (1845) recorded that the shellfish were consumed 'as near as possible to the fishing stations; occasionally going a little inland to avail themselves of a spring or stream of fresh water'. In cooking, shells were roasted.

Gunn (1845) stated that middens were found all along the coast and up to several miles inland from sea along estuaries. Heaps and mounds of shells, varied in sizes 'from what might be supposed to be the debris of a family dinner, to accumulations several feet in thickness, and many yards across' and in make-up comprised locally available shell species (Gunn 1845). Gunn (1845) noted that some species were favoured e.g., '…the Warrenah', (*Turbo* spp.) which is very common in many situations, seems to have been a very favorite article of food…', while also noting that shell of some locally available shellfish species were absent from the middens.

In northern Australia, anthropologist Betty Meehan undertook seminal research with the Anbarra community from the Blyth River region of Arnhem Land in the Northern Territory. One focus of Meehan's (1982) research investigated economy, diet and nutritional returns including seasonal resource use and the wider resource base. For example, some sites within the territory of the Anbarra were known as 'cold weather camps' or 'rain time camps' (Meehan 1982:166). Freshness of food was also an important consideration and shellfish were important in this regard as they can be collected daily and 'eaten fresh' and were 'a valuable source of flesh' that remains 'available between major hauls of fish and other animal foods' (Meehan 1982).

The Anbarra generally describe middens as *andjaranga anmama* meaning many dead shells, however, they also attach wider cultural and spiritual significance to such features (Meehan 1982:165). Some sites 'are remembered for the people who camped there as well as what they would have eaten' (Meehan 1982:166). In some cases, the Anbarra cannot name the people who inhabited a particular site but instead the Anbarra attribute these sites to 'dead men' meaning that 'it was inhabited by Gidjingali ancestors whose names they cannot or do not want to remember' (Meehan 1982).

Other shell mounds which Meehan (1982:167) argued are human in origin, the Anbarra attributed to the 'Dreaming'. These mounds are referred to as '*kula kula* or dog's mounds' because the Anbarra say they were created 'at some time in the past by the first dog in the country who piled up these extensive mounds of shell with his paws, as dogs do when they are digging a hole' (Meehan 1982:167). Similarly, Meehan (1982:168) noted that 'shell mounds adjacent to Ngalidjibama were formed by a large stingray, Yuluk who managed to make these mounds as he flapped his way along the dune'.

Shellfishing was/is a communal activity incorporating economic, social and cultural dimensions (Meehan 1982). A focus of much recent research has been to consider the economic role of shellfish in broader debates regarding diversification of the resource base in response to variable climate trends that occurred during the Holocene (Morrison 2014).

Middens also have significance for Indigenous communities linked to cultural activities associated with their formation. McNiven (2013), for example, investigated midden deposits created by Torres Strait Islanders of northeast Australia. McNiven (2013), observed, in this region, midden formation is a part of wider cultural activities and as a result of a community's practices, middens may change over time (e.g., in size, or makeup).

2.2 Coastal Fisheries and Marine Resources

Beaton (1985—see also Yesner et al. 1980) noted that Indigenous peoples living along the coast may have mixed economies consuming terrestrial, coastal and marine resources. Coastal economies reflect a move from shore-based collecting to 'a greater emphasis on hunting and fishing in the open seas' (e.g., Barker 1991, 2004; Hiscock 2008). Beaton (1985) described the following attributes indicative of more specialised coastal and marine focussed economies:

> We might consider a coastal economy to be one devoted, at least more so than not so (Yesner 1980:728) to the exploitation of marine resources. Lacking convincing quantitative measures of marine versus terrestrial faunal complements (as is usually the case in archaeology) we might see archaeological indicators of this as well in material culture such as fish-hooks, barbs or gorgets, fish-traps, netting devices, pry-bars for taking sessile molluscs, watercraft, dense prey assemblages of marine fauna, or in effigies or rock-art assemblages dominated by marine-inspired motifs. We might expect coastal

occupation sites to display a relatively complete range of attributes associated with residential activities. We would note changes in these attributes over time or over space in both local and regional circumstances.

Fish traps, for example, are tangible features which embody intangible ecological knowledge in relation to species harvested and seasonal resource availability associated with fish trap function. Fish traps are better preserved features of fishing practices which can be found around the Australian coastline and in other parts of the world and are also used by many island communities (e.g., Yap in the Federated States of Micronesia; Mer in the Torres Strait; High Cliffy Island, northwest Western Australia and island communities in the Gulf of Carpentaria) (Bannerman and Jones 1999; Connaway 2007; Jeffery 2013; Mollenmans 2014; O'Connor 1987; Roberts et al. 2016b; Rowland and Ulm 2011; Sim and Walsh 2008).

Fish traps have also been linked to more complex social and spiritual organisation and intensification of resource use (Lourandos 1980, 1983, 1997; Tait Elder et al. 2014). In Yap in the Federated States of Micronesia, for example, fish traps (*aech*) are associated with land ownership and social hierarchy (Jeffery 2013). In Yap, fish were the major source of food before the introduction of pigs and chickens. As a communal activity, group fishing provided for the 'the sharing of catch with participants and others in accordance with local customs' (Jeffery 2013).

It is important to note that coastal cultural heritage may also include features in the natural environment that form an important part of the coastal economy. For example, natural rock pools used in fish trapping or reed beds that provide the raw material for fibre weaving and fish net manufacture (Martin 2008; Mountford 1936; Tindale 1936). Coastal cultural heritage may also be intangible encompassing the necessary ecological knowledge regarding the sea and its resources as well as cultural and spiritual dimensions (seascapes) reflected in stories or knowledge and the performance of ceremonial and ritual activities with a marine focus (Fowler et al. 2014, 2015; Roberts et al. 2016b, 2019; McNiven 2003; Memmott et al. 2006). Investigating these facets of a site is important as they may provide context to the associated archaeological heritage.

The nature of coastal resource use could vary at the regional level and in time (Hiscock 2008:162–181; Lourandos 1997; Ulm 2006). In north-eastern Australia, for example, Hiscock (2008:168–171) argued that the transition from a coastal to a more specialised marine economy during the Holocene led to the utilisation of watercraft and specialised fishing equipment such as bone fishhooks. Hiscock

(2008:171) also noted that such equipment may not have been a factor in the 'success of island occupation in some regions'. O'Connor (1992:58), for example, studied coastal use along the Kimberley coast of north-western Western Australia where she found that coastal use in this region was continuous throughout the Holocene, including the exploitation of islands, but without the need for specialised technology (bone fishhooks, complex fishing gear, outrigger canoes).

2.3 Watercraft and Islands

In Australia, and elsewhere, the formation of islands during the Holocene occurred in line with sea-level rise when portions of the mainland became isolated by rising seas (e.g., Bowdler 1995; Cane 1998; Draper 1991, 2015; Roberts et al. 2019; Sim and Wallis 2008). The general model of coastal resource use discussed in the previous sections lead over time to encompass offshore marine resources and island use (with the associated considerations regarding the development of sea-going watercraft and island biogeography to support permanent and/or seasonal populations on islands) (McNiven 2003; Sim and Wallis 2008). Most researchers agree that, for Australia, only Tasmania, Flinders Island and Kangaroo Island continued to be occupied immediately following sea-level rise, while only Tasmania was continuously occupied throughout the Holocene (Bourke et al. 2009:54; Hiscock 2008:103; Sim and Wallis 2008). Kangaroo Island (adjacent to Yorke Peninsula/Guuranda) and Flinders Island in Bass Strait are thought to have been abandoned around 4000 BP (Lampert 1981; Sim and Wallis 2008).

In northern Australia, Sim and Wallis (2008:95) proposed that newly formed islands ceased to be occupied as people abandoned 'peripheral coastal plains areas' due to post-glacial marine transgression. Sim and Wallis (2008:95) argued that there was a general 'hiatus' in island use until around 4500 to 4000 years ago when climate conditions in the northern part of the continent are thought to have improved because less storm activity made conditions for open-sea travel by watercraft more favourable. While more remote islands required some form of watercraft for island access, near shore islands in some regions could be accessed by wading/swimming (e.g., Wardang Island/Waraldi, Yorke Peninsula/Guuranda, South Australia) (Fowler 2015).

Re-occupation of offshore islands involving permanent settlement is subject to the availability of sufficient resources (i.e., availability of water and/or food supply to support the island population) (Memmott et al. 2006:29; Rowland et al. 2015; Rowland 2018). In this regard, research into offshore island use has also been influenced by international research in relation to the development of 'island biogeographic theory' (MacArthur and Wilson 1967). Generally, 'island biogeographic theory' proposes that there is a positive correlation between island size and island biodiversity so that larger islands are more likely to have greater diversity in species (Bowdler 1995; MacArthur and Wilson 1967:8–18; Sim and Wallis 2008). Proximity to other islands and the 'mainland' are also important for supporting biodiversity as 'biotic exchange' is more likely over shorter distances (MacArthur and Wilson 1967:123–144). Such factors are seen by some researchers as being important considerations in understanding the capacity of islands to also support human populations (Lampert 1981; MacArthur and Wilson 1967:8–18).

Researchers in Australia, however, have been divided on the significance of biogeographic considerations in interpreting human occupation or abandonment of islands during the Holocene (see Bowdler [1995]; Lampert [1981]; Sim and Wallis [2008] for a range of views). Lampert (1981:184–185), who undertook research on Kangaroo Island, considered that biogeographic factors helped explain why the island was no longer occupied after 4000 BP (however see also Draper [2015] as discussed later in this section regarding the on-going spiritual connection with this island by Aboriginal communities on the adjacent mainland). Lampert (1981:184–185), however, noted that there were other factors involved in the cessation of occupation of this island. These other considerations included the general vulnerability of smaller and isolated human populations, increasingly arid conditions that were occurring on Kangaroo Island at the time and the supposed lack of watercraft.[4]

Bowdler (1995) also considered island biogeography in her wider review of island use in Australia and argued that 'the Australian evidence confounds expectations in this area'. More specifically she wrote:

> There appears to be no relationship between the time of occupation of an island and its distance from the mainland, its relationship to other islands, the area of the island, nor any combination of these. This lack of obvious patterning with respect to all those variables tends to contradict most predictions based on biogeographical models (see also Cherry 1990; Diamond 1987). The most obvious cultural corollary to island exploitation is the presence of watercraft and an orientation towards marine resource exploitation by the source population on the adjacent mainland. This of course is obvious but suggests

[4] Robinson et al. (1996:119) in their review of South Australia's offshore islands recorded Lampert also found 'stone artefacts on Eyre Peninsula, Thistle and Boston Islands when he was studying mainland Kartan associations with Kangaroo Island and, since Boston Island showed Aboriginal occupation of the shoreline, concluded that Boston Island was visited after its isolation from the mainland shortly before 7,500 years BP. Travel to the island seems possible, since it is only 2.5 km from the mainland, and the waters between are sheltered. Though there was scattered evidence of occupation on Thistle Island, Lampert concluded it had not been visited after the rise in sea levels.

> that explanation lies not so much in general modelling as in patterns of regional development.

Likewise, Sim and Wallis (2008:104) argued that island biogeography by itself was not sufficient to account for changing patterns of occupation on Australian islands during the Holocene. Sim and Wallis (2008:104) investigated the chronology of occupation of Vanderlin Island, Gulf of Carpentaria and from this research they reasoned that environmental biodiversity, rather than island size alone, appeared to be the key factor influencing human occupation of islands 'as it provides humans with alternatives when climatic or other stress renders particular environments unsuitable for human habitation'.

The relationship between island communities and communities on the adjacent mainland were varied as Memmott et al. (2006:30) summarised:

> The Tasmanians and the Tiwi of Bathurst and Melville Islands appear to have no contact with people on the mainland. The Keppel Islanders of the Queensland central coast had limited contact with the mainlanders and were physically, culturally and linguistically distinct from them (Rowland 1999). Other islanders, such as those from the sand islands of Moreton Bay and Fraser Island, had almost continual contact with the mainland.

Memmott et al. (2006) were interested in understanding the processes leading to the development of three distinctive cultural groups: the Lardil and Yangkaal of the North Wellesley Islands, Gulf of Carpentaria; the Kaiadilt of the South Wellesley Islands, Gulf of Carpentaria and the Ganggalida people on the mainland. The Wellesley Islands are thought to have been occupied again from at least 5,660 cal BP based on dates obtained for shell samples obtained from Wurdukanhan midden site. The focus of this research was to understand the development of distinctive cultural and economic practices between these groups in spite of occupying similar island environments (Memmott et al. 2006:29).

Rosendahl et al. (2015), however, have critiqued this early timing for the occupation of the Wellesley Islands arguing that the shell assemblage that provided the shell material from which these dates were obtained may be natural in origin (see discussion on natural middens versus middens that are anthropogenic in origin in Bowdler [1983:135–144]). As Rosendahl et al. (2015) argued, this early date is at odds with the general model of mid-Holocene island reoccupation from 4,500 to 4,000 years ago as proposed by Sim and Wallis (2008). In data collected for their research, Rosendahl et al. (2015) reported that the earliest recorded date for human occupation was from 3000 years ago.

Rosendahl et al. (2015:7) argued that the human occupation of the islands follows similar migration patterns occurring elsewhere, 'with populations expanding into new areas, intensifying their use of the resource base with localised increases in new site establishment and a signature that demonstrates a complex knowledge of the environment'. Rosendahl et al. (2015:6) posited two alternative models to account for these developments:

1. A 'risk' minimisation response to increased climatic instability with subsequent increased group mobility following known abundant resources (Hiscock 2008).
2. Or alternatively an increase in regional population densities with continued group fissioning and an overall decrease in territory size and increase in site densities (McNiven 1999; Collard et al. 2011).

Fullagar (2015) explored 'motivations' that may have influenced island visitation in a southern Australian context focussing on islands off the Victorian coastline. Possible motivations for island visitation could include access to rare resources, for ceremonial purposes, accidental landings, fleeing from conflict and to access island food resources during shortages on the mainland (Gaughwin and Fullagar 1995). In this context, Fullagar (2015) investigated island visitation to Great Glennie Island, adjacent to Wilson's Promontory, Victoria. Generally, island use in this region was not thought to form a significant part of the resource or land pattern use of the mainland Aboriginal coastal communities.

The archaeological evidence from Great Glennie Island indicated visitation to this island was intermittent. Fullagar (2015) analysed lithics and faunal remains excavated from a small cave on the island. Five distinct stratigraphic units were identified in the excavation. Comparison of faunal remains and lithics as well as an analysis of usewear on the lithic tools from each of the stratigraphic units indicated variation in resource use and technology over time. No clear patterns were discerned to understand the motivation of people visiting this island except for evidence of more intensive resource use in the most recent stratigraphic unit. Fullagar (2015) concluded that the infrequency of visitation to Great Glennie Island supports the view that access to island resources was not a major component of the broader economy of the adjacent mainland Aboriginal communities.

The earliest evidence for human occupation on Kangaroo Island was recorded at Seton Rockshelter in the southwest of the island and dates from 16,110±100 BP/19,724–19,144 cal BP.[5] At this time, the island was still connected to the mainland (Draper 2015; Hope et al. 1977; Lampert 1981; McDowell et al. 2015). Kangaroo Island became fully isolated from the mainland 10,413–9948 cal BP when Backstairs Passage formed as a result of post-glacial sea-level rise (Roberts et al. 2019). As noted above, Lampert (1981:184–185; however see also Draper 2015 discussed below) considered that increasingly arid conditions on Kangaroo Island from around 4,000 BP (along with the general vulnerability of smaller and isolated human populations, biogeographic considerations and the supposed lack of watercraft) helped explain why this island was not occupied after this time.

Kangaroo Island is significant in the history of Australian archaeology for the so called 'Kartan' large tool culture associated with the island first described by Norman Tindale which was thought to represent an earlier cultural phase in Australian 'prehistory' followed by a separate later small tool technology (Lampert 1981; Tindale 1931). Draper (2015) argued that the 'Kartan' large stone tools were not evidence for a separate and earlier cultural phase but appeared to be more abundant due to taphonomic factors. He further argued that these larger tool types were selectively exposed due to size as a result of ploughing activities which is the context in which most of these implements had been discovered (Draper 2015).

Draper (2007; 2015; Bowdler 2014 in relation to Bass Strait islands; Memmott et al. 2006 in northern Australia contexts) has argued against Lampert's (1981) assessment that Kangaroo Island ceased to be occupied from 4000 BP. Draper (2015:11) argued that Kangaroo Island, in area 4000 km^2, continued and continues to be important in Ngarrindjeri 'Dreaming'. Also, in support of his view, Draper (2015:13) noted that lithic technology on Kangaroo Island is similar to that found on Fleurieu Peninsula on the adjacent mainland which was continuously in use during the Holocene. Similar technology is also recorded on adjacent Yorke Peninsula/Guuranda as will be discussed further in later sections (see for example Hill and Hill 1975). And so, the debates continue.

In excavations that Draper undertook on the island he found evidence that the large tool types formed part of a broader range of technology that was in use throughout the Holocene. Draper (2015) stated that this technology represents a 'single, long-standing technological tradition, remarkable both in its efficiency and its flexibility'. Archaeological evidence from Rocky River and Pig's Waterhole on

[5]Radiocarbon ages were calibrated using OxCal (version 4.3) using the IntCal13 calibration dataset (Bronk Ramsey 2009). All dates are reported at 95.4% probability.

Kangaroo Island also reveals that people camped at these locations during the last 4,000 years (Table 1/Figure 2). The most recent radiocarbon date recorded at Rocky River was 400–350 BP/523–315 cal BP (Draper 2015).

Table 1: Post 4000 BP Aboriginal archaeological sites on Kangaroo Island (from Draper [2015]).

Site	Environment	Age	Description
Pig's Waterhole (Lampert 1981)	Basin between hills, east end of island, 4 km from coast.	• 3,100±90 BP • 3,557–3,062 cal BP	Minimum date for occupation of site; quartz, quartzite, chert flakes and cores, 28 whole or broken cobble choppers.
Rocky River	Sandy shoreline for approx. 50 metres around shoreline of intermittent swamp/lagoon, 10 km inland.	• 400±50 BP • 523–315 cal BP	Test pit 1, 3rd unit (60 cm depth). Five rescue test pits dug before road upgraded. Five stratigraphic units (1st is most recent) to 1 metres depth contain quartz, quartzite (including cobble) and chert flakes, cores, and retouched tools, with wide variation in depth of each unit. Dating inconsistencies reveal some disturbance of sandy sediments, and the mixing effects of an ancient pit feature (test pit 3). All dates associated with stone artefacts in horizontally bedded sediments.
		• 2,340±130 BP • 2,744–2,064 cal BP	Test pit 1, base of 4th unit (90 cm depth).
		• 2,360±70 BP • 2,709–2,180 cal BP	Test pit 3, 3rd unit (35 cm depth).
		• 3,110±180 BP • 3,814–2,853 cal BP	Test pit 3, bottom of pit feature near base of 4th unit (75 cm depth).
		• 1,080±60 BP • 1,177–835 cal BP	Test pit 4, 2nd unit (15 cm depth).

Rocky River (Homestead Paddock site)	Old lagoon/swamp shoreline, approx. 100 metres from Rocky River site (above).	• 1.280±140 BP • 1,518–927 cal BP	55 cm depth, at base of upper, sandy layer and darker, compacted peaty layer. Immediately beneath quartzite cobble chopper.
		• 1,380±80 BP • 1,518–1,085 cal BP	55 cm depth, at base of upper layer, 50 cm from first dating sample, adjacent 2 quartz flakes.

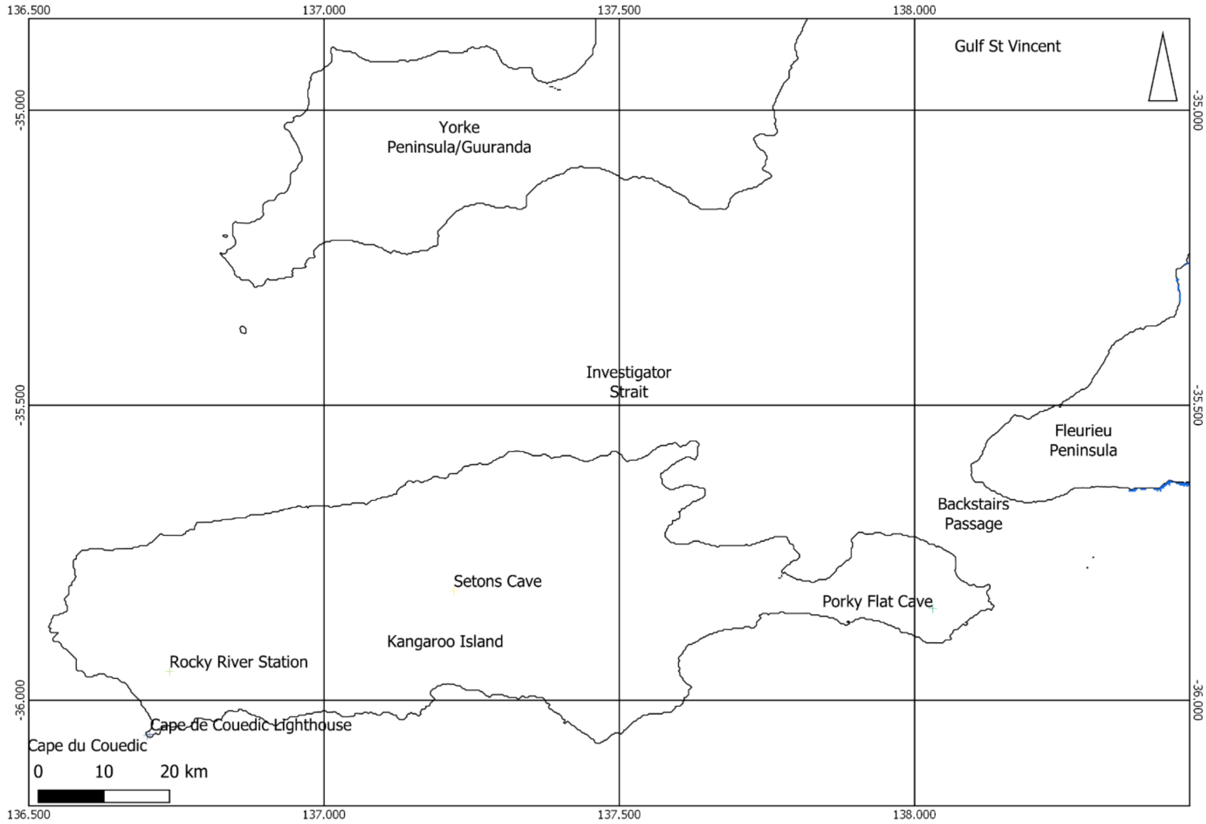


Figure 2: Post 4000 BP Aboriginal archaeological sites on Kangaroo Island (from Draper [2015]).

Draper (2015:8–11) suggested that rafts in use by Ngarrindjeri people at contact along the nearby lower Murray River, lakes and the Coorong would have been suitable to make the sea crossing from mainland to Kangaroo Island in periods of calm sea conditions. Kangaroo Island is visible from the southwestern Fleurieu Peninsula and the island is important in the creation mythology and after-life beliefs of the Aboriginal peoples that live on the adjacent mainland. Draper (2015) considered that this spiritual connection with the island may have been a motivation for people to continue to visit the island continuously throughout the Holocene.

More generally, Draper (2015) argued that Aboriginal peoples 'of the southern Australian coastal regions both used watercraft and visited offshore islands such as Kangaroo Island throughout the pre-colonial Holocene period'. His assessment will be interrogated further in later sections, by focussing on other islands along the South Australian coastline, in particular, those adjacent to Yorke Peninsula/Guuranda. These islands were and continue to be important in the cultural and spiritual beliefs for the local Aboriginal communities on the neighbouring mainland (e.g., Gillen c.1894–1898; Roberts et al. 2019; Sutton 1888).

2.4 Resource Use Models

In addition to investigating particular types of past resource use (see themes discussed in previous sections), archaeologists have also investigated the broader economies in which such resource use took place. In this regard, much archaeological research into Indigenous resource use focuses on subsistence and foraging models linked to the concept of environmental determinism (Wright Jr 1993—however see also David et al. 2006; Lourandos 1983, 1997, discussed in later sections). These models include: 1) 'Optimal foraging theory' which argues that resource use choice is governed by harvesting efficiency (see Campbell and Butler [2010] and Williams et al. [2015] discussed below); 2) The 'broad spectrum revolution' which emphasises the role/development of a diversified resource base in response to environmental stress (Zeder 2012); and 3) Comparison between 'open access resource pools' where there is little or no restriction on resource use (which can lead to over-harvesting) and 'common resource pools' which consider social controls (e.g., resource ownership, tenure or customary law) that govern and manage resource use (Campbell and Butler 2010).

Campbell and Butler (2010), for example, considered the range of hunter-gatherer resource use models (e.g., comparison between open and closed resource pools, optimal foraging theory and broad-spectrum resource use) in their investigation of sustainable resource use by hunter-gatherer communities in the Pacific Northwest, North America. Campbell and Butler (2010) investigated the continuity of salmon harvesting spanning 7,500 years in this region (reflected archaeologically in a stable fish bone record of salmon use during this time despite changes in ecology and social systems).

Campbell and Butler (2010) argued that flexible resource use ('broad spectrum model'), as well as 'beliefs and social institutions (including ownership, regulation, rituals and monitoring)' ('common resource pool model'), were important in regulating the use of salmon throughout this period due to the constraints these beliefs and social institutions placed on over-harvesting salmon in this region. Additionally, they argued that an understanding of how the people in this region sustainably managed salmon fisheries provides important insights to help address contemporary declines in salmon populations in this area as a result of overfishing and habitat degradation (Campbell and Butler 2010). As Campbell and Butler (2010) noted:

> …only a small fraction of our modern society relies economically on or has direct interaction with the fish, which limits our concern and willingness to fundamentally change behaviours that contribute to habitat degradation and loss, the main challenges facing salmon populations today.

In this regard, an important consideration for many researchers investigating resource use in hunter-gatherer communities is recognising the role of traditional ecological knowledge (TEK) and traditional social customs and beliefs that govern resource use (Memmott et al. 2006). TEK encompasses the accumulated knowledges that hunter-gatherer communities developed about their environment, weather patterns, seasons, tides and astronomical cycles; such knowledges also encompassed knowledge of the behaviour and habits of animal and fish species; the use of plants as food, in fibre making and for their medicinal properties (Campbell and Butler 2010; Memmott et al. 2006).

Memmott et al. (2006:36), for example, observed that the Wellesley Islanders had extensive knowledge of ecology and environment:

> …concerning the marine environment, its plants and animals, the weather, tides and the behaviour of the seas. There is a detailed classification of the seasonal cycle, and extensive knowledge of the nature of offshore winds, the movements of fish schools, the times of the fattening of fish and the reproduction of sea animals.

These activities are linked with responsibilities associated with tenure and customary law which 'involve the proper management and welfare of people' (McNiven 2003:335). Memmott et al. (2006:36), for example, found throughout the region of their research (Wellesley Island Group and adjacent mainland in Queensland) that:

> [t]raditional resource gathering activities in coastal domains are generally entwined closely with the spiritual features of 'saltwater country'. The socioeconomic importance of the sea and coastal land systems, especially on the islands, complements the intensive bodies of religious knowledge about 'saltwater country'. This aspect of the Indigenous cultures in this area can be referred to locally as 'Sea Law' or 'Saltwater Law' It is said to

come from an ancestral time of creation known as 'the Dreaming' and incorporates beliefs concerning the formation of the coastal environment by ancestral beings who left sacred energies in particular sites…'.

McNiven (2003:330) also argued that the archaeology of seascapes 'needs to extend beyond subsistence and technology and investigate spiritscapes and associated ritual sites used to manage and control the sea spiritually'. Spiritscapes, McNiven (2003:335) noted, are reflected in the 'spiritual renewal of the land and sea through the practice of ritual, the maintenance of ritual objects and the singing of songs and the performance of ceremonies'.

Also important in models that consider sustainable resource use in relation to climate variability discussed in the next section is the role of oral history traditions. Minc (1986:39) argued that group memories of past subsistence crises, preserved in oral traditions, can play a role in providing strategies for traditional communities to cope with subsequent crises. Minc (1986), who examined the role of oral tradition amongst the Tareunmiut and Nunamiut of Northwest Alaska, distinguished between different forms of oral tradition and different time scales of memory: 1) 'Secular tradition' (encompassing folktales, songs and histories) which operate to recall values and behaviours 'relating to group survival across seasonal or short-term inter annual shortages'; and 2) 'Sanctified oral traditions' such as ritual performances which rely on correct reproduction over extended periods and 'provide a model of resource variability recurring on the pan-generational time scale'.

2.5 Climate Change

Most research has focussed on coastal resource use along the contemporary Australian coastline that formed following post-glacial sea-level rise. At the time of the LGM, global sea levels were c.125 metres lower than today (Lambeck and Chappell 2001; Lambeck and Nakada 1990; Lewis et al. 2013:115). Australia, Tasmania and Papua/New Guinea and smaller adjacent islands were connected at that time forming the continental landmass known as Sahul.

The climate at the time of the LGM was also colder and drier (see Figure 3 LGM climate map—after Ray and Adams 2001/2002). Little is known about possible coastal resource use from this time as the LGM coastline is now submerged beneath the sea (however see Benjamin et al. [2020]; Morse [1988]). In Australia, an estimated 2.12 million km^2 of land was inundated as a result of the marine transgression that followed the LGM (Bailey et al. 2017:1; Dougherty et al 2019, Sloss et al. 2007; Williams et al. 2018). While sea levels generally stabilised around 6,000 BP and the climate generally changed from colder and drier conditions to warmer and wetter conditions, climate variability continued in the mid to late Holocene as a result of El Nino southern oscillation (ENSO) cycles (Beaton 1985; Williams et al. 2013, 2015).

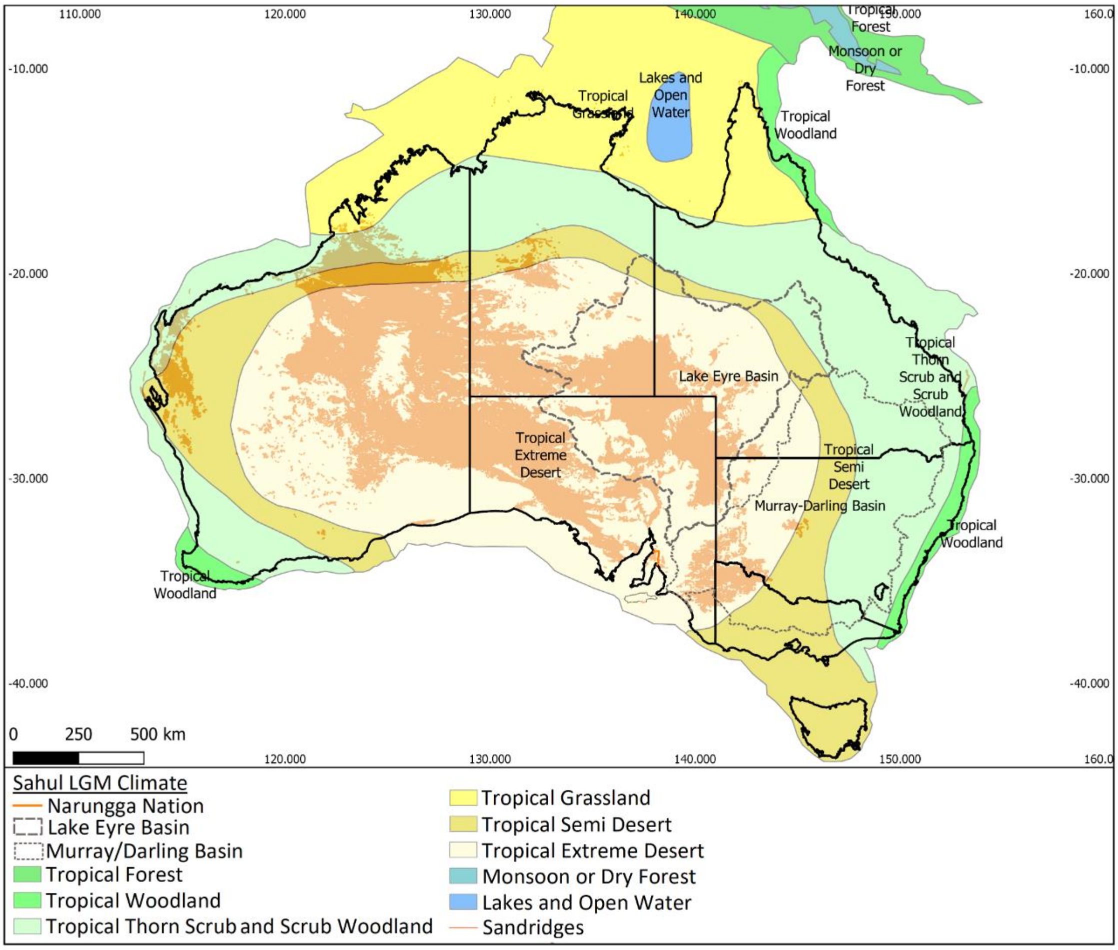


Figure 3: Last Glacial Maximum Sahul Climate Map (adapted from Ray and Adams 2001/2002).

One focus of research into post-glacial sea-level rise has been to consider how quickly newly inundated environments became transformed from terrestrial to coastal and marine ecosystems after the stabilisation of present-day coastlines (Beaton 1985; Woodroffe et al. 1988). Rowland and Ulm (2011:37), for example, argued that reef systems would likely take time to develop in newly inundated environments.

Beaton (1985) also argued for a transitional period from terrestrial to marine environments. Beaton's (1985) 'coastal lag model', developed from his research at Princess Charlotte Bay, Queensland. Beaton (1985) argued for a later timing for coastal specialisation because of the time required for marine species to adapt to newly inundated terrestrial environments. At Princess Charlotte Bay, Beaton (1985) could find little evidence for human exploitation of newly formed shorelines until 1500 years after sea levels had stabilised. Use of islands in this region occurred even later (2350 years BP) whilst it was even later still (but an unspecified period in this article) before middens begin to appear in the archaeological record (Beaton 1985).

Woodroffe et al. (1988; see also Walters [1985] in relation to Toorbul Point, Queensland) similarly considered the impact of sedimentation build up in the South Alligator River, Northern Territory, following inundation of this riverine valley system. Over time this environment changed from coastal to tidal flats with mangrove stands and then to freshwater flood plains. In contrast to Beaton's (1985) research, Woodroffe et al. (1988) found that resource use did not fall off, but the nature of resource use changed over time in line with changes in the environment.

Similarly, Rosendahl et al. (2015) found on the Wellesley Island Group, in the Gulf of Carpentaria, Queensland, that mangrove habitats and shellfish communities had been established by 7000 BP, which indicated that 'the absence of island use during initial islandisation was not due to a lack of resource availability'. Rosendahl et al. (2015:7) argued that the pattern on Mornington Island and other parts of northern Australia demonstrated that: 'resources established rapidly after initial coastal and/or island formation'.

Many researchers have emphasised that cultural change and demographic patterns in Aboriginal societies during the Holocene have been influenced by climate variability and the impact this has on available resources (i.e., environmental determinism) (e.g., Beaton 1985; Hiscock 2008:172–175; Rosendahl et al. 2015; Sim and Wallis 2008; Woodroffe et al. 1988). Bourke et al. (2007:93), for example, stated, 'that ENSO-related climate oscillations must have significant impacts on human populations, primarily affecting the resource base'. Williams et al. (2015) similarly correlated changing demographic patterns in Aboriginal Australia with climate oscillations. Williams et al. (2015:1) proposed the following sequence: 1) The Holocene climate optimum (9–6 kya) coincides with rapid expansion, growth and establishment of regional populations, including across the arid zone (conditions at this time allowed longer 'patch residence' times which led to more sedentary lifestyles and allowed low level food production in some parts of the continent); 2) The subsequent onset of ENSO conditions (4.5–2 kya) resulted in 'population fragmentation, abandonment of marginal areas, and reduction in ranging territory'; and 3) Climate amelioration as a result of La Nina conditions (post 2 kya) resulted 'in an intensification of the mobility strategies and technological innovations that were developed in the mid-to-late Holocene' resulting in population expansion and utilisation of the whole continent. Williams et al. (2015:9–10) argued that the appearance of middens, the greater exploitation of marine resources and the initiation and use of offshore islands occurs during the interim period following the end of the Holocene climate optimum and the subsequent onset of ENSO arid conditions.

Climate variability due to ENSO cycles may have had varying regional environmental impacts. Conditions in the south of the continent became drier approximately 4200 years ago as a result of ENSO conditions (Lourandos 1983:82). Lower lake levels determined from pollen analysis and sedimentology at Lake Keilambete in southwestern Victoria are associated with these arid conditions (Lourandos 1983:82). At this location, lake levels were low in the period from 5,000 BP to 1,900 BP with the lowest levels recorded around 3,100 BP and thereafter water levels fluctuated from 1,900 BP onwards (Lourandos 1983:82). Likewise, at White Lagoon, Kangaroo Island (South Australia), lake water levels fluctuated during the Holocene with high water levels associated with wetter conditions prior to 4,000 BP and water levels falling dramatically after this time (Draper 1991; Lampert 1981:21–22).

In the north of the continent, in the Gulf of Carpentaria, however, climate conditions generally improve and become 'more stable with less storm activity and lower effective precipitation' in the period c.4,200 and 2,500 years ago (Sim and Wallis 2008:103). Following this period, there was an increase in ENSO events which peaked around 1300 BP. Sim and Wallis (2008:103) identified a low occupation phase on Vanderlin Island during this time. Similarly, on Bentinck Island, Gulf of Carpentaria, researchers found evidence for a drying trend from 5,000 BP to 3,700 BP; the climate then became more variable to 2,000 BP associated with increased ENSO strength and intensity; after which time climate conditions generally ameliorated until the present in conjunction with a period of wetter conditions between 1,500 and 1,000 years ago (Moss et al. 2015:1; see also Bourke et al. 2007).

Important to debates that emphasise or question 'environmental determinism' is the consideration of how Aboriginal peoples responded to environmental stress (Nursey-Bray et al. 2013). Clarkson and Wallis (2003:141) suggested that it is not climate variability that creates risks for hunter-gatherers but reduced climate predictability. Similarly, Bourke et al. (2009) provided a review of climate change and its impacts on Aboriginal communities, however, they contextualised such impacts by comparison with other modes of resource use and other types of economies. As Bourke et al. (2009:98) summarised:

> While extreme climatic events may impact on agricultural societies, hunter-gatherer people are known to be more adaptable to significant climate change due to their flexible,

> broad spectrum foraging strategies for dealing with both temporary and long-term availability of particular resources (Meehan 1982) and other risk reducing strategies such as mobility and exchange (Thomson 1949). The case studies cited above indicate that foraging behaviour on the coastal margins of northern Australia was generally flexible, and that people actively altered their foraging strategies to incorporate newly available or increasingly abundant species within the general pattern of environmental and climatic change previously outlined. However, hunter-gatherer adaptive strategies do have climate thresholds of cultural tolerance that may be triggered by extended periods of unpredictable climate events.

Lourandos (1983; see also David et al. 2006) disagreed with purely 'environmentally deterministic' research. Lourandos (1983) was at the forefront of arguing that cultural change in Aboriginal societies was socially mediated. Lourandos (1980, 1983, 1997; Lourandos and Ross 1994) argued that evidence for socioeconomic intensification in the mid to late Holocene was linked to demands associated with more complex social organisation and wider social networks within Aboriginal communities (David et al. 2006; Lourandos 1980, 1983; Lourandos and Ross 1994). In this regard, Lourandos (1983:81) acknowledged wider international interest in these questions (e.g., Bender 1981; Meillassoux 1973). Lourandos (1983:81) noted that well-known anthropological case studies included the socially complex 'stratified' North American Northwest coastal societies which 'operated and presumably developed, without a agricultural or horticultural component in their economy'.

Lourandos (1983), in his review of research into Aboriginal societies during the Holocene, including coastal economies, argued that demography and socio-cultural patterns follow environmental trends from the terminal Pleistocene and early Holocene periods but diverge from these in the late Holocene. In critiquing Beaton's (1985) research, Lourandos (1997:130) argued that Beaton's (1985) data (discussed in earlier section) could also be interpreted as 'progressive cultural change throughout the late Holocene' involving the expansion of economic niches including:

- More intensive use of the mainland coastal fringe and resources (large shell mounds);
- The use of the offshore islands and reefs; and
- The introduction of more efficient marine technology (for example outrigger canoes) which would have allowed a wider range of marine exploitation (for example dugongs).

Lourandos (1997:165) summarised: 'there is a general pattern of increasingly complex socio-demographic conditions as indicated from around 6,000–3,000 BP and peaking in the last 2,000–1,000 years'. Lourandos (1997:168) concluded that the last 1,500 years saw a greater magnitude of change which is indicated by evidence for alterations in stone tools and fishing equipment. The archaeological evidence for intensification was reflected in an increasing number of sites, increases in the range of artefacts and evidence from faunal remains for wider resource use in the mid to late Holocene (including during periods where climate conditions became more adverse) compared with earlier periods (Lourandos 1980, 1983, 1997).

Pertinent to this thesis, researchers in other parts of Australia investigating coastal and island communities have identified similar trends (Lourandos 1997; Memmott et al. 2006; O'Connor 1987; Rosendahl et al. 2015). Memmott et al. (2006:30), for example, noted that developments in coastal specialisation and offshore island use during the last 5,000 years may also have been a result of socio-economic intensification. Similarly, Rosendahl et al. (2015:7) observed that the broader scale trend seen in human occupation of islands follows similar patterns occurring elsewhere, 'with populations expanding into new areas, intensifying their use of the resource base with localised increases in new site establishment and a signature that demonstrates a complex knowledge of the environment'.

Hiscock (2008:264–267) acknowledged that social dynamics have implications for settlement and economy. However, he cautioned against the notion that there was a single period of reorganisiation or a single cause. Hiscock (2008:264) stated that it is diversity rather than uniformity that characterises evidence for change in Australian 'pre-history'. He further noted that such change was not necessarily restricted to the Holocene but occurred throughout Australian 'pre-history'. Hiscock (2008) observed that ideology and social life can be difficult to discern from material residues. In addition, the relative abundance of archaeological materials from the late Holocene may be due to better preservation.

2.6 Coastal Geomorphology

Stright (2005) noted that: 'archaeological sites along modern coastlines reflect prehistoric activities from time periods when prehistoric coastlines coincided with present shoreline positions'. However, as coastlines are subject to dynamic forces, the position of the shoreline may have altered over time. Beach progradation, for example, can result in former shoreline sites being located hundreds of metres inland of the present-day coastline (Hall and McNiven 1999:2). Researchers in other regions of the world have adopted geomorphological approaches and methods to investigate landscape history and palaeogeography. Geomorphological research into coastal and island environments are discussed in this section (e.g., Cherry et al. 2012 [change in island land-use patterns over time]; Rick et al. 2013 [palaeocoasts and associated peri-coastal sites including high ground vantage points]; Tait Elder et al. 2014 [coastal evolution due to sea-level fluctuations and other factors]).

These researchers utilised geomorphological approaches to investigate landscape history within their regions of study. Identifying landscape history allowed for targeted surveys ('archaeological discovery methods') to help locate archaeological sites and cultural heritage linked in time to these past landforms. Former shorelines were important as these locations provided indicators for locating archaeological sites or cultural heritage linked to activities of people living along such coasts during earlier periods in the Holocene (Barker 2004; Rick et al. 2013; Tait Elder et al. 2014; Ulm 2006; Wynne 1980).

Tait Elder et al.'s (2014:45–46) research, for example, focussed on fish traps located along the coast in the Pacific Northwest of North America. They identified that such 'sites are susceptible to a range of geomorphic and anthropogenic factors' that have impacted the 'preservation and visibility' of the fish traps. Coastal geomorphological factors can contribute to vertical (e.g., sea-level fluctuations, tectonic uplift or subsidence or hydro-isostasy) and/or lateral movements of the coastline (e.g., coastline erosion, sedimentation or beach progradation).

Tait Elder at al. (2014), identified that 'coseismic subsidence' along the coast in their region of study resulted in the submergence of all but the most recent fish traps. Through their analysis, Tait Elder at al. (2014) argued that regional patterns in cultural use and human responses to coastal dynamism are better understood by taking into account taphonomic factors including the geomorphic and human impacts on the coastal margin at both local and regional scales which provided a 'truer' chronology of the distribution of fish weirs in their region of study.

For the purposes of their study, Tait Elder et al. (2014:47) defined coastal environments 'as being within or directly adjacent to current tidal influence'. Tait Elder et al. (2014:51) adopted the geomorphic classification framework from Shipman (2008) to classify the range of coastal environments in their study area. They used 'a combination of site visits, aerial photography and local environmental descriptions' to apply the 'geomorphic classification system' to each site location. Tait Elder at al. (2014:47) considered their concepts should 'be applicable to coastal areas throughout the world'. These approaches also provided insights into temporal distribution and site patterning in the past.

While Tait Elder et al. (2014) focussed on landscape history in coastal environments, Rick et al. (2013) extended these concepts to investigate pericoastal (inland) sites associated with former shorelines. They undertook a terrestrial archaeological survey project designed to identify palaeocoastal sites on Santa Rosa Island, California. Using reconstructions of ancient shorelines and paleogeography, they predicted that sites might be found where lithic resources, freshwater springs, caves or rockshelters, and strategic vistas drew palaeocoastal peoples into the island interior (Rick et al. 2013). In this research, site chronology was established by identifying lithics known to date from the terminal Pleistocene/early Holocene and, where possible, obtaining radiocarbon samples from midden deposits (Rick et al. 2013:324).

Investigating the archaeology and history of the island of Montserrat, West Indies, Cherry et al. (2012) adopted 'an integrated temporal approach' (after Lightfoot 1995). They focussed on long term perspectives rather than particular points in time. Cherry et al. (2012) argued that, viewed over the long term, the island's landscape documents 'a history of multi-scalar attempts to live in an environment that is comprised of unique challenges, risks, and opportunities'. On Monserrat Island, the 'co-occurrence' of settlements from different time periods at particular locations including coastal inlets, ghaut mouths and inland vantage points at higher elevations has been influenced by Montserrat's topography, volcanism and limited natural resources. Cherry et al. (2012) found a diachronic or long-term perspective was important for understanding the history of a people. Analysis of the layout, artefactual remains and surrounding landscapes at multi-temporal sites provided the basis for investigating how past populations negotiated changes in the island's environment.

2.7 Summary

The chapter has summarised themes that have arisen out of academic research into the culture and economy of peoples living by and from the sea, today and in the past. Research themes have included functionalist approaches which have focussed on resource use e.g., shellfishing, coastal fisheries and extension of the resource base to encompass marine resources and the use of islands including the development of seagoing watercraft. Researchers have extended this research to develop general models of Indigenous coastal and island resource use. These models e.g., optimal foraging theory, broad spectrum revolution and comparison of open resource pools and common resource pools have developed out of research into hunter-gatherer resource use more generally. Researchers have also investigated the role of Indigenous ecological knowledge, customs and beliefs and the spiritual connections Indigenous peoples have with their lands and waters. The varying examples discussed in this chapter reveal the importance of local studies in contributing to our understanding of Aboriginal coastal economies and their inherent diversities and specialisations. Whilst much coastal and island archaeological research has taken place along the Australian coastline, research in South Australia has been limited (Figure 4). This thesis serves to extend the range of research beyond a northern Australian milieu to encompass a largely undocumented and distinctive environmental and geographic region of southern Australia where little is known about the time-depth of the emergence of Holocene coastal specialisations.

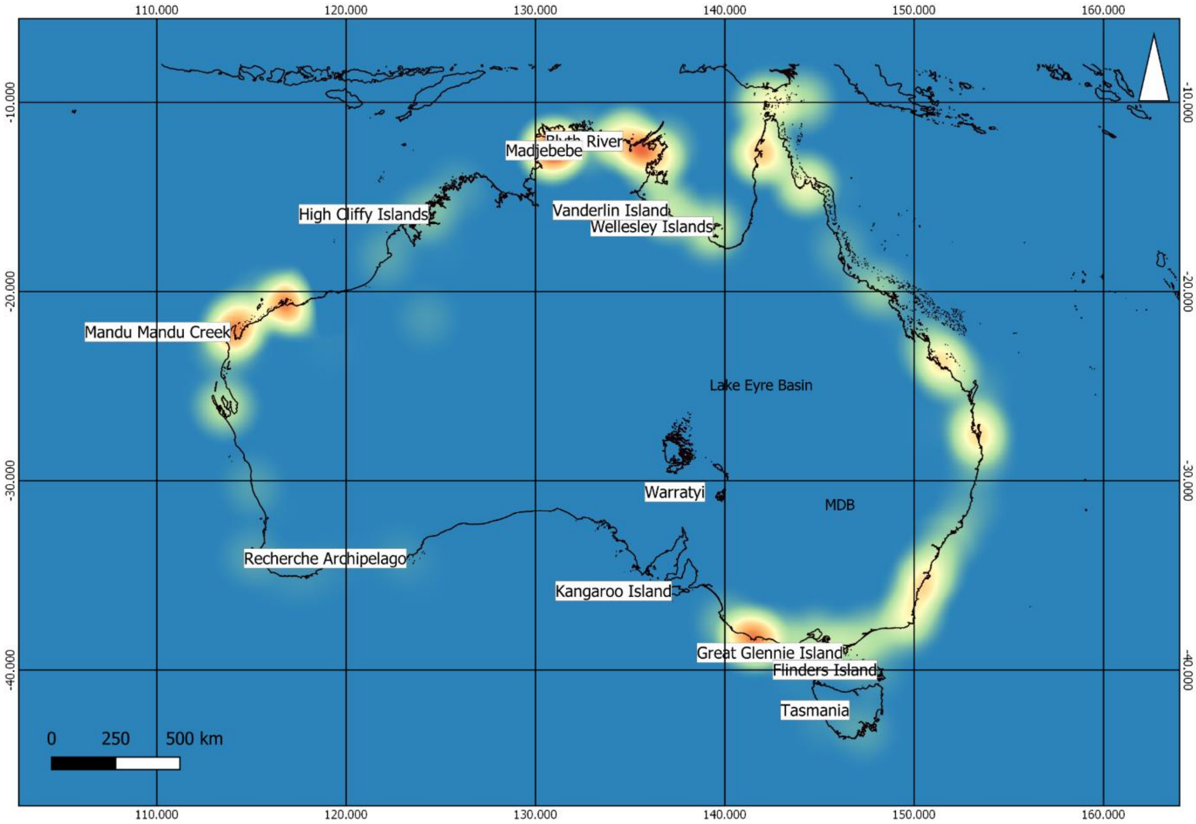


Figure 4: Heat map illustrating the distribution of dated coastal and island archaeological sites recorded around the Australian coastline (n=1110) (site data compiled from Williams et al. 2013).

3. REGIONAL OVERVIEW

Yorke Peninsula/Guuranda is located on the South Australian coast situated between the Eyre Peninsula to the west and the Fleurieu Peninsula to the east. Yorke Peninsula/Guuranda has an area of 4,265 square kms with a coastline of 563 kms with no point on the no point on the peninsula more than 25 km from the sea (FGCSA 1997; Wood and Westell 1998; Zang 2006). The highest point is the Arthurton Trig Point north of Maitland at 229 metres above sea level (Zang 2006). A series of shallow valleys line the interior of the peninsula. The predominant Yorke Valley area lies roughly in the area between Arthurton, Maitland, Ardrossan and Curramulka (Hill and Hill 1975). Only the north-east end of the peninsula connects to the mainland and the peninsula then is bounded by St Vincent Gulf in the east, Investigator Strait in the south and Spencer Gulf to the west.

3.1 Physical Geography

In form, Yorke Peninsula/Guuranda, is defined by geological processes that pre-date the LGM (FGCSA 1997; Zang 2006). The submerged palaeovalleys beneath gulf waters and uplifted lands that today comprise Eyre Peninsula, Yorke Peninsula/Guuranda and Fleurieu Peninsula as well as the Mount Lofty Ranges and Kangaroo Island are a product of geological faulting initiated during the Cenozoic resulting in the subsidence of gulfs and uplift of peninsulas and ranges (Figure 5) (FGCSA 1997; Zang 2006). Kangaroo Island also was formed as an extension of the Mount Lofty Ranges from which it is now separated by Backstairs Passage, which was cut by glacial erosion during the Early Permian (299 to 290 Mya) (Bourman et al. 2016:355).

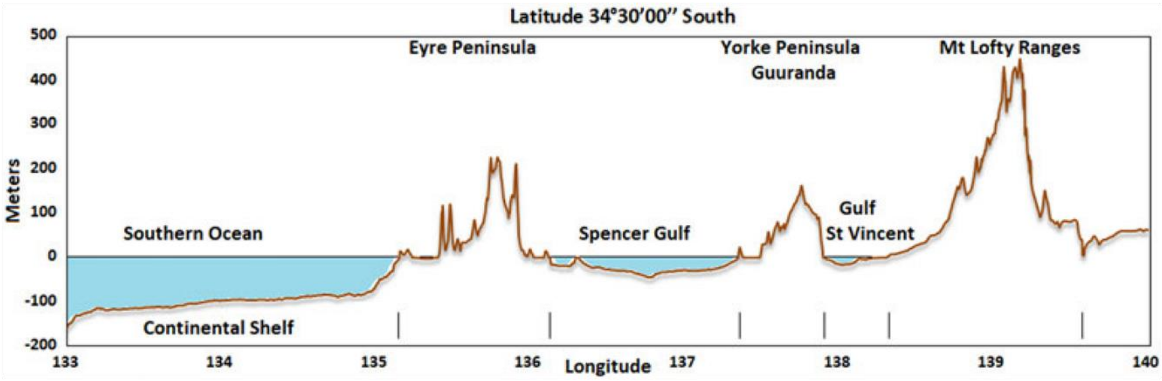


Figure 5: East/West cross-section illustrating the geological faulting that contributed to the formation of the ranges, peninsulas, and gulfs referred to in this paper (after FGCSA1997:21).

In addition to these tectonic processes, glaciation, volcanic activity and episodes of marine transgression prior to the LGM have also influenced the contemporary Yorke Peninsula/Guuranda coastline (Bourman et al. 2016; FGCSA 1997; Zang 2006). Inland from the coast, much of the surface of mainland Yorke Peninsula/Guuranda is covered by a thin soil layer of tertiary and quaternary sediments overlying sedimentary limestone lain down during prior periods of marine transgression when the whole of the region was covered by shallow seas (Bourman et al. 2016; Field Geology Club of South Australia Incorporated 1997). The geological history of the region is still preserved in the visible surface geology (Figure 6/Table 2) (GSSA 2019).

Yorke Peninsula/Guuranda is also flanked by a number of island/island groups: Althorpe, Bird, Chinamans Hat, Deadman's/Mungari, Goose, Green/Murnarla, Haystack, Middle, Rocky, Royston, Seal, Shag, South, Troubridge and Wardang/Waraldi Islands. Kangaroo Island to the south of Yorke Peninsula/Guuranda is the largest island. These islands are all visible from mainland. Like other islands along the Australian coast, these islands were formed in the Holocene following post-glacial sea-level rise.

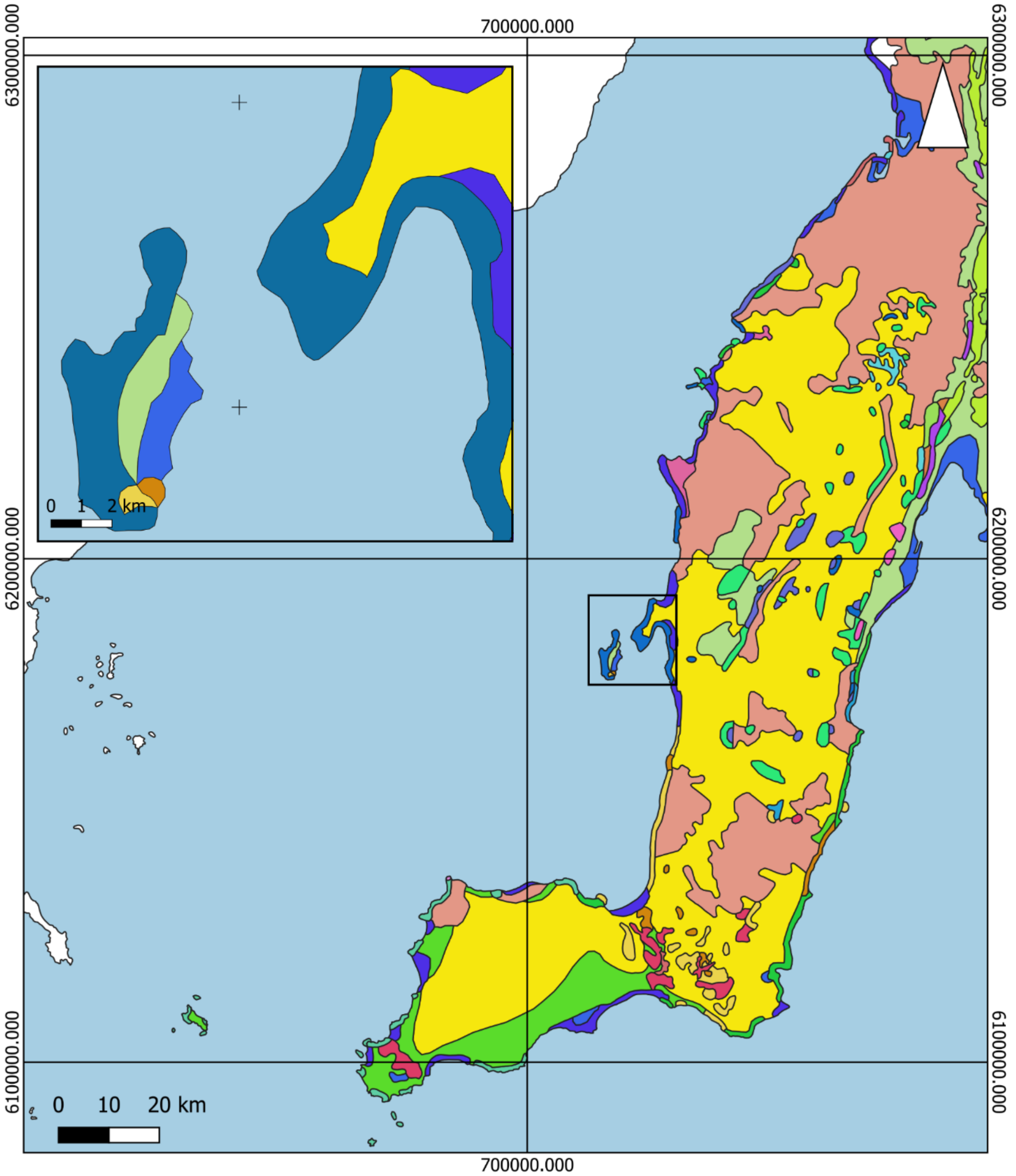


Figure 6: Yorke Peninsula/Guuranda and Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi (inset) geological regions (GSSA 2019). See Table 2 for map key/geological timescales.

Table 2: Yorke Peninsula/Guuranda surface geology Figure 6 map key inclusive of geological timescales (GSSA 2019).

	ABC Range Quartzite	NEOPROTEROZOIC
	Bridgewater Formation	PLEISTOCENE
	Carboniferous-Permian unit 1	CARBONIFEROUS-PERMIAN
	Corny Point Paragneiss	PALAEOPROTEROZOIC
	Donington Suite	PALAEOPROTEROZOIC
	Emeroo Subgroup	NEOPROTEROZOIC
	Eocene-Miocene unit 5	EOCENE-MIOCENE
	Eocene-Pleistocene regolith/colluvial unit 1	EOCENE-PLEISTOCENE
	Glanville Formation	PLEISTOCENE
	Hallett Cove Sandstone	PLIOCENE
	Hiltaba Suite	MESOPROTEROZOIC
	Holocene alluvial/fluvial sediments	HOLOCENE
	Moralana Supergroup unit 3	CAMBRIAN
	Moralana Supergroup unit 4	CAMBRIAN
	Paleocene-Eocene unit 4	PALEOCENE-EOCENE
	Pleistocene alluvial/fluvial sediments	PLEISTOCENE
	Quaternary aeolian sediments	PLEISTOCENE-HOLOCENE
	Quaternary aeolian unit 3	PLEISTOCENE-HOLOCENE
	Quaternary calcrete	PLEISTOCENE-HOLOCENE
	Quaternary lacustrine/playa sediments	PLEISTOCENE-HOLOCENE
	Saint Kilda Formation	HOLOCENE
	Saint Kilda Formation unit 14	HOLOCENE
	Umberatana Group	NEOPROTEROZOIC
	Wallaroo Group	PALAEOPROTEROZOIC
	Wilpena Group	NEOPROTEROZOIC
	Yudnamutana Subgroup	NEOPROTEROZOIC

Whilst the broad framework of the Yorke Peninsula/Guuranda is defined by geological processes, the more detailed location of the coastline is also influenced by the action of geomorphological processes that took place as marine transgression progressed and since sea levels stabilised c.6000 years ago (Bourman et al. 2016). These processes include wind action, wave action, tidal action, erosion and sedimentation taking place along the coastal margin (Davidson-Arnott 2012).

The coastline is being actively eroded in places such as at the coastal cliffs formed of Hindmarsh Clay at Ardrossan, St Vincent Gulf on the east coast of Yorke Peninsula/Guuranda (Bourman et al. 2016:206). Sediment has also accumulated as tidal flats at some locations such as at Port Victoria Bay/Dharldiwarldu (Bourman et al. 2016:203). Sediment accumulation has also resulted in the formation of prograding beaches and sandy cuspate forelands (Bourman et al. 2016). Pine Point and Black Point/Gudliwardi, St Vincent Gulf on the east coast of Yorke Peninsula/Guuranda and Cape

Elizabeth on the west coast and at Bird Point on Wardang Island/Waraldi are examples (Bourman et al. 2016:203; Gostin and Hill 2014:21–35). Coastal erosion has also exposed the basement rocks that underlie the peninsula (Zang 2006). Evidence for the coastal processes and underlying geology outlined above can be found on Point Pearce Peninsula/Burgiyana. These processes also have implications for the preservation and visibility of Narungga heritage discussed in later sections.

The sea floor underlying gulf waters has also been altered following marine transgression (see sediment studies of southern Spencer Gulf [Fuller et al. 1994] and northern Spencer Gulf [Gostin and Hill 2014; Hails et al. 1984]). Gostin and Hill (2014) stated:

> …the submarine bathymetry of northern Spencer Gulf has been shaped by both Pleistocene and Holocene shallow estuarine and coastal processes. Subaerial exposure of marine sediments, channel incision, and aggradation of peritidal sediments have alternated throughout the Pleistocene. Many channels have been infilled and exhumed in response to changing sea levels during this period…

The sea floor surface is covered by Holocene bioclastic sediment generally less than 2 metres thick (Gostin and Hill 2014:28). This sediment layer is up to 8 metres thick near Pt Augusta at the head of the gulf (Gostin and Hill 2014:21–35). Sediment is actively transported northward along the peninsula coast as a result of longshore drift (Bourman et al. 2016; Gostin and Hill 2014).

3.2 Biodiversity

Most of Yorke Peninsula/Guuranda is prime agricultural land, with mostly small rolling hills and flat plains (FGCSA 1997). Since European invasion of the region commencing in 1847, almost all of the original vegetation has disappeared as a result of land clearing due to farming and now native vegetation can only be found along roadsides and in conservation parks and along the coastal margin (Kenny 1973:30). Yorke Peninsula/Guuranda, however, shares many animal and plant species with similar biogeographic zones on the neighbouring peninsulas and Kangaroo Island (Corbett 1973). These considerations are important as they help provide insights into the biogeographic zones that existed prior to European invasion and in now submerged landscapes underlying gulf waters (Roberts et al. 2019).

Remnant natural vegetation includes woodland of dry land teatree and drooping sheoak throughout the peninsula; chenopod shrubland occurs in the central region of the north; and open mallee scrub, chenopod shrubland and open heath are found in the north of the peninsula (Zang 2006:10). Coastal vegetation on Yorke Peninsula/Guuranda consists of samphire around salt lakes and along low rocky coastlines (Kenny 1973:33–35). Mallee scrub occurs in active coastal dune areas and mangrove stands occur in sandy coastal areas (Kenny 1973:33–35). Reeds and rushes grow in areas where coastal freshwater springs or soaks are found. The terrestrial environment supported a variety of economic plant and animal species including kangaroo, wallaby, emu and wombat (Corbett 1973).

The coastal environment along the two gulfs is generally protected with slight wave action and extensive sand and mud flats, while the southern coast is more exposed and prone to severe wave and storm action originating from the Southern Ocean (Corbett 1973; Laws 1973). Coastal waters support a variety of marine habitats including: 1) Intertidal sands; 2) Mudflats and mangroves, with tidal channels; 3) Rocky reef platforms with many plants and animals attached; 4) Seagrass meadows in shallow water; 5) Deep water communities of sponges, sea squirts, scallops, bryozoan corals and brachiopods; 6) *Pinna* (razorfish) communities with rich epifauna; 7) Tyre reefs and old shipwrecks; 8) Bare sand and shoals; and 9) Malleus-Pinna assemblages (hammer oysters and razorfish) (Friends of St Vincent Gulf 2014). The coastal habitats support a variety of economic sand and rocky reef shellfish species known to Narungga (Table 3).

Table 3: Yorke Peninsula/Guuranda shellfish species with economic and cultural significance (list not exhaustive) compiled by Roberts et al. (in prep.–see NAPA 2006).

Common Name	Scientific Name	Narungga Name
Abalone/Muttonfish (all relevant species)	*Haliotis* spp.	*birra (pira)*
Black Cowrie	*Zoila friendii thersites*	*maaru(murroo)*
Black Periwinkle/Pennywinkle	*Melanerita melanotragus*	*warana*
Cartrut Shell/Winkle/Common Dog Whelk	*Dicathais* spp.	
Chiton	*Poneroplax albida*	
Cockle/Pipi/Mud Cockle (all relevant species)	e.g., *Katelysia* spp. and *Plebidonax deltoides*	*bilili*
Limpet (all relevant species)	e.g., Family *Nacellidae,* Family *Patellidae,* Family Lepetidae and Family Lottidae	*'goonthy hat'*
Mud Oyster	*Ostrea angasi*	
Mussel (all relevant species)	Family Mytilidae	
Nautilus Shell (all relevant species)	Family Nautilidae	*birra-ungky*
Razorfish	*Pinna bicolor*	

Rock Whelk (all relevant species)	e.g., *Cabestana spengleri* and *Thais orbita textilosa*	
Scallop (all relevant species)	Family Pectinidae	
Striped Periwinkle/Pennywinkle	*Austrocochlea* spp.	*warana*
Tulip Shell	*Pleuroploca australasia*	
Warrener/Turbo	*Turbo* spp.	

Gulf waters are also home to more than 200 migratory and reef fish (Table 4). Migratory fish species include whaler shark, snapper, Western Australian salmon, sardine, anchovy, King George whiting, yellow fin whiting and southern garfish (Shepherd et al. 2014). A variety of marine mammals including dolphins and seals and sea birds also share the marine environment (Corbett 1973).

Table 4: Fish species with economic and cultural significance (list not exhaustive) found in Spencer Gulf (including migratory species). Compiled by Roberts et al. (in prep.–see NAPA 2006).

Common name	Scientific name	Narungga name
Schooling mid-water species		
Queen Snapper	*Nemadacrylus valenciennesi*	
Sea Sweep	*Scorpis aequipinnis*	
Barber Perch	*Caesioperca razor*	
Tommy Ruff	*Arripis gemgiana*	*dhangra* [large], *guura* (*kura*) [small]
Seagrass/sand species		
Little Weed Whiting	*Neoodax bateatuls*	
Red Mullet	*Upeneichthys vlamingii*	
Benthic/near benthic species		
Western Blue Groper	*Achoerodus gouldii*	*gadabibardi (gatapitparti, gutter-be-berty)*
Dusky Morwong	*Dactylophora nigricans*	*gayinbara* (*kainbara*, *gynbra*, *gynagburra*, *coynbinya*, *kaipulja*, *gaibuija*, *kangburra*, *gyndjburra*, *gynje-burra*) (this term sometimes relates to a butterfish of a large size), *nhudli* (*nudli*, *noodlee*, *noordly*) (butterfish with a bent tail/spine), *warimbru* (*worrimbru*)
Silver Drummer	*Kyphosus sydneyanus*	
Magpie Perch	*Cheilodactylus nigripes*	
Zebra Fish	*Girella zebra*	
Under-canopy/cave species		
Senator Wrasse	*Pictilabrus laticlavius*	
Scaly Fin	*Parma victoriae*	

Blue Devil	*Paraplesiops meleagris* and *Paraplesiops alisonae*	n/a
Bream and Drummer (all relevant species)	*Acanthopagrus* spp. and *Nematalosa erebiand* Family Kyphosidae	*buda-budu* (*buda-buto*, *booda-buttoo*, *badalultha*) [bony], *urdududna* [silver], 'T*hoongka-Guuya*'
Butterfish/Humpy Butterfish/ Hump Back Butterfish/ Dusky Morwong/Strongfish	*Dactylophora nigricans*	*gayinbara* (*kainbara*, *gynbra*, *gynagburra*, *coynbinya*, *kaipulja*, *gaibuija*, *kangburra*, *gyndjburra*, *gynje-burra*) (this term sometimes relates to a butterfish of a large size), *nhudli* (*nudli*, *noodlee*, *noordly*) (butterfish with a bent tail/spine), *warimbru* (*worrimbru*)
Catfish	*Cnidoglanis macrocephalus*	*awadji* (*awatyi*, *ower-jee*) [estuary catfish]
Dory (all relevant species)	Family Zeidae	n/a
Flathead (all relevant species)	*Platycephalus* spp.	n/a
Flounder (all relevant species)	Family Pleuronectidae and Family Bothidae	*dha yuguli*, *ta:yukuli*, *ta-yukuli*, *ta:jukuli*, *thabarayoogooly*,
Garfish (all species)	Family Hemiramphidae	*warndga*
Groper/Bluehead	*Achoerodus gouldii*	*gadabibardi* (*gatapitparti*, *gutter-be-berty*)
Leatherjacket (all relevant species)	Family Monacanthidae	n/a
Morwong (all relevant species excluding the Dusky Morwong which is listed separately above)	Family Cheilodactylidae	n/a
Mullet (all relevant species including estuarine and red)	Family Mugilidae, Family Mullidae	*warta* [jumping], *millharta*, [travelling], *mil-da-murtoo*, *gadawari* (*gatta worrie*), *ballara* (*bolara*), *baldi* (*paltie*)
Mulloway	*Argyrosomus japonicus*	*doong-garra*, *dungara*
Parrotfish/Wrasses (all relevant species)	Family Labridae	n/a
Pilchard/Australian Sardine	Family Clupeidae and Family Engraulididae	n/a
*Puffer Fish/Toad Fish (all relevant species)	Order Tetraodontiformes	*dhanni murdla*, (*darni-mudlu*, *dunny-mood-loo*)
Rock Cod (all relevant species)	Family Moridae	n/a
Salmon (all relevant species)	e.g., *Arripis truttaceus* and *Arripis trutta*	*gulyalya* (*gulalya*, *coolallah*, *gool-ul-ya*, *kulalya*) [Australian], *wittata*

Shark (all relevant species excluding great white)	Class Elasmobranchii	*widhadha* (*widat:a*, *withut-too*, *wilthuthu*, *witata*), *gurada* (*guratu*, *kuratu*, *goreta*, *goorta*, *goo-rat-too*) (some sources record this as the carpet shark or even the banded carpet shark, however current usage may also refer to a shark of any kind), *papus*
*Shark (great white)	*Carcharodon carcharias*	*widhadha* (*widat:a*, *withut-too*, *wilthuthu*, *witata*), *gurada* (*guratu*, *kuratu*, *goreta*, *goorta*, *goo-rat-too*) (some sources record this as the carpet shark or even the banded carpet shark, however current usage may also refer to a shark of any kind), *papus*
Snapper (all relevant species)	e.g, *Chrysophrys auratus* and Family Sparidae	*gadbari* (*kadbari*, *gadburi*, *cud-burry*, *cood-berry*, *gatburie*), *midaga* (*mittaga*)
Snook	*Sphyraena novaehollandiae*	*Dhudna*
Stingray/Stingaree/ Skate/Fiddler (all relevant species)	Order Myliobatiformes, Order Squatiniformes and Order Rajiformes	*mandibalda* (*mandipalta*, *mundy-bulter*) [smooth], *gadhara* (*gad:ara*, *guthera*, *gud-der-ah*) [small], *mandildu* (*mandiltu*, *mun-dilt-too*, *monditu*) [large], *guddoo-la* [fiddler]
Sweep (all relevant species)	*Scorpis* spp.	n/a
Tommy Rough/Tommy Ruff	*Arripis georgianus*/Family Arripidae	*dhangra* [large], *guura* (*kura*) [small]
Trevally (all relevant species)	e.g., *Pseudocaranx georgianus*	*minthaya*
Trumpeter/Striped Perch (all relevant species)	e.g., *Pelates Octolineatus* and Family Latridae	n/a
Whiting (all relevant species including)	Family Sillaginidae	*yardli* (*yerdli*, *jardli*, *yard-lee*, *yurrd-lee*, *yud-lee*) [spotted], *widba* (*witba*) [silver], *wallaldu* (*walaltu*), *winggara* (*wingarra*, *wingara*, *wingera*)
Yellowtail Kingfish	*Seriola lalandi*	n/a

3.3 Climate History

At the time of the LGM, the climate of Yorke Peninsula/Guuranda was similar to the arid zone (desert like) conditions that prevail north of Port Augusta, South Australia, today (Bourman et al. 2016:200;

Hughes et al. 2017; Williams et al. 2013). Remnant longitudinal desert dunes are preserved across most of present-day South Australia and provide evidence for the widespread extreme arid conditions during this time (Figure 7).

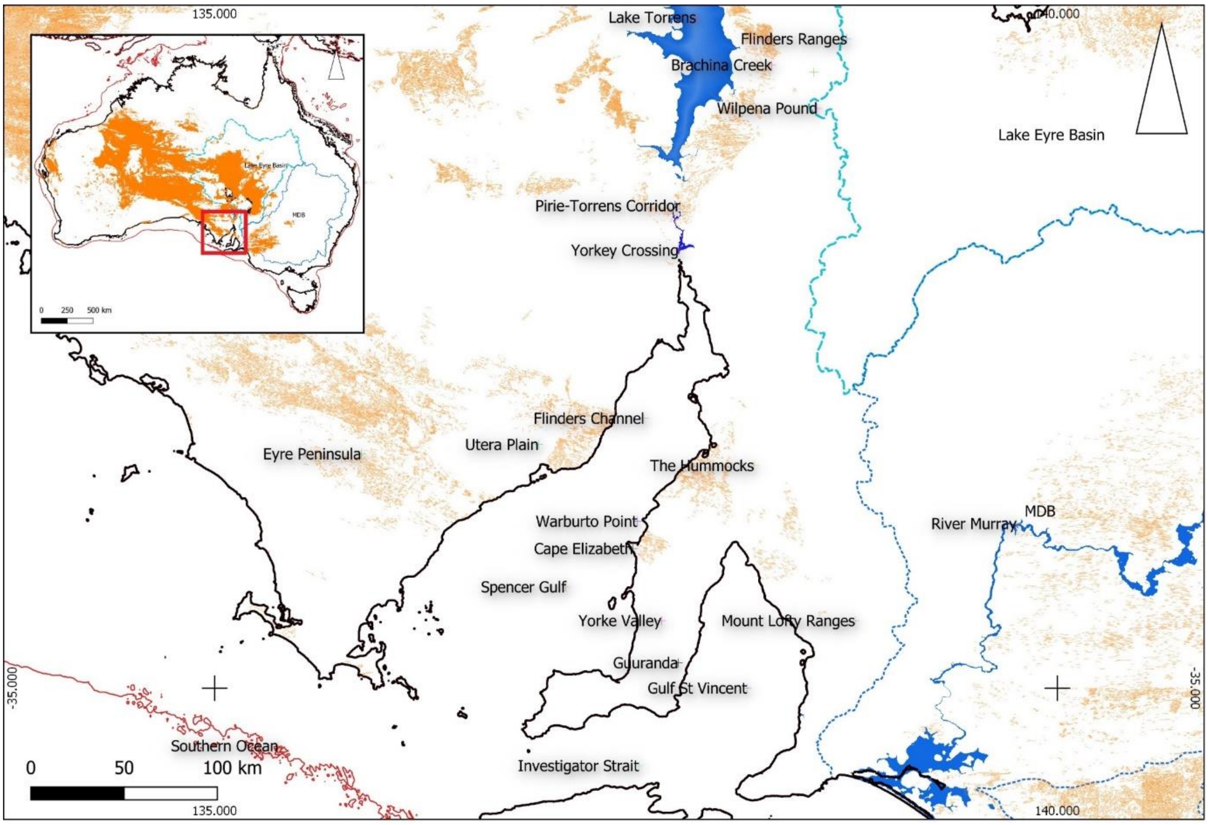


Figure 7: Desert dunes field from the LGM (ochre shading).

Remnant longitudinal desert dunes formed of light brown to red soils from the time of the LGM are still evident between at Tiparra Bay between Cape Elizabeth and Warburto Point on Yorke Peninsula/Guuranda (Jessup 1967; Van Deur 1983) (Figure 8).

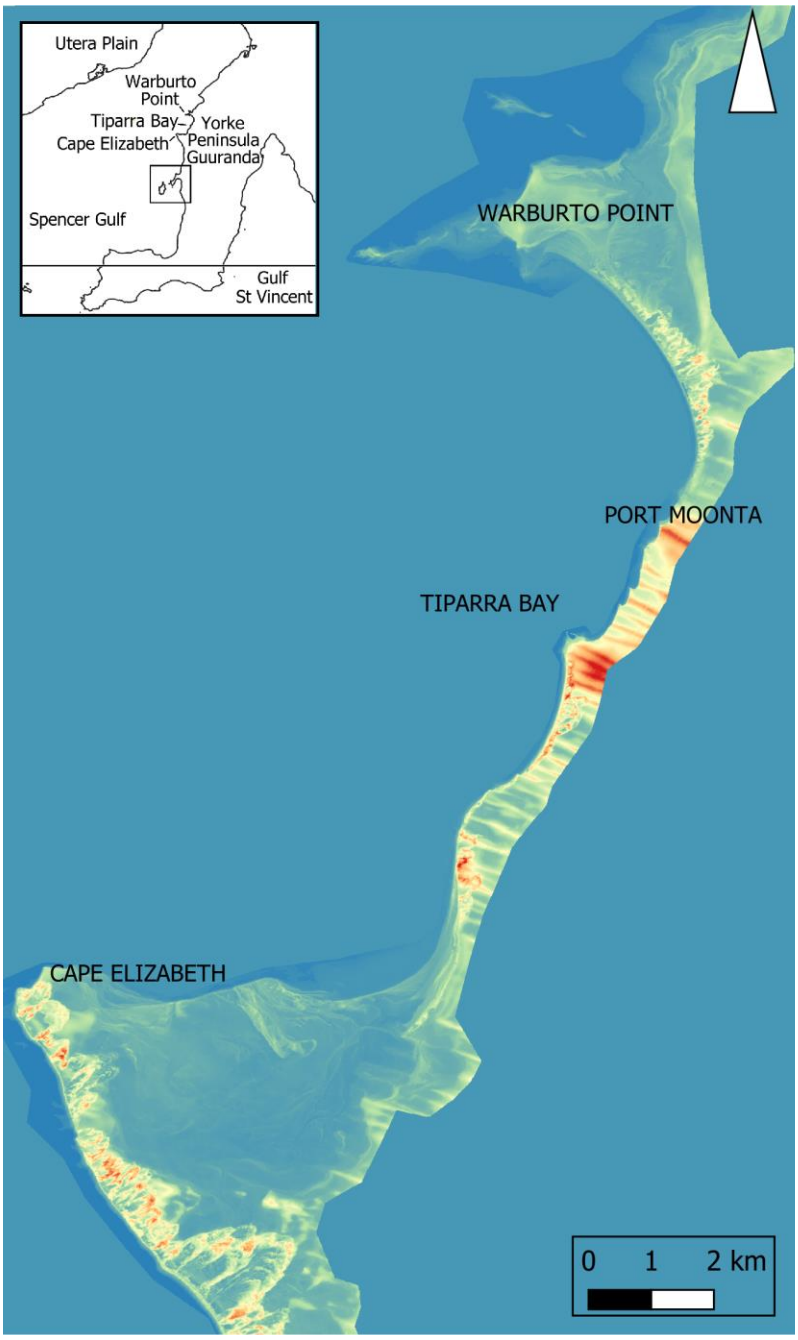


Figure 8: Tiparra Bay relict longitudinal desert dune system. Map created in GIS from 1 meter Lidar coastal survey data for western Yorke Peninsula/Guuranda. Note map limit is the extent of the Lidar survey at this location from this data source.

Van Deur (1983) investigated these relic desert dunes from the LGM found on the Utera Plain, Eyre Peninsula, across Spencer Gulf from Tiparra Bay. These dunes have a northwest-southeast and continue across the formerly exposed gulf floors (Jessup 1967; Van Deur 1983). Van Deur (1983) identified that an absence of vegetation to stabilise soils during a period of increased aridity provided the conditions for predominantly north-westerly sediment carrying winds to form these dunes (Van Deur 983). Following the LGM, climate conditions improved with higher rainfall leading to increased vegetation growth which acted to stabilise the dunes leading to their preservation in the landscape.

While conditions during the LGM were generally arid, wetland environments (refugia) are recorded from this time, for example, Brachina Gorge in the Flinders Ranges (Williams et al. 2001). With reduced rainfall, there were less flood events during periods of rainfall contributing to sediment build up in this gorge. Temperatures 9 degrees lower than present also meant there was less evaporation providing the conditions for the wetland environment to develop (Williams et al. 2001).

The long-term climate trend on Yorke Peninsula/Guuranda has been from a colder and drier climate during the LGM to a wetter more temperate climate today (Ray and Adams 2001/2002; Williams et al. 2013, 2015). As noted in the previous chapter, climate conditions during the Holocene in Australia were variable. Evidence from Kangaroo Island indicates that cold and dry conditions continued until approximately 7000 BP (Lampert 1981:15–22). The climate became wetter in the following 2,200 years. After 4,800 BP, conditions became increasingly drier again until about 2,000 BP when climate conditions became like the present (Lampert 1981:15).

Typical of the southern coastal areas of South Australia and influenced by the surrounding bodies of water, Yorke Peninsula/Guuranda today has a Mediterranean climate with some areas bordering a semi-arid climate, with hot, dry summers and cool, wet winter seasons (Corbett 1973; FGCSA 1997; Zang 2006). The climate today has average yearly minimum temperature of 10^{o}C and average maximum yearly temperature of 23^{o}C (Zang 2006:9). Average rainfall is < 500 mm per annum with 70% of the rainfall occurring between May and October (Zang 2006:9). Yorke Peninsula/Guuranda does not currently have permanent creeks or rivers. Potable water is/was springs and other groundwater sources often along the coast.

3.4 Summary

Yorke Peninsula/Guuranda is distinctive in form and environment. The peninsula is low-lying with maximum elevation of 229 metres, an area of 4,265 square kms and coastline of 563 kms. The surface geology of Yorke/Peninsula Guuranda reflects both the deep and recent earth history of the region, in particular along the coast. Yorke Peninsula/Guuranda does not have permanent creeks or rivers, but water is available from groundwater sources and the terrestrial environment is habitat to a wide variety of animal and plant species (including economic species) similar to animal and plant species found on adjacent peninsulas and Kangaroo Island. The long coastline relative to the area of the peninsula also provides access to a wide range of coastal resources. The adjacent coastal waters are habitat to a wide variety of fish and shellfish species as well as marine birds and mammals. Yorke Peninsula/Guuranda also has 20 islands. The physical geography also preserves evidence for the climate and sea-level history of the region. The region encompassing Yorke Peninsula/Guuranda was landlocked at the time of the LGM when the region had an arid climate compared to its Mediterranean climate today.

4. ETHNOHISTORY

This chapter outlines the language, country (land and sea) and culture of the Narungga people of Yorke Peninsula/Guuranda that has been documented in ethnohistorical and Narungga sources. It is noted that the representations of Narungga culture and social structure found in ethnohistorical sources should not be seen as definitive or exhaustive. Moreover, they were collected and written down by non-Narungga people. It needs to be acknowledged that the observers often struggled to accurately capture the complexities of Aboriginal societies. Much of the information is 'anecdotal' and was not collated following any formal academic method. There may also be inconsistencies in Narungga word forms, descriptions of sub-groups, totemic affiliations and rules governing social relations recorded by the different sources. Where possible, Narungga sources (e.g., Graham and Graham 1987; NAPA 2006; Wanganeen 1987) are also referenced for clarification in cases where such discrepancies may exist as well as to privilege community narratives. It is also important to recognise the continuing relevance of Narungga heritage for Narungga people. Wanganeen (1987) noted 'traditional ceremony and ritual inherited from the past is acknowledged today, and different people speak about sacred possessions and ceremonies'.

4.1 Sources

Europeans first documented and mapped the southern Australian coastline including Yorke Peninsula/Guuranda in 1802 with the separate voyages of exploration by Mathew Flinders and Nicholas Baudin (Anon. 1836; Krichauff 2008). Following these initial visits and prior to the establishment of the colony of South Australia in 1836, the main visitors to the region were sealers and whalers. Whilst it is known that sealers made landfall on Yorke Peninsula/Guuranda, the encounters that may have taken place between them and Narungga were not documented (Anon. 1836).

It is following European invasion that aspects of Narungga culture first began to be recorded by the early European sources (and later by Narungga people) described below e.g., Black (1920), Fison and Howitt (1880), Giles 1881; Gillen (ca 1894–1898). Griffiths (1988), Howitt (1904), Hughes 1840; Johnson (1922, 1930a, 1930b, 1931a, 1931b, c.1898–1900), Kühn and Fowler in Curr (1886:143–147), McArthur 1876; Mountford (1936, 1952), Mountford and Roberts (1969:18), Smith (1930:341–342), Sutton (1888), Thom (1953); Tindale (1936) and Wanganeen (1987).

Edward Snell was an engineer, surveyor, artist and diarist. His diary (Snell in Griffiths 1988) recorded his experiences living in Australia including during the period when he was employed as a surveyor on

Yorke Peninsula/Guuranda from 9 June to 23 September 1850. His diary excerpts recorded important aspects of the culture and economy of the Narungga people in the period prior to large-scale European invasion of Narungga lands.

Rev. Julius Kühn, a Lutheran missionary, was instrumental in the establishment of the Point Peace/Burgiyana Mission Station and became the mission's first superintendent (Krichauff 2008). Kühn was one of the sources for the description of the Narungga people recorded by Fison and Howitt (1880).

T.M. Sutton was also superintendent of the Point Pearce/Burgiyana Mission Station from 1882 to 1893. Sutton collated information on Narungga clan divisions, moieties and marriage customs, language, Dreaming narratives and afterlife beliefs. Some of the information recorded by Sutton is of a culturally sensitive nature and these aspects are not reproduced in this thesis.

Subsequently, Francis J. Gillen, who resided for nine years at Moonta from 1899 to 1908, also had a close association with the residents of the Point Pearce/Burgiyana Mission station. Gillen (in Mulvaney et al. 1997:263) described his informants as 'six old Grey beards' at Point Pearce Mission Station. Gillen recorded: '…the old men were very reluctant when I first started on them but after they had seen the Photos [sic] and some things I took out with me they gradually thawed, their old eyes sparkled and they were Evidently [sic] delighted to find a white man who did not look upon their customs as being hideous and their beliefs wicked…'.

Louisa Eggington, a Narungga woman was a source of important information regarding the culture of her people (Johnson c.1898–1900; Mountford 1936; Tindale 1936). J. Howard Johnson recorded information provided by Louisa Eggington between 1898 and 1900. Later, Norman Tindale, spoke with Louisa in 1935 and recorded additional information. Tindale (1936) stated that Louisa belonged to the Warri local group. Louisa's information covered culture, language and vocabulary, myths and important placenames covering southern Yorke Peninsula/Guuranda.

J. Howard Johnson was the son of a pioneer pastoralist of Yorke Peninsula/Guuranda. He was friends with Louisa Eggington and her husband. He compiled information on the language, placenames, culture and Dreaming narratives as related by Louise Eggington. The information was originally collected between 1898–1900 and was subsequently published in the *Yorke Peninsula Pioneer* in 1930–1931.

John McConnell Black published three papers on Aboriginal languages between 1915 and 1920. Black (1920) recorded the vocabularies of four South Australian languages including Narungga which was collected at Point Pearce Aboriginal Mission Station/Burgiyana in October 1919. Sarah Newchurch and Harry Richards were the Narungga sources for the vocabulary recorded by Black. Black was also a noted botanist and documented the Narungga name *burkiana* for the plant species *Geijera parviflora*. *Geijera parviflora* is the oil bush that grew in the area encompassing Point Pearce Peninsula/Burgiyana and is the plant species from which the peninsula derived it Aboriginal name.

George Thom was a resident of southern Yorke Peninsula/Guuranda who first arrived at Marion Bay in 1909 when he was 18. In 1953 he wrote a series of articles for the *Yorke Peninsula Pioneer* on the history of the Marion Bay district. His recollections included aspects of Narungga heritage 'mainly handed down from native sources' which he learned from three early residents of Marion Bay. Thom's (1953) account records aspects of the lifeways and Dreaming narratives of the clan group living in the south of the peninsula.

David Hill and Sandre Hill were also descended from early European residents of Yorke Peninsula/Guuranda and were interested in documenting the Aboriginal archaeological heritage of the region. They were not formally trained but collaborated with Graham Petty and Norman Tindale from the South Australian Museum in the preparation of their work (Hill and Hill 1975).

Allan Parsons was a resident of Yorke Peninsula. He wrote a history of Yorke Peninsula/Guuranda. Parsons was also a member of the Anthropological Society of South Australia and was interested in the region's Aboriginal archaeological heritage and wrote of Aboriginal campsites he had observed on Yorke Peninsula/Guuranda.

In the 1960s and 1970s, Elizabeth (Betty) Fisher (AM) collected important information from the late Gladys Elphick (MBE), the late Tim Hughes (Military Medal/MBE), the late Doris Graham and the late Myrtle Kite among others.

In the 1970s, Heinrich (1976:210) collected knowledge of some aspects of traditional lifeways of the Narungga people as recalled by Narungga Elders at Point Pearce/Burgiyana (Krichauff 2008:116). From these sources, Heinrich (1976) described one clan group attempting to maintain their traditional lifeways near the Point Pearce/Burgiyana Mission in the 19th century.

Graham and Graham 1987; NAPA 2006 and Wanganeen 1987 are important recent Narungga sources who have worked to collate and preserve the history of Narungga people and their continuing connection to their country, land and waters. More recently, a number of collaborative research projects have also been undertaken with the Narungga and Point Pearce communities (e.g., Fowler et al. 2014, 2015, Mollenmans 2014; Roberts et al. 2013, 2016, 2019).

4.2 Narungga Nation

The Narungga Nation encompasses the whole of Yorke Peninsula/Guuranda northwards as far as the fringe of the South Hummocks Range/Nhandu-warra (Tindale 1936). Government records in the 19th century also described Narungga country as encompassing Yorke Peninsula/Guuranda extending north to Port Broughton and east to the Hummocks with main camps said to be located at Bute (north), Wallaroo (west), Ardrossan (east) and Cape Spencer (south) (Hill and Hill 1975).

Sutton (1888) stated that ‘being cut off from other tribes very little was known of war, consequently their weapons were few’. Fowler in Curr (1886) estimated that the Narungga population was originally about 600 but was reduced to less than 100 by the 1880’s, due to the impacts of European encroachment and the introduction of diseases. Such estimates are often flawed/understated. Fowler estimated the maximum lifespan was up to 80 years (Fowler in Curr 1886).

Kühn (in Fison and Howitt 1880) gave the tribal name as *Turra*. Sutton (1888) stated the name of the tribe was *Adjahdurah* meaning my people. *Adjah* means my or mine and one individual of the tribe would be called *Durah*. Subsequently, Francis J. Gillen learned that the tribal name was *Narrang-ga* (Howitt 1904). Similar in form, Tindale (1936) recorded the name as Narranga. Contemporary usage preferences Narungga (NAPA 2006).

4.3 Social Organisation

Most sources record that the Narungga Nation had four local clan divisions: the eastern Narungga region, Winderah (Windera); the northern region, Koornarrah (Gunara); southern region, Dilpah (Dilpa), and the western region, Warree (Wari) (Wanganeen 1987—see also Howitt 1904; NAPA 2006). Wanganeen (1987) records that each group had its own Dreaming:

- Winderah—*durantoo* (*waui*), red kangaroo;
- Koornarrah—*ghordi* (*gudi*), emu;
- Dilpah—*gooratoo*, shark; and
- Warree—*wiltee*, eaglehawk.

Howitt (1904) argued that the Narungga had an ‘anomalous class system’ where class organisation and the local organisation cover the same ground, meaning ‘totems’ were associated with discrete regions. Howitt (1904) thought that this class system type was also found amongst the Yerkla-mining, the Narrinyeri and the Yuin communities. With this class system, the class and totem names attach to the paternal locality meaning children adopted the totem of their father. Black (1920:85; NAPA 2006) documented the Narungga term *bangara* meaning country but which may also refer to land belonging to an individual that was inherited from their father. Black (1920) noted this term was similar to the Kaurna word: *pangkarra* ‘described as the district belonging to an individual, which he inherits from his father’. The late Tim Hughes as told to Betty Fisher (Hughes in Fisher n.d. [Part II]: 10) summarised:

> …See, we’re Narungga on the whole Peninsula, same as other people on their territory. This was our country, like, say England’s a country, Scotland’s a country, Wales, and all that, you know, but they’re all Great Britain, with the rest. So, the Peninsula was our country, see. But some groups lived, here, some lived there, some were – for instance, some may be wombat people, some might be seagull people, some might be other kind of people. Some might know more about what their people were – if you were seagull people, you would know more about seagulls than anyone else, see? That kind of thing. And some people could marry into other people in the groups, some couldn’t – it was very – well, you might call it very complicated – it was all about where you came from, who you were, and who they were, and all that. Mum knows, the women know about that. You have to ask her. But there’s more to know before you know anything about that – it goes on and on, it’s too much to know if you haven’t been brought up that way – you have your rules, like first cousins can’t marry, that sort of stuff? Well, ours were very strict, and went into a lot more than that – it was all about making sure that our blood relations didn’t get too close, you know – but it was more than that, because it was about our stuff all about what they call our culture, and that’s not what I’m talking about…

Gillen (ca 1894–1898) also provided a summary of his understandings of the rules governing class and relations including totem affiliations, marriage and food restrictions:

> A man inherited the totem and locality name of his father so that if my father were Kangaroo and Kurnara I would be Kangaroo and Kurnara too. Each man is associated with a totem which he calls “Paru” and in addition to this special totem he possesses certain

sub totem which he calls Kuyia and which with the special totem he inherited from his father. Here are some instances:

"Warria" who has a "butterfish" wife is a Kangaroo son of a Kangaroo man and Eaglehawk woman who has as Kuyia – Salmon (Kulalya) Mullet (Paltie) Bream (Bakalultha) Wombat (Wartu) Wallaby (Wadlhla) Seal (Multa).

"Charlie" is a seal his father was a Seal and his mother a butterfish he has the same Kuyia as Warria both men are of the Warra that is western direction and when they die their spirits will go away and rejoin the spirits of their fathers far away in the west where they will feed upon the Kuyia

"John" is an Emu his father was an Emu he has as Kuyia Truvalle (Minthaya) Schnapper (butturie) Tommy Rough (Kura) Silver Whiting (Witba) he is a Kurnara and when he dies his spirit will go away to the north where it will join his father's spirit and feed upon the Kuyia

"Jack" is a Mullet his father a Mullet Mother a butterfish he has as Kuyia jumping mullet (Warta) travelling mullet (Millharta) Silver Bream (Urdududna) he is a Windhara man when he dies his spirit will go east and feed upon the Kuyia

A man may and does eat his totem in which he has a special proprietorial interest. It is not wrong to eat the totem animal. The owner of the totem has a special right to eat it, a right denied to those who are not of the totem.

Men of other totems are not supposed to eat of the flesh of kangaroo and mullet for instance, unless by permission of Kangaroo and mullet men. A man also possesses a proprietorial interest in his Kuyia but in a lesser degree. It is a serious crime to eat another man's totem without permission it is wrong to eat his Kuyia and a good blackfellow wouldn't eat it without permission.

Louisa Eggington in Tindale (1936) stated that Narungga only married within their own people and would not marry people from other Aboriginal communities. According to Sutton (1888), men and women of the same totems were allowed to marry. A woman would take her husband's totem at marriage. They were not allowed to marry blood relations under pain of death. First cousins are considered equal to brothers and sisters; foster children were treated as their own (Sutton 1888).[6]

Social and ceremonial gatherings took place between the clan groups (Johnson c.1898–1900). Ceremonies feature prominently in the accounts of early European settlers and others on the peninsula. Carmichael (1988), for instance, described a possible stone arrangement south of Brentwood that comprises a collection of calcrete rubble having the appearance of a 'garden path'. The location is close to Yonglacowie (Roger's Comer), is reported to have been a meeting place for northern and southern groups of Narungga (Carmichael 1988). Port Wakefield was also an important area where the Narungga held ceremonies with the Kaurna and other mid-north groups, as well as meeting for trade and fishing excursions at certain seasons (Berndt 1940).

Heinrich (1976:10) recorded Wauraltee as one important meeting place where: 'central tribes congregated periodically to hold corroborees and initiation ceremonies'. Phillips (1934) recalled another meeting place at Minlaton/Minlacowie where people from the north and south would gather for corroborees that used to last for nearly a week. Phillips (1934) also described the corroborees he witnessed at Moorowie where up to 100 Narungga congregated for the performance of traditional ceremonies:

> …corroborees were usually held at night. The male blacks would dance round a fire, and imitate kangaroo hunts, fishing exploits, fights with other tribes, etc They used to daub themselves with pipe clay and red ochre. The men would chant a kind of song and the women would sit around in a circle with an opossum rug in their laps, rolled up to make a drum, which they used to beat with their hands, and keep excellent time, too. Each song would represent some event, such as the "hunt corroboree." I remember one vividly, the "rain corroboree," or, in native lingo, "the Munga corroboree."

Sutton (1888) recorded: 'In seasons of drought they had rain corrobborees, so likewise when kangaroos and emus were scarce they had kangaroo and emu corrobborees'. Sutton (1888) noted the Ghureldrie had an important role at corroborees who 'made and sang their songs' and was 'a very important personage on these occasions'. The position of Ghureldries was also said to be hereditary, passing from father to son.

---

[6] Kühn in Fison and Howitt (1880), in contrast, stated: '…the classes are exogamous, but any totem of one class, may intermarry with any totem of the other class…'.

4.4 Language

Narungga wordlists were compiled by Kühn and Fowler in Curr (1886), Sutton (1888), Gillen (c. 1894–1898), Johnson (ca 1898–1900), Black (1920) and Tindale (1936). Wordlists include important placenames, species names and counting words. Narungga woman, Louisa Eggington was the source for 410 words and placenames collated by Johnson (ca 1898–1900) and Tindale (1936) for the southern Yorke Peninsula/Guuranda region. The Narungga community undertook a project to preserve their language heritage bringing together these various sources and incorporating their knowledge to produce the Nharangga Whara Narungga Dictionary (NAPA 2006).

Narungga language forms part of the Thura-Yura language sub-group (Hercus and Potezny 1991). This sub-group covers much of South Australia from Adelaide north to the Flinders Ranges and west to Eyre Peninsula and the west coast. Within this sub-group, Narungga language is most closely linked to the neighbouring Aboriginal groups in the east: the Kaurna, Ngadjuri and Nukunu peoples (Hercus and Potezny 1991; Tindale 1936). Tindale (1936) observed similarities between the Narungga and Kaurna languages, noting the variations between the two languages were largely in pronunciation.

Narungga toponyms also shared word forms in common with the Barngarla people to the west on adjacent Eyre Peninsula from whom they have been separated since Spencer Gulf formed following post-glacial marine transgression. For example, the *abi* placename suffix designating water was used by both the Barngalla and Narungga people in addition to the more commonly used *awi* placename suffix.[7] The *abi* placename suffix, however, is not known to have been in use with Narungga's eastern neighbours the Kaurna, Ngadjuri and Nukunu people (Hercus and Potezny 1991). In addition, some toponyms associated with water, the a of -awi/abi was elided, rather than the final vowel of the preceding word (Table 5). In this feature, Narungga is similar to the Wirangu of the west coast of South Australia (Hercus and Potezny 1991).

Table 5: Narungga compound word formation examples with elided suffix (Hercus and Potezny 1991).

Location	Narungga word form and meaning
Calloway	'Kali'wi', 'Dog Water'; near Daly Head.
Carriebie	'Kari'bi', 'Emu Water', near Black Hill Conservation Park.

[7] In Barngarla language Hercus and Potenzy (1991) stated: '…there are a few of the typical -owie names in Parnkalla country…'. 'Some -abi names too can be found on upper Eyre Peninsula, such as Currabie near Mt Wedge and Carappee south-west of Kimba both of which probably represent 'Kar'abi' 'Grassy plain Water', and Moonabie (possibly 'Munna-abi', 'Chest Water'), south-west of Whyalla. These -abi names are based on 'kapi' which is quoted by Schurmann as an alternative word· for 'water' in Parnkalla'.

Sutton (1888) stated the term for water was *cabbie* in the south of Yorke Peninsula/Guuranda and *cowie* in the north. Simpson and Hercus (2004:181, see also NAPA 2006) also observed that Narungga language possibly comprised two dialects, in the south and the north.

Thom (1953) stated: 'the area of one particular tribe can still be defined by the place names in the area, by the terminal syllable of *owie* (meaning watering place)'. According to Thom (1953), toponyms ending in *owie* also allowed for the tracing of many Narungga watering places, such as Minlacowie, Bublacowie, Tukokowie, Pondolowie and Orriecowie; as well as Mutborowie, Bubladowie and Hilterowie, the latter all near Marion Bay. Johnson (1930) also provided examples:

> Orrie Cowie should be More-a-cowie, because of the small needled wattle (Morea) which was formerly common there. Curramulka is derived from two words, Gorry an emu, moolka a stone waterhole (a stone waterhole where emus come to drink).[8]

According to Tindale (1936), in addition to waterholes and soaks discussed above, names were also given to good hunting and camping places. Narungga places were connected by trackways. Parsons (1987) recorded the road running off in a south westerly direction at Roger's Corner and a road running east from the Minlaton known as Bob's Road were originally two Narungga trackways.

Focusing on the coastal economy, many words and toponyms in the Narungga language have associations with the coast. As Louisa Eggington in Tindale (1936) explained, 'my people never named the inland places, only those near the coast':

- At Daly Head, for example, the water was called ['Waluri], it ran into the sea from under a big rock, at tide mark. There was a big rock there from which they fished for Snapper (*Pagrosomus auratus*).
- At Marion Bay, Kokudawi ['Kokudawi], was the principal place for fishing. Most of the spearing was done at night; fish spears with a double head were used; torches were burned to attract the fish, these were made of bark.

[8] Snell in Griffiths (1988) records the Narungga name for Curramulka was more completely Curry Murka Cowey inclusive of the *awi* suffix designating a location where water can be found.

- The best place to spear Butterfish (*Sciaena antarctica*) was at Penguin Point ['Kanarap: a].
- In December many Yellow-tail (*Seriola grandis*) were caught at Kokudawi.

Many words and toponyms in the Narungga language also have associations with the sea and marine flora and fauna (see table 3/table 4 for examples). Black (1920:89) records: *tadni* (sea); *tadni waldu 'nindjana* (the rushing through of the sea) which is the Narungga name of the tip of Point Pearce. Black (1920:89–90) also records *waralti* as the name for Wardang Island/Waraldi: 'the name was given by Mrs Newchurch as meaning "Rat Island," but if [wara] is synonymous with [binku] it probably means "Bandicoot Island"'. Recognising that Narungga placenames may be descriptive of the localities to which they refer means that greater insights into the Narungga coastal and broader economy may be achieved.

4.5 Narratives

Natural features in the seascape are also associated with Narungga Dreaming narratives (Gillen c.1894–1898; Johnson 1922; Mountford 1936; NAPA 2006; Roberts et al. 2019; Smith/Unaipon 1930; Sutton 1888; Tindale 1936). Gillen in Mulvaney et al. (1997:436) summarised: 'the Narung-ga have traditions about every natural feature and they have preserved the Native names which they evidently use amongst themselves'. Mountford (1936:50) also recorded:

> …many parts of the coastline figured in the legendary stories of these people, for they believed that their half-human, half animal ancestors created all the natural features of the country. Other legends were told, stories of how the seabirds came into being, and why the crayfish is so ugly, stories which revealed the close intimate knowledge of the Aborigines concerning nature and the life around them.

Table 7 lists some of the Narungga narratives that have been documented in ethnohistorical sources (Gillen c.1894–1898; Johnson 1922; Mountford 1936; NAPA 2006; Roberts et al. 2019; Smith/Unaipon 1930; Sutton 1888; Tindale 1936. Variations in spelling of Narungga words adopted by different sources are summarised in table 6.

Table 6: Narungga naming variations for ancestral beings in ethnohistorical sources.

NAPA (2006)	Sutton (1888)	Gillen (1894–1898)	Johnson (1922)	Smith/Unaipon (1930)	Tindale (1936)	Mountford (1936)
Badhara	-	Buddhra	Budderer	Buthera	Badara	Buddru

Madjidju	Majaja	Mudatja	Mudjetchoo	Mudichera	Madjitju	-
Ngarna	-	Nanu	Arnner	Larna	Ngarna	Nana
Bunaurli	-	Bunaurli	-	-	-	-
Alauari	-	Alauari	-	-	-	-

Table 7: Narungga Dreaming narratives and sources.

Reference	Source	Locality
Creation of People and Animals		
Madjidju	Johnson	
Madjidju and the creation of Men and Women	Gillen	A certain lagoon
Madjidju and the creation of animals, fish and the shark	Gillen	
Madjidju takes the form of a Bat	Gillen	Corny Point/Murparlie
Madjidju and the creation of people and the shark. Madjidju takes the form of a bat	Tindale	Marion Bay
Madjidju makes the rain	Gillen	
Creation of Spencer Gulf		
How Spencer's Gulf came into existence	Smith/Unaipon	Spencer Gulf, Cape Spencer, Port Lincoln
Creation of Spencer Gulf	Mountford and Roberts	Spencer Gulf, Southern Isthmus
A time when the seawater was fresh	Sutton	Adjacent waters
The Creation of Islands		
The creation of islands	Sutton	Islands
Ngarna and the creation of Wardang and nearby islands	Edwardes	Wardang Island/Waraldi and Nearby Islands
Badhara and the creation of Wardang and nearby Islands	Graham and Graham	Wardang Island/Waraldi and Nearby Islands
The creation of Wardang and nearby islands	Max Fatchen cited in Heinrich	Wardang Island/Waraldi and Nearby Islands
The Father of the Tribe		
Wardang Island—The home and burial site of the father of the tribe	Sutton	Wardang Island/Waraldi
The brother of the father of the tribe	Sutton	
The brother of the father of the tribe and Madjidju	Sutton	

The brother of the father of the tribe fights with Madjidju's tribe	Sutton	
Madjidju's tribe are turned into seabirds	Sutton	
Previous to this the sea water was fresh	Sutton	
The mark of the cut in the bat they say can be seen now	Sutton	
The natives will on no consideration kill them	Sutton	
Badhara and his Family		
Badhara and his son Bunaurli	Gillen	Wardang Island/Waraldi
The death of Bunaurli	Gillen	Anippia near Corny Point
Badhara's younger son Alauari	Gillen	
Alauari avenges bunaurli's death	Gillen	
The burnt appearance of markings on some birds and animals	Gillen	
Ngarna and the death of Alauari	Gillen	Yarirun now known as Lake Gibson, Murdabalpina now known as Cape Spencer
The death of Ngarna	Gillen	
The death of Badhara	Gillen	Goose Island/Murnarla
Ngarna and the death of Badhara	Johnson	Royston Head/Arnner, near Cape Spencer, Point Turton/Boonpoo, Minlaton
Badhara and the Bat		
Badhara	Smith/Unaipon	The southern part of Yorke Peninsula/Guuranda, Corny Point
Badhara fights with Madjidju	Smith/Unaipon	
Madjidju is the chief of the bat tribe	Smith/Unaipon	
Why to this day Madjidju has his present form	Smith/Unaipon	
Madjidju is the bearer of evil tidings	Smith/Unaipon	
Badhara fights with a tribe	Smith/Unaipon	Curremulka
The Willy-Wagtail	Smith/Unaipon	
The tribe are turned into shags	Smith/Unaipon	
Ngarna and the death of Badhara	Smith/Unaipon	Marion Bay

Madjidju and the death of Ngarna	Smith/Unaipon	Rhino Head
The Story of Ngarna and Badhara		
Ngarna	Tindale	Yorke Peninsula/Guuranda
Ngarna kills a woman at Pt Turton	Tindale	Wardang Island/Waraldi, Point Turton/Punpu
The woman is turned into a large stone	Tindale	Point Turton/Punpu
Rock with a pattern on it like the rectangular pattern to be seen on wallaby skin cloaks	Tindale	Point Turton/Punpu
Ngarna fights with Madjidju	Tindale	
Madjitju is one of the ['ilara] People	Tindale	
Ngarna fights with Madjidju	Tindale	Section 20, Warrenben
Ngarna is turned into a sleepy lizard	Tindale	
Ngarna and Madjidju		
Ngarna kills a woman at Pt Turton	Tom Egginton	Wardang Island/Waraldi, Point Turton/Punpu
Ngarna fights with Madjidju	Tom Egginton	
Ngarna is turned into a sleepy lizard	Tom Egginton	
Ngarna meets Badhara	Tindale	Emu Bay (between Rhino Head and Penguin Point)
Badhara is a Little Man	Tindale	Ilarawi (Hillderowie Well, Section 2, Warrenben)
Ngarna and the death of Badhara	Tindale	Salt Lagoon (Section 10, Hundred of Warrenben)
Ngarna’s burial site	Johnson	Royston Head, near Cape Spencer
Ngarna and the death of Badhara	Johnson	Point Turton, Minlaton
The death of Ngarna	Tindale	
Rock with a pattern on it like the rectangular pattern to be seen on wallaby skin cloaks	Tindale	Nildidjari near Cape Spencer
Ngarna’s burial site	Tindale	Rhino Head
‘Evil Spirits’		
Noogunner	Johnson	
Berryger-noo-gunner/bald-headed ghost	Johnson	
Coop-a	Johnson	
Wun-yerra	Johnson	
Wainjira (evil spirit)	Tindale	Point Yorke, called Kadjarawi

Bulgawan/wicked old woman	Tindale	Pandalawi/north-west corner of Section 26A, Hundred of Warrenben
Little People		
Little people	Tindale	Ilarawi
Little people	Johnson	Emu Waterhole/Yillowrowie

As can be seen in table 7 many of the Narungga narratives are linked to the coast, the sea and islands. These narratives describe arid times, catastrophic floods, marine transgression, the formation of islands and other features in the intertidal zone. It has been argued by some researchers that these narratives may reflect the preserved knowledge of real events in the past (Nunn and Reid 2016).

Roberts et al. (2019) highlighted these narratives form a highly significant system of knowledge and were considered together by the Narungga and non-Narungga authors in their paper to generate a new dialogue about Aboriginal traditions and scientific data. Narratives that describe the creation of Spencer Gulf, for example, recall a time when the gulf was once a valley filled with a line of freshwater lagoons (Mountford and Roberts 1965—see also summary in Roberts et al. 2019). Smith/Unaipon (1930) in a separate account also record a time when there was no Spencer's Gulf, but only marshy country reaching into the interior of Australia (Roberts et al. 2019):

> The people of reaching into the interior of Australia. It was a bone of this being the Narrangga tribe … had a story that has been handed down through the ages … . It is a tale of a strange and wonderful being who lived when there was no Spencer's Gulf, but only marshy country that was the means of bringing the Gulf into existence. At the lagoons and marshes there lived various families [of animals] … . One day the kangaroo, the emu, and the willy-wagtail were sitting on the seashore between Cape Spencer and Port Lincoln. The emu wandered away from his companions, and found a leg-bone of a huge kangaroo … . He carried it back to where they had slept the night before … . In the morning they discussed matters. The willy wagtail spoke first. "Oh!" he said "I had such a bad dream! I dreamed I stood upon an island that was round in shape, and without a mountain or hill upon it. The sea was all round me. Suddenly a great wave rose up, and came rolling and tumbling toward the island. I was scared. I ran this way and that way, but the waves were now all tumbling over the island. I threw up my arms in despair. I do not know what kept the sea from passing over and flooding the island and drowning me … ". "Oh!" said the emu, "I dreamed that where the lagoons are now was a dry, dusty, and parched country. Desolation was everywhere. Animals, birds, and reptiles

> were lying dead all round … ”. The emu led the kangaroo and the willy-wagtail to the spot, and they dug and dug until they found the other bones. The bones were lying pointing in a straight line toward Port Augusta. The kangaroo took up the bone that the emu had discovered and probed the ground with it. He did not know that the bone was a magic one. But as soon as he used it the earth opened itself. The kangaroo started to walk toward Port Augusta, and as he advanced he probed the ground with his magic bone. The sea broke through, and came tumbling and rolling along in the track cut by the kangaroo bone. It flowed into the lagoons and marshes, which completely disappeared … . (Smith 1930:168–172)

Similarly, Mountford and Roberts (1969:18) recorded:

> In those days, the kangaroo was a man who grieved over the unnecessary fighting. Thinking over the situation he finally decided that if an opening could be made in the southern isthmus, which in those days blocked the sea from entering the valley, the conflict [between birds and other animals] would be ended by the flooding of the lagoons. Now the kangaroo-man possessed the thigh bone of a mythical ancestor…. So he pointed the bone at the isthmus, which slowly split open. The sea poured through the opening, flooding the entire valley, so that the birds and animals were forced to live together in peace.

The identities of the Aboriginal sources for the above narratives are unknown (Roberts et al. 2019). However, Luise Hercus recorded a version of this story (centered at Port Germein) from Gilbert Bramfield (a Nukunu man from the neighbouring Aboriginal group to the north), about how “one old man made this kangaroo bone” and how he carved out Spencer Gulf: “The bloke went this way with his kangaroo bone he broke it at Port Augusta there, and then he was digging with a really short stumpy one and made all these lakes all the way through (the salty lakes up from Yorkey’s Crossing)” (see Hercus 1992:16).

There are also Narungga traditions about the creation of islands, such as Wardang Island/Waraldi and other islands near the Point Pearce/Burgiyana community (Roberts et al. 2019). In one Narungga tradition it was the creation ancestor Badhara who threw a rock from Middle Fence to Boy’s Point/Gunganya warda. When the rock landed, it split the land and lots of bits flew and made Wardang

Island/Waraldi Island, Green Island, Goose Island/Murnarla, and Dead Man's Island/Mungari (Graham and Graham 1987:53). A similar tradition was recorded by Edwardes (1934:51):

> The early Aborigines had an interesting legend explaining the genesis of Wardang and the Wauraltee group of islands. They told of a mighty tribal god named Nugna [Ngarna]. This god was in the form of a man of gigantic stature and prodigious strength. On one occasion when his people had invoked his wrath Nugna took up his huge club and dealt the earth a terrific blow. The force of the blow caused several fragments of land to fly into the gulf, to form the Wauraltee [Waraldi] Islands; while the great depression caused by it was invaded by the sea to form Port Victoria Bay and Point Pearce.[9]

In the above quote the ancestral being's name is changed in comparison to the Graham and Graham (1987) account, but the manner in which the islands were created remains similar—in fact it must be noted that there are numerous other versions of this creation narrative (e.g., Aboriginal Studies Curriculum Committee n.d.; Gillen c.1894–1898; Heinrich 1972:47; Ostapchuk 1969:74; Smith 1930:341–342; Sutton 1888:18; Tauondi College n.d.; Tindale 1936:58–59). However, of interest in the Edwardes (1934) recording is the reference to an invasion of the sea. In comparison to these accounts Sutton (1888:18), who was a superintendent of the Point Pearce Aboriginal Mission Station, separately recorded that a spider was said to have made the islands (Roberts et al. 2019).

Narratives also describe the creation of specific rocks and other features in the intertidal zone, such as Badhara's Rock—with the latter falling within the Badhara/ Ngarna narrative, and in at least one version (Tauondi College n.d.) the rock is the embodiment of Badhara's club head (or waddy) which he threw at Ngarna (Roberts et al. 2019). The waddy misses Ngarna and hits the ground with a tremendous crash, breaking in two. Today the club head is the large rock known as Budderer's [Badhara's] Rock, lying at Moongurie [Mungari] on the western side of Bookooyana [Burgiyana]..., …we see blood from the wounds in the sand nearby (Roberts et al. 2019). Badhara was said to be buried on Goose Island/Murnarla after he drowned while diving for his spear and the site of his grave is said to be marked with a great heap of rocks (Gillen c.1894–1898:843).

Added to these narratives the late and knowledgeable Narungga man Tim Hughes more recently told Elphick (1966–1968) that the area around Point Pearce/Burgiyana was:

[9] The Narungga toponym Dhadni warldu nhindjana meaning "where the sea rushes in"—"apparently an old name" for the tip of Point Pearce Peninsula/Burgiyana (NAPA 2006:28), may also relate to sea-level narratives, but could also of course reference tidal movements.

> a most sacred part of our land, that part is the most important … the biggest part, and most special. That's what makes us grow up, got everything special about all that stuff … that's older than everything, all the lands and islands.

The narratives discussed in this section reflect Narungga knowledge about how the world they lived/live in came to be and reflect the spiritual links Narungga have with their lands and waters (see Roberts et al. 2019 for additional discussion).

4.6 Material Culture

This section summarises Narungga material culture recorded in ethnohistorical sources. These records provide early insights into the range of material culture used on Yorke Peninsula/Guuranda (e.g., Carmichael 1988; Hill and Hill 1975; Parsons 1986) prior to the arrival of Europeans. They also provide insights into the range and distribution of Narungga heritage and material culture within the region prior to many of the sites being disturbed through the impacts of European settlement and farming activities. It is noted, many of the ethnohistorical references were recorded by amateur observers. Artefacts were often stolen/collected from sites without formal survey to record the archaeological context in which they were found. As a consequence, the present-day assemblages of many sites on Yorke Peninsula/Guuranda have been disturbed as a result of these practices. Objects made from organic materials may also be lost as a consequence of natural processes of decay and the passage of time. Wood, shell, plant fibre and animal by-products (bone, skins, sinews), for example, were all important natural resources (see below).

Wooden implements included spears, waddies, boomerangs and yam sticks which were shaped with sharp stone tools (Taplin 1879). Kühn and Fowler (in Curr 1886) stated that weapons included spears and wooden swords five feet long which were slightly curved but claimed boomerangs and woomeras were not in use.[10] Plant fibre processed in earth ovens was used to make string used for the manufacture of nets used for fishing (Figure 4.1).

[10] Contrary to Sutton (1888) noted in previous section who stated, 'being cut off from other tribes very little was known of war, consequently their weapons were few'.

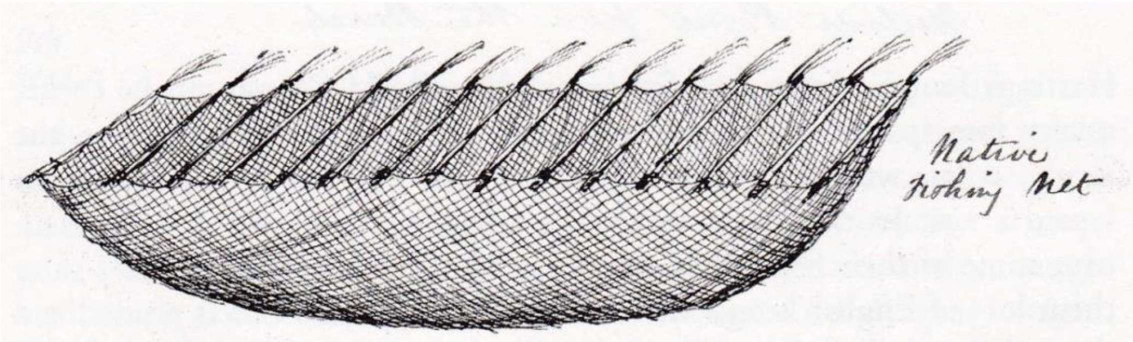


Figure 9: Sketch of Narungga fishing net recorded by Snell in use on the east coast of Yorke Peninsula/Guuranda Edward Snell in (Griffiths 1988:128).

Tindale (1936—see also Davies 1952; Snell in Griffiths 1988) recorded the process for manufacturing fish nets as described by Narungga woman Louisa Eggington:

> …fish nets were made from the fibre obtained from broad flags ['buntu, 'buntu]. These were placed in a long hole or oven and covered with hot ashes for about a day. After this preliminary wilting the stems were chewed and the fibre made into string by working and rolling on the thighs. Women chewed the fibre; it made their teeth smooth, and sometimes caused them to be sore.[11,12]

Narungga also used this method to make net bags which were carried over the shoulder supported by a string.

Nets for snaring wallabies were made from kangaroo and wallaby sinews. Brushwood fences were erected to herd the animals into these nets (Tindale 1936). Other animal by-products were also an important natural resource. Kangaroo, wallaby and possum skins were used to make cloaks and rugs.

---

[11] Tindale (1936:66) records *buntu* as a "broad-leafed flag or reed." NAPA (2006: 25) records *bundu* as: 1) A broad-leafed reed used to make fibre for fishing nets (*Phragmites communis* or *Phragmites australis*); 2) Any grass or rush growing in swamps or in coastal areas; and 3) The fibre made from *bundu*.

[12] Davies (1952) also recorded this method of net manufacture at Marion Bay:

> Each year fresh nets had to be made. Large bundles of flat leaf rushes were collected. Then a trench was dug in the sand, and a big fire lit beside it. When the fire burnt down the embers were raked into the trench and covered with sand. The rushes were placed on the sand, covered with leaves, and another sprinkling of sand put on top.
>
> An old man of the tribe gave the signal when he thought the rushes had been sufficiently cooked to make them pliable. After removal from the pit they had to be chewed to reduce the fibre to a proper state for working. Men and women took part in this operation. The chewed fibre was then spun into lengths and wound on sticks ready for the netmaking. The nets were not large, about 5 ft. long and 3 ft. wide.

(Kühn and Fowler in Curr 1886). The following extract from Tindale (1936—see also Johnson [1922]) described how they were made:

> …the use of kangaroo and wallaby skin rugs were made from the pelts of these animals and worn as cloaks (for example see South Australian Museum [A. 6409]). It bears on its inner surface a regular pattern of crossed lines formed by rubbing the folded skin with a broken piece of quartzite hammerstone. Though of comparatively recent manufacture, this rug was made by an aborigine in the native way. The skins were simply pegged out and dried in the sun, and, after trimming to a regular shape, they were stitched together with kangaroo or wallaby tail tendons. The cross markings were made by folding and firmly pressing the skins, fur side inwards, and then by scoring the prominent edges of the folds thus formed with the sharp edge of a stone implement or shell. In this case the markings were simply to make the skins more flexible, but besides such geometrical patterns it was the custom to mark the skins used for rug making with various other, and more irregular, designs, which may have been signs of proprietorship. Such figures were often made more conspicuous by colouring them with red ochre or other native pigments. When worn as a cloak the rug was passed under the right arm and fastened over the left shoulder with a wooden or bone pin. Both arms were thus left free.

Animal bone was used to make pins, as noted in the extract above, as well as well as other implements such as points. Hill and Hill (1975) also recorded the presence of 'wallaby jaw tools' and noted the presence of wallaby jaws at many of the sites they recorded.

Collectively, the various ethnohistorical sources document the range of lithic tools that were found at sites across Yorke Peninsula/Guuranda (e.g., Campbell and Walsh 1947; Carmichael 1988; Hill and Hill 1975; Parsons 1964, 1979, 1986). As noted previously, lithic tools were often collected without adequately documenting their archaeological context. As such, while we can describe the range of tool types used by Narungga from the artefacts that were collected, we are only able to make broad generalisations about how they fit into the archaeological record.

Hill and Hill (1975) argued, in general, that quartz and chert were the main materials used for the smaller tools. They noted, quartz is found readily over most of the peninsula and its occurrence is widespread in all campsites especially in the southern portion where it makes up the bulk of the material used (Hill and Hill 1975). Pine Point on the east coast of Yorke Peninsula/Guuranda was the location of a stone quarry where chert as well as ochre was obtained (Hill and Hill 1975). A source of chert and jasper was also located on the west coast between Point Riley and Wallaroo/Wadla waru in a reef only accessible at low tide (Hill and Hill 1975).

Carmichael (1988), based on his analysis, made observations about possible internal trade routes for the distribution/exchange of lithic raw material across the peninsula. While quartz is readily available throughout the peninsula, known locations where chert is found are only in the north at Pine Point on the east coast and at Moonta/Munda, Port Hughes and near Wallaroo/Wadla waru (noted above) on the west coast of the peninsula:

> A study of the artefacts and chips suggests that some of their-trading routes, as the area is almost barren of anything but the ubiquitous kunkar. At Onegowie, in the sandhills, are numerous cores of about 1½ inch mesh, larger when the material is quartz. While at Cudoorowie it is unusual to see any cores as large as 1 inch mesh. This suggests that Onegowie rather than Cudoorowie was the general trading place. Among the material found are banded agates, cherts and variegated jaspers, similar to those found at Moonta Bay/Munda and Port Hughes, while other jaspers, red and yellow, are similar to those found at Pine Point. This applies to both sites. The lesser number of quartz cores, though larger in size at Onegowie suggests that they were not so highly regarded as trading items. Quartz was available both from the north and south.

In addition to stone, other materials were used for tool manufacture including shell, bone (discussed above), Australites and in recent times, European glass (Figure 4.4). Kühn and Fowler (in Curr 1886) recorded the sharp edge of shell such as the abalone were used as knives. Subsequently glass was used with shaped glass implements with finely serrated edges found at many campsites (Hill and Hill 1975). Australites were believed to have possessed magical properties as well as being highly prized for use as implements because of the glass-like nature (Hill and Hill 1975—see Roberts et. al 2020).

Drawing on wider archaeological debates of their time, Hill and Hill (1975) and Parsons (1986) made observations about possible cultural sequences inferred from the archaeological evidence they observed in their surveys. Parsons (1986), for example observed:

> As much of the Peninsula is under cultivation, the coastal sand-dunes are almost all that is left to show any evidence of Aboriginal occupation. Where the dunes have moved

> inland and exposed a brown earth floor, occasionally these Kartan tools can be seen firmly embedded in this floor. This is surely evidence of the great age of these: artifacts, 14,000 to 40,000 years being the estimate.
>
> The ‘Pirrian' culture, which does not seem to have been in existence south of Central Yorke Peninsula, shows examples of finely worked microlith tools. These artifacts are of jasper, chert and chalcedony. They are quite modern compared with the Kartan tools and their age is put at from 3,000 to 4,000 years.

Hill and Hill (1975) also stated the uniface trimmed pirri type found at Moonta and Black Point have been found over most of Australia but were no longer use in South Australia by time the European invasion. Hill and Hill (1975) also made observations about ‘Kartan culture’ tool types noting the presence of implements representative of this culture had been observed at many locations on Yorke Peninsula/Guuranda. Fifty were recorded in an area centred around Section 220, Hundred of Maitland and were made from the red granite which is available at the location.

Both Parsons (1986) and Hill and Hill (1975) reference the work of Norman Tindale. Their observations linked the archaeology of the Yorke Peninsula/Guuranda region with the broader debates regarding cultural sequences that have taken place in wider Australia in the past (see chapter 2.5). Given the era of these reference it is also acknowledged that revision is required (see for example Holdaway and Stern 2004:314–315).

4.7 Economy

This section outlines the range of resources that contributed to the Narungga economy. Economically, Yorke Peninsula/Guuranda contains a range of distinctive bio-geographical regions providing access to seasonal food and freshwater resources.

Water is a key resource. While Yorke Peninsula/Guuranda does not currently have permanent creeks or rivers, for the Narungga people, water (at least in recent periods) was available from shallow wells in dunes near the coast, rock holes in limestone, water bearing mallee roots and ephemeral creeks (Kenny 1973, Mountford 1936) (Figure 10).

Figure 10: Freshwater sources on Yorke Peninsula/Guuranda (not exhaustive) recorded in ethnohistorical sources (NAPA 2006, SA Gazetteer 2020).

Hill and Hill (1975) discussed their observations of campsite locations being found near water resources in coastal settings (elevation and the availability of game were also important factors in campsite location):

> …several native wells occur as blowholes in the limestone areas around Marion Bay. Old residents spoke of the Aborigines using a spring trickling from the base of a cliff near Rogues Point. Most water was semi-permanent and would not support a large group of

> Aborigines for long. They were forced to wander in small family groups from site to site, leaving some of their stone implements at each camping area. This nomadic movement also gave the animals and birds they hunted a chance to breed up again.

Ethnohistorical sources recognised these localities would have been attractive locations to establish campsites (Carmichael 1988; Parsons 1979, 1987). Carmichael (1988:3–6), for example, recorded one such campsite at Coobowie. The location was a sheltered site near to two wells. There were also rushes nearby which were used to make fish nets, in turn, noting Narungga knowledge recognised that the presence of plant species such as rushes could indicate the availability of a freshwater source.

Smaller natural rock holes and crab holes were also features where freshwater would have been available for a time following periods of rain (e.g., Hill and Hill 1975; Snell in Griffiths 1988). Snell (in Griffiths 1988) described the ephemeral nature of freshwater and in some regions of the peninsula. Near Stansbury freshwater was only available in rock holes which were covered to prevent access by animals and likely dried up in the summer months (Snell in Griffiths 1988:129).

At some locations freshwater on the peninsula is available throughout the year. For example, Hill and Hill's (1975) research focussed on Tiparra Springs as an important coastal campsite with one of the best supplies of permanent water, the springs:

> …lay in a group of sandhills, not high but covering a considerable area, in the centre of which was a hollow, like a crater of a volcano, in which were a number of remarkable springs of fresh water.

Anon. (1879) recorded 15,000 gallons of freshwater per day were drawn from wells at Point Pearce Peninsula/Burgiyana for stock and household use illustrating the abundance of water from ground water sources at this location.

Following European invasion many Narungga wells were taken over by the European invaders. Carmichael (1988) records the following extract from accounts collected by Mr and Mrs Visciglio from their conversations with John and Betsey Edwards of Coobowie/Gubawi:

> When the whites came in 1868, settlement was started then - the shepherds fenced the waterholes and chased the Aborigines away and wouldn't let them have any water.

Narungga placenames linked to locations where water is found are thus important as they provide insights into the location and distribution of Narungga freshwater sources on Yorke Peninsula/Guuranda before the impacts of European invasion and colonisation of Narungga lands.

The Narungga people are skilled at fishing and expert swimmers and would/do dive to collect shellfish (Griffiths 1988; Roberts et al. in prep). They are/were also knowledgeable of marine species, tides and associated lunar/astronomical phases linked to seasonal resource availability (Mollenmans 2014; Mountford 1936; Tindale 1936; Roberts et al. 2016b). They used (and continue to use) a range of collection and capture methods to harvest coastal and marine resources from the range of distinctive coastal environments that exist on Yorke Peninsula/Guuranda (Mollenmans 2014; Roberts et al. 2019). Betty Fisher (2006:2), for example, wrote the following (with reference to the head of St Vincents Gulf):

> What was undertaken at the head of the Gulf? Tim [Hughes] told me that the men knew the fish would be there in numbers. He could remember walking up the coast of the Peninsula and watching the shoals of fish being herded along by the sharks, "just like a sheepdog herds sheep" he said. They were heading them for the areas at the head of the gulf. "Our old people knew all those things. Our old people didn't need a University. We had all the sciences – the geology – we knew the land; biology – we knew our Law and we knew every plant and bush and tree, every bird and animal and fish…"

Betty Fisher also recorded a 'Dreaming' story relating to dolphins from Tim Hughes which is reproduced below:

> There were two brothers, young. They went out. One hunted wallaby. One wanted to find dolphins. They went out from that place to somewhere near Edithburgh. The brother who wanted to hunt wallaby came to a place where there was water. He lay down there. When he woke up, there were big tracks, which he followed. Pretty soon these tracks were crossed by other tracks but he kept on. The big tracks, like Wallaby but bigger, led him round Rhino Heads. He still followed. The tracks led him right round by Pondalowie and all the other bays, but he still followed. He lay down where he found water. It was very filled-in country – lots of bushes, low down. Each time he stood up to seek the animal, it ducked down low. He still followed. Pretty soon, at around Corny Point, he could see the

> animal, but his spear missed. Each time, he had to get other food. He still followed. That wallaby took him right up around past Pt Turton and the Yellow Ochre place, up to near Port Victoria. To this day, that man never eats Wallaby. The brother who wanted to find dolphin went out from somewhere near Edithburgh. He swam out to where dolphins were swimming. Each time, the waves sent him back to the beach. He heard the Old Man dolphin say "that is not for you." The boy still swam out. The waves sent him back, each time. He then went to other beaches and bays, the next beach. Same thing happened. Each place was too hard. He still swam out. By then he was a bit older. He walked across the Peninsula and sat down. Then he went on a high place, a cliff. He called the Old Man dolphin. They talked together. By then he was a man. He called the Old Man dolphin again. This time the dolphins sent in lots of fish. The man caught the fish and took them back for eating. That man still talks to dolphins.

Thom (1953) provided an overview of the range of technologies used in hunting and fishing and tool manufacture as well as the location and availability of the raw materials used to produce them:

> The fishing nets of the natives of lower Yorke Peninsula were cleverly woven from fibres stripped from sword grass that grows there, and fibre from the bullrushes which abound in the coastal sandhills. Their spears were made from those hard and very tough black mallee shoots, the points being hardened by fire in the customary aboriginal fashion. From suitable water-worn granite pebbles and gibbers which may be found freely along parts of the coastline, they shaped their stone hammer and axes.

Table 3 and 4 in chapter 3 record Narungga names for a sample of fish, shell and other marine species important to Narungga people both economically and culturally. The importance of shellfish is attested to by the archaeological survey of Yorke Peninsula/Guuranda by Wood and Westell (1998:28), nearly 65% of the sites surveyed for this report included shell middens or middens in association with stone artefact scatters. R.G. Jameson (*South Australian Gazette and Colonial Register*, 8 December 1838) observed in the area of Troubridge Shoal 'a party of eight or ten natives gathering the shellfish' also noting the abundance of shellfish that can be found along the coast in this area. Snell in Griffiths (1988), in general, noted the abundance of shellfish at Milner Point: '…we found great numbers of perriwinkles, mutton fish, Chiton, Wilks, etc on the rocks…'. As noted in previous sections, seashell was also used as ornamentation in necklaces worn by women and used to make knives (Fowler in Curr 1886).

Fishing was/is also is a mainstay of both diet and cultural identity linked to communal gatherings and ceremony as outlined in previous sections. Betty Fisher recorded the following from Gladys Elphick regarding fishing and nets (Fisher c.1964-1968):

> We were fishers from a long time past–down at the bottom end of the Peninsula they'd make nets (I've never seen it done), and catch a load of fish. Then they'd send word along with signal fires, from one group to the other, all the same tribe, camped different places, all along, right up to Kadina and Wallaroo and all the places. They'd all come down and have a big corroboree (you call it)–probably stay four weeks, or four Moons, two Moons, something like that. And while they were there, they'd go through ceremonies. Tell stories, dance, sing, all that.

Narungga fishing technology included/includes nets, spears and fish traps combined with knowledge of the behaviour of different fish species meant fish could be harvested at different quantities to suit the demands of the Narungga community from small family groups to large community gatherings (Hill and Hill 1975; Tindale 1936). Fowler (in Curr 1886) recorded one method of fishing:

> A good-sized fish being roasted, and tied up in a bundle of rushes, is fastened round the neck of a strong swimmer, so that it hangs down his back. With this he swims out to sea a mile or more, and then returns to the sandy beach, the roasted fish still hanging behind him. When near the shore, the swimmer attaches the fish to a spear stuck in the sand, where the water is about three feet deep. In the meantime the men have got ready their long nets, and the shoal of fish, as soon as it arrives on the scent of this drag, is surrounded and taken, Mr. Fowler says that he saw an enormous quantity of schnapper secured in this way on one occasion. It is a mode of fishing I have not heard of before.

Tindale (1936) also described the use of fish nets and identified a range fish species that were harvested by netting:

> Each man owned his own net, which was six to eight feet long, five to six feet high, and usually of small mesh, suitable for fish such as the sea Mullet (*Mugil cephalus*). Sometimes nets with a larger mesh were made for catching the Australian Salmon (*Arripis trutta*). In fishing three or four nets might he joined together, with sticks standing between to

support them. There were neither sinkers nor floats·. The people dived down to secure the fish. Bundles of grass were sometimes tied on the top of the nets to keep the fish from jumping over and might help to keep the nets floating. When many nets were joined together they would form a line many hundreds of feet long.

Snell in (Griffiths 1988:128) also writes of Narungga fishing practices from near Stansbury (see also Figure 11) noting their dexterity at swimming sometimes diving 70 or 80 yards under water. Men swam with large nets while women and children shouted from the cliffs giving directions to where fish were observed.[13]

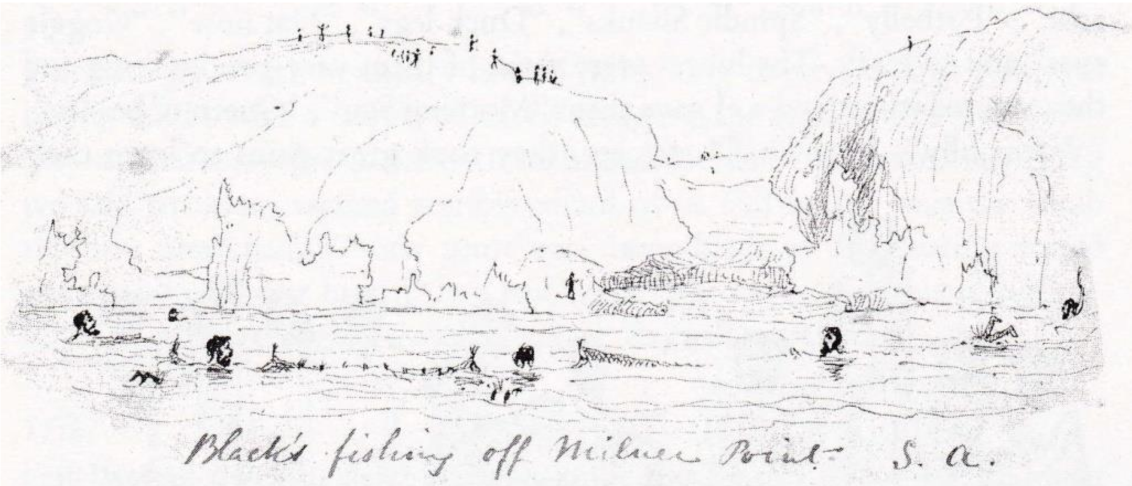


Figure 11: Sketch by Edward Snell (Griffiths 1988:128).

Davies (1952) similarly recorded fishing with nets at Marion Bay. Watchers stationed on cliffs signalled the arrival of mullet schools. Men carried the nets out to sea forming long lines with two men to a net while other men swimming further out drove the fish towards the nets.

Fishing continued to be employed throughout the post contact period (Hill and Hill 1975; Parsons 1987). At Bluff Beach, west of Minlaton, fish (butterfish, flounder and flathead) were speared in the shallows, while at Parsons Beach, a spotter would whistle from on top the dunes to indicate the location of fish to a line of men spread along the beach (Parsons 1987). Hill and Hill (1975) described some spear fishing methods fishing for Dusky Morwong/*Dactylophora nigricans*:

In 1948 the author witnessed, in daylight near Tiparra Rocks, an Aboriginal with a spear moving along in the shallows whilst several of his fellowmen walked along the cliff-top

[13] Cliff watching was also employed when fishing to warn of the presence of sharks (Black 1920:88).

> spying out the "Dusky Morwong" (*Chellodactylus nigricans*) sleeping in the water below. The man was towing, on a rope, three large fish he had speared. This may have been the traditional method of spearing these fish.
>
> Mr. A. Menz once described the spearing of a dusky morwong that he had witnessed around 1925 near Port Victoria. An Aboriginal waded out waist deep into the sea and indicated that he could see fish. Mr. Menz could not see anything and retreated to shore. After half an hour of standing perfectly still, the man speared a dusky morwong. Dusky morwong are very curious and gradually swim closer, enabling them to be speared.

Dusky Morwong/*Dactylophora nigricans* is known to Narungga people as ‘butterfish’ and is a significant fish species integral to their cultural identity (Mollenmans 2014). The Narungga community identify themselves and are known by broader South Australian Aboriginal communities as the ‘Butterfish Mob’ (Roberts et al. in prep.).

Whilst the Narungga economy had a coastal and marine focus, inland regions were also important for hunting terrestrial game during winter. Ethnohistorical sources suggest that hunting for game was generally undertaken during winter when water was more plentiful inland whereas fishing was a summer activity (Hamilton 1868). Inland, the Yorke Valley was an important hunting ground. The Yorke Valley lies roughly in the area between Arthurton, Maitland/Maggiwarda, Ardrossan and Curramulka.[14] Hill and Hill (1975) stated the heavy nature of the soil near the head of the valley and the generous rainfall produced large trees surrounded by bushy undergrowth. ‘Crabholes’ (a shallow circular depression in clay soil) were common and held water for long periods after heavy rains. Hill and Hill (1975) speculated this environment with grassy plains and dotted with sheoaks would have supported a large population of animal and bird life compared to the waterless mallee country extending on both sides towards the coasts.

In southern Yorke Peninsula/Guuranda, Phillips (1934) also noted important hunting grounds which extended from Moorowie to Warrenben. Johnson (1922) described the weapons used for hunting:

> so far as weapons were concerned, the natives of Yorke's Peninsula had only plain wooden spears and waddies; at least I never heard of them making boomerangs or having barbed or stone spears or stone knives.

[14] *Madi waltu* is recorded as meaning white flint (Anon 1923).

Kühn and Fowler (in Curr 1886) stated that kangaroo and emus were speared but also taken in nets. Tindale (1936) described how the nets and brush traps were made and used in hunting game:

> …nets for snaring wallabies were made from kangaroo and wallaby sinews. These were placed on the kangaroo pads after fences of brushwood had been built and apertures left at intervals to guide the animals to the nets. At these apertures a triangular bag net of sinews ['minti] was tied. It had a string looped around the opening. When the animal entered the bag it thrust its head down into the small pocket end. The noose string, which was tied to a branch closed the mouth of the bag.

Parsons (1987) recorded oral histories on Yorke Peninsula/Guuranda and noted one resident recalled Narungga hunting practices included:

> …forming a line and beating through the scrub. In one instance a Narungga women was seen to 'drop' a kangaroo by throwing her killing stick at it.

Johnson (1922—see also Tindale 1936) described other methods of trapping game:

> the natives were skilled hunters, and at Pondalowie (stony waterhole) they used to drive the kangaroos on to a peninsula through a narrow neck and spear them at their leisure.

Robinson et al. (1996) similarly writes of South Island near Pondalowie Bay. The island is easily accessible from the mainland and may have 'provided a similar natural trap and holding area' (Robinson et al. 1996).

In addition to game, plant foods also formed an important component of Narungga diet. Heinrich (1976:10) recorded: 'pig-face plants, edible berries and native peaches (quandongs) added variation to the diet'. Tindale (1936) described some of the plant foods and associated cultural traditions:

> The gum ['budala] of the wattle trees ['kundaraka] was sweet and liked as a food. There were many trees with this gum near Moonta.

> Wild peaches ['parabara] were much liked. Louisa remembered an old song which came from the north country, and which was sung at Marion Bay. It tells how the sun "burned" or "made red" the peaches…
>
> “Wild peaches hanging in the trees, the sun will burn you (to the colour of fire) we will gather you (for food)”.

Plants were also important in marking the seasons which in turn marked the timing of the arrival of economic fish species. The following two extracts (Davies 1952; Thom 1953) discuss two such plant species that signalled the arrival of migrating fish species. Thom (1953) described the role of the flowering billy buttons signalling the arrival of the butterfish into shoal water followed by mullet:

> During portion of the year these natives resided in belts of ti-tree and sheoak country, living mainly upon kangaroo, wallaby, emu, and similar game. When the billy buttons came into flower in the spring these natives read as a signal from Mother Nature that the time had come for a "walk-about" to the sea coast.
>
> For this also was the time when the butterfish make their way into the shoal water along that part of the coastline for some months. This latter fact I checked up by personal observation, and can fully confirm.
>
> As the butterfish moved out to sea again their place along the coast would be taken by shoals of mullet, which the natives followed from Marion Bay right along Investigator Strait to Troubridge Point.

Davies (1952) recorded that the flowering of the tea-tree also marked the arrival mullet. The abundance of the fish that could be caught allowed for larger social and ritual gatherings where Narungga people from across the peninsula would come together:

> The strong local belief that a heavy blossoming of the tea-trees and a good season for mullet go together has descended from the aborigines who once lived on Yorke Peninsula. Apparently the Yorke Peninsula natives were great fishermen. The mullet season was the time for the big annual gathering of the tribe.

> Initiation ceremonies were held at the start of the mullet season. The tribes gathered at Marion Bay, right at the toe of the peninsula. They called the place Cockadowie. They came from as far away as Wallaroo, 100 miles to the north, to take part in the fishing.

Parsons (1987) also recorded that Narungga people would remain for the duration of the flowering of the tea-tree as this was also a sign that the Tommy Ruffs were about.

Ethnohistorical sources also record the significance of nearshore islands. Wardang Island/Waraldi and adjacent islands area are/were economically and culturally significant places for the Narungga community (Roberts et al. 2019). The islands were places to gather food such as shellfish, sea bird eggs, penguins, bandicoots and fish (Black 1920; *South Australian Register*, 9 March 1884, p. 9). Wardang Island/Waraldi is also important in Narungga 'Dreaming' and has contemporary significance in association with the activities of Point Pearce /Burgiyana Mission and its residents on the island (Fowler et al. 2014; Roberts et al. 2013, Roberts et al. in prep).

As Roberts et al. (2013:81–82) summarised the following: 'prior to the use of European style vessels Narungga people crossed the channel to Wardang Island by other means and there are various accounts of such events'. Access to the islands was by swimming or wading (Black 1920:88; Cockburn 1984:235; Fowler 2015:306; Graham and Graham 1987:53; Hill and Hill 1975:38; Roberts et al. 2013:81–82; Wood and Westell 1998:18–19).

Black (1920:88) stated that the purpose of visits to Wardang Island/Waraldi was to catch fish and penguins whilst also noting the risks (from shark attack) associated with such crossings:

> When crossing to Wardang Island the blacks [sic] would wade out to [mungari] and swam the rest of the distance. Mrs. Newchurch's grandfather and grandmother told her that while the swimmers were in the water the old men sat along the shore and sang an incantation to keep the sharks away. No one was allowed to move until the party landed on the island. When ready to return they made a signal across the water and the singing began again.

Narungga Elder, Cecil Graham (now deceased), similarly recorded memories of such crossings passed down to him:

> My grandfather told the story about when in the old days some people camped on a little island, Greeny [Green] Island. The old men would go over to Wardang Island, butterfishing. They'd swim across through the shallow water, and be back before the tide came in. One old lady this time was scared. She said, 'Don't go today, the shark might get you.' The man swam. He had a sore on his leg. He never came back. (Graham and Graham 1987:53)

Wood and Westell (1999:18) more recently recorded the following Narungga account from Elder Irene Agius (now deceased):

> Now, with our ancestors, they used to make parts of the branches off the tree, walk out to Greenie [Green Island], if they needed to cross the island, drag the branches with them, go from one island and keep walking while the tide was out. Then they had a channel to cross off from, part way off from Greenie to Wardang Island. You had strong men each side of the channel and strong men to help cart the old ladies and old men over to Wardang Island. And by having the strong men up each end of it, two or three strong men up each end of the channel, they were facing opposite end to each other and they would wave their branches so to distract the sharks from coming to take the, take them. And that's how they crossed to Wardang Island.

Fowler (2015:306) reconstructed the likely crossing routes based on the ethnohistorical sources and taking into account hydrographical information for the waters between the mainland and the island:

> While most references to travelling to Wardang Island/Waraldi state the route was from Green Island, based on hydrographical information, this was one of the deeper and longer crossings available. The shortest route commencing at Green Island would conclude at the Little Jetty area and has a long extent (1.95 km) of 5–10 metres water depths (and a total distance of 2.55 km) (Chief Surveyor 1990). Only the reference by Hill and Hill (1975) states that travel occurred from the 'tip' of Point Pearce/Burgiyana Peninsula to Wardang Island/Waraldi. This route from the southernmost extremity of Point Pearce/Burgiyana Peninsula would travel via Rocky Island and end at Bird Point on Wardang Island/Waraldi. This route only has one very short distance (100 m) at 5–10 metres water depths, however also has many sand banks at low tide (and a total distance of 1.75 km) (Chief Surveyor 1990).

Figure 12 illustrates water depths along the route via Rocky Island. Such crossings entailed much effort, attesting to the both the economic and spiritual significance of these islands to the Narungga people.

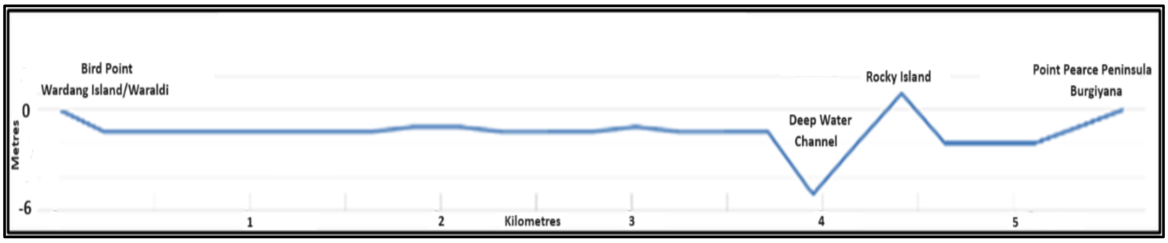


Figure 12: Rocky Island sea-crossing route low tide water depth chart.

In addition to Wardang Island/Waraldi, a number of smaller islands are also located in Spencer Gulf adjacent to Point Pearce Peninsula/Burgiyana. These islands which include Green Island/Munarla, Goose Island, Rocky Island and Deadman's Island/Mungari are/were also important islands for the Narungga community (Fowler et al. 2015). Green Island/Munarla was also important as a waypoint for people accessing Wardang Island/Waraldi further offshore from the Point Pearce Peninsula/Burgiyana coastline (see the *South Australian Register,* 9 March 1884, p. 9*)*. Apart from Wardang Island/Waraldi, Goose Island is the next largest island in this case study area with maximum length of c.300 metres and width of c.200 metres. Gillen in Mulvaney et al. (1997:436) also wrote of significant Dreaming narratives associated with Wardang Island/Waraldi and the smaller island in the case study area as outlined in preceding sections.

4.8 The Colonial Period

Kühn and Fowler (in Curr 1886) stated that Europeans first invaded Yorke Peninsula/Guuranda in 1847 but had occasionally been visited by sealers prior to that date (as previously noted):

> the first Europeans to contact the Narangga would have been sealers who were reputed to have had a small settlement at Warrenben Hut and Well some years before the establishment of a permanent colony at Adelaide in 1836. These lakes are covered, with salt which was dug by the sealers for preserving pelts. The ruins of the hut used are still visible adjacent to the former native wells on Sec. 78 Hundred of Warrenben.

The dispossession of Narungga from their lands and waters commenced with the arrival of the pastoralists in 1846 and was the cause of conflict between Narungga and the European intruders (Hill and Hill 1975; Krichauff 2008). Thom (1953) recalled stories that massacres may have taken place in the early days following the arrival of the Europeans:

> One very important piece of history of these primitive inhabitants refer to a spot called Muldarby which means "the place of death" and which is in the Tukokowie area. It would appear that, in the earliest days of white settlement of the Peninsula, a great many of the natives died very suddenly and mysteriously at this place. One assumption suggests that the natives ate poisoned flour from the early white settlers, but apparently the real truth surrounding the tragedy was never brought to light. However, this tragic incident marks the sudden ending of almost an entire tribe, the scene of the tragedy being ever shunned by surviving natives, who gave it the name of Muldarby (the place of death).

The arrival of Europeans also saw the introduction of diseases that caused many deaths amongst the Narungga community. Kühn and Fowler (in Curr 1886) stated:

> …lung diseases and enlargement of the liver are the maladies most prevalent in this tribe. A few years ago scarlet-fever and measles were introduced, and killed many.

Concerned European residents agitated for the government to intervene to make provision for the welfare of Narungga people leading to the establishment of the mission station at Point Pearce Peninsula/Burgiyana in 1868 (Krichauff 2008). Kühn in (Krichauff 2008:166) found the location for the proposed mission included:

> …good land and very good water, there is a well which has water year in and year out… the Reserve is by the sea, a lot of grass for stock, timber and stone for building, also fish and kangaroos, wallabies, wombat, possum…

The Narungga traditions of fishing (with adaptations) continued. A newspaper correspondent writing in 1874 (*The South Australian Register*, 9 March 1874, p.9) described some aspects of life at the Point Pearce /Burgiyana Mission. The author stated: 'Saturday is a day off when boys go fishing or hunting' (*The South Australian Register*, 9 March 1874, p.9). The correspondent also noted that there is an island about two miles from the point where penguins abound and another which is thickly inhabited with shags. He stated that in the past Aboriginals used to swim over to this point for eggs but now they go by boat.

The correspondent also noted that the mission is three miles from the sea with water being plentiful in the sand hills. On Point Pearce Peninsula/Burgiyana freshwater is available in wells and soaks at shallow levels along the north coast in the in the Galadri/Hollywood area. Narungga people camped near this area when the mission was first established (Graham and Graham 1987:15; Wood and Westell 1999:16). Once the mission was established, the 'Willows' well and water tank that are discussed in later sections in this text were also built in this area to tap the fresh water available at this location.

Some Narungga rejected living at the mission, preferring to maintain their traditional lifeways. Heinrich (1976:10) described one such group:

> …although the people were members of the 'Naranga' tribe, they formed groups within the tribe, one such being the 'Curratompti'. In 1880, this group of about twenty people, ruled by the wife of an enfeebled chief, was a matriarchy. Described as proud and independent, these people rejected all inducement to settle at Point Pearce Mission Station after it was established in 1869, preferring to retain their ancestors' way of life. Even though they were essentially nomadic in their habits, they favoured a camp site on a hill south of the present town, and sheltered by large salt-bushes. From the top of an enormous sandhill they scanned the water for their favourite food, the strong-fish, which were caught by spearing or with nets made from fibres of the broad flag. Shellfish were gathered from the sandy beaches, and native animals such as kangaroo, wallaby and wombat were hunted and eaten according to tribal custom. Pig-face plants, edible berries and native peaches (quandongs) added variation to the diet. The absence of any fresh water streams or catchments made them look for water in the soaks and wells which were found near the sandhills lining the beach.

Fishing continues to be important today (Graham and Graham 1987; Wood and Westell 1999). As Wood and Westell (1999:11) note, 'the 'Point Pearce community maintain a strong association with the sea', and, 'Point Pearce people are renowned fishing people'. Butterfish is reported as the most significant catch (Wood and Westell 1999:11).

4.9 Archaeological Surveys

Wood and Westell (1998) and Wood et al. (2003) provide the most comprehensive surveys of Yorke Peninsula/Guuranda including a desktop survey incorporating ethnohistory and a list of all sites that have been recorded and listed with Aboriginal Affairs and Reconciliation (AAR). Wood and Westell (1998) documented 105 new sites in addition to more than 80 sites previously registered with AAR. Wood et al. (2003) recorded a further 82 sites including a rockshelter, two small artefact scatters associated with rock holes and 79 open campsites. These surveys were limited to coastal settings as most of inland Yorke Peninsula/Guuranda is freehold land that was not available to be surveyed.

In summary, these surveys resulted in the following general conclusions (Wood and Westell 1998; Wood et al. 2003):

- Campsites/middens generally include food remains, stone artefacts and occasionally fireplaces, and are by far the most commonly found site type on the peninsula. The overwhelming majority are recorded along the coastal fringes with the small number of inland sites generally found around the shorelines of salt lakes and ephemeral swamps.
- Sites vary from large, complex sites containing masses of material (e.g., stone artefacts, shell, fish and other faunal remains, hearths. etc.), to small, discrete clusters of stone artefacts. The differences in size and content is often described within a scenario of large, semi-permanent base camps and small, less frequently inhabited foraging or satellite camps.
- Campsites on the peninsula are invariably exposed to weathering processes that act to degrade organic material, such as fibre, wood and bone, and today, it is usually the more durable items that remain in open sites; essentially stone, shell, and to a lesser extent the larger fragments of bone and teeth. A significant portion of the original site content is likely to be 'invisible’.

Wood et al. (2003) summarised the range of coastal landform settings where sites were found including sheer 60 metres high cliffs to shore level dunes. Coastal habitats included rocky, sandy, low energy and high energy environments. Wood et al. (2003) observed that whilst some coastal landforms had evidence for more intensive use, all coastal landforms have at least some degree of sensitivity.

A variety of faunal materials were noted, including from shellfish, fish, crustaceans, birds, eggshell, mammals and reptiles (Wood et al 2003). Of these, shells were found more frequently and in generally larger volumes than any other faunal class. Emu egg dominated the assemblages of a small number of sites. While the species of shell present will obviously be influenced by variation in local habitat, four species were consistently encountered: warreners (*Turbo undulata*), periwinkles (*Nerita melanotragus*), abalone (*Haliotis* spp.) and whelks (*Thais orbita*). All of these are rocky shoreline species.

Wood et al. (2003) noted some significant sites and places recorded during their survey. The Cape Elizabeth area represents arguably one of the most sensitive archaeological landscapes on the peninsula. The reliable freshwater springs at Tiparra, Nalyappa and Warburto Point no doubt underpinned the intensive occupation of this area with the frequent, highly productive reefs and tidal platforms offering considerable resources. The Warburto Point oven site was considered scientifically significant because it contained well-preserved in-situ occupation remains. An unusual feature of the site was the large number of calcrete cobble hearths associated with shellfish remains, ochre fragments and artefactual debris (Wood et al. 2003).

Some of the most extensive and diverse deposits identified during the project were also recorded in the far southwest of the peninsula between Daly Head and Browns Beach (Wood et al. 2003). A site located on top a sheer 60 metres high cliff near the Ethel wreck is a clear illustration of the general sensitivity of all coastal landforms (Wood et al. 2003).

(Wood et al. 2003) stated the most significant result of the project was the recording of 16 sites on Wardang Island/Waraldi, as only one site had been recorded here previously. Wardang/Waraldi and Goose Islands are of great mythological significance to the Narungga and also represented a significant economic resource. This was recognised in clauses written into the earliest leases granted over the island (ca 1861) giving people rights to visit the island to hunt, fish and gather vegetable foods (Gara 1991:1).

Wood et al. (2003) stated the geology of the peninsula does not facilitate the widespread development of rockshelters or caves. While limestone units exposed along the coast can often be undercut into small crevasses and hollows, the rock is typically soft and tends to collapse before the development of large shelters capable of accommodating an encampment of any size. A small number of rockshelters, however, have been recorded on the peninsula at Gym Beach and Berry Bay (Wood et al. 2003):

> The Berry Bay rockshelter contains a stratified sequence of hearths (charcoal and ash lenses), bone and stone artefacts. The rockshelter is situated in the cliff at the top of a talus slope and 5 metres above high water level. Cultural materials, including shellfish remains and stone artefacts, are eroding down the talus slope as well as being contained within open campsites in the low fore dunes immediately below the rockshelter (Wood and Westell 1998).

Other Narungga heritage included an engraving site at Rocky Point, near Black Point (Walshe 2003). A single rock engraving has also been recorded in the form of a single motif at Point Turton (Preiss 1962a:43). A cast was made of the engraving and lodged with the South Australian Museum (accession number A53961) (Preiss 1962b:32).and at Point Turton. There are also a number of areas on the peninsula where ochre was quarried (e.g., Pine Point and Port Moorowie) (Wood et al. 2003).

Wood et al. (2003) noted that surviving materials represent the more durable components of an assemblage which probably included various stone and wooden tools, food remains, habitation structures, etc. In a local context this essentially means the shell and stone components of an economy will be what is visible even though it is known that it would have integrated plant foods such as pigface, saltbush, quandong, native cherry, muntries, various roots, tubers and seeds, land mammals, birds, shellfish, fish and crustaceans (Wood et al. 2003). Few of the wooden or fibre implements (digging sticks, clubs and spears, reed fishing nets and netting bags) are likely to be preserved (Wood et al. 2003).

4.10 Chronology

Roberts et al. (2019) summarise that while the Narungga economy described in ethnohistorical sources and prior archaeological surveys is likely tied to marine transgression history, a fully published chronology that plots this cultural trajectory is lacking for Yorke Peninsula/Guuranda. The following dates, however, have been reported (see also Figure 13):

1. A radiocarbon date from charcoal from a hearth (at a depth of 1.65 m) at Port Moorowie = 910±50 years BP (CS166)/ 926–732 cal BP (95.4 % probability range) (pers. comm. Vivienne Wood 2018);
2. A radiocarbon date from charcoal lodged in the rib cage of a buried individual (at a depth of approximately 19 cm) at Edithburgh = 567±62 years BP (R18099/1, NZA 2801)/ 659–512 cal BP (95.4 % probability range) (pers. comm. Vivienne Wood 2018); and
3. Dates from a number of sites and burials ranging from c. 8,000 to 200 BP via the South Australian Museum bioarchaeology project (see South Australian Museum 2013).[15]

[15] However, it should be noted that these dates are not fully reported with laboratory codes or context.

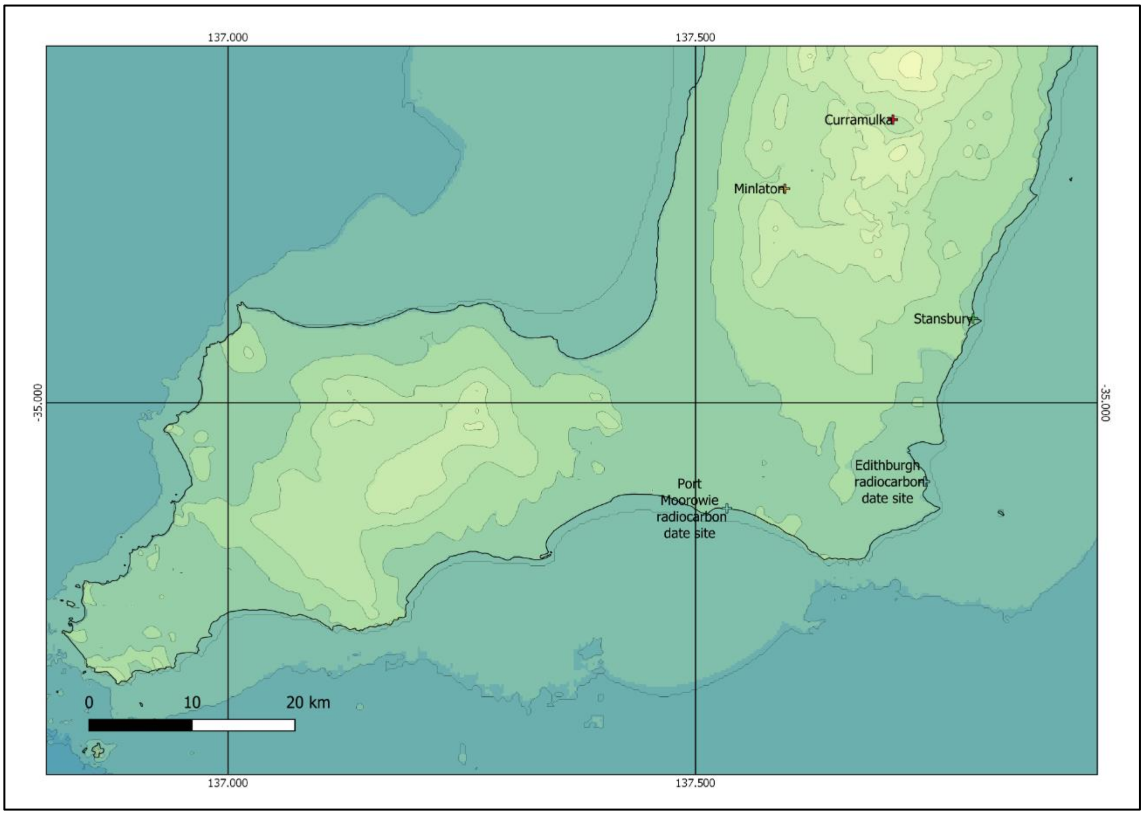


Figure 13: Port Moorowie and Edithburgh radiocarbon date sites.

It is important to recognise Narungga and their ancestors have occupied the region encompassing Yorke Peninsula/Guuranda for many millennia, possibly for more than 40,000 years on the basis of recent DNA research (Tobler et al. 2017). However, archaeological evidence for Pleistocene occupation is currently lacking (although see dates at Pt Augusta and broader South Australia [Hamm et al. 2016; Walshe 2012]).

4.11 Summary

Narungga Nation encompasses the whole of Yorke Peninsula/Guuranda. At the time of European invasion Narungga Nation had a complex social organisation divided into 4 sub-groups. Narungga language, placenames, ecological knowledge and narratives provide insights into the complexity of their culture both economically and spiritually. The Narungga economy was focussed on coastal and marine resources including use of islands. The terrestrial landscape also provided access to food and water resources. Narungga narratives are linked to both the contemporaneous seascape but also include narratives that align with the regional sea-level history of Yorke Peninsula/Guuranda and a time when sea levels were lower, and the region was dry land. Ethnohistorical sources and prior archaeological surveys provide insights into the culture and economy in recent times but prior to this research there was little chronology to help understand how Narungga Nation developed over time.

5. METHODS

This chapter outlines the methodology adopted to investigate the Narungga coastal and marine economy with particular focus on Point Pearce Peninsula/Burgiyana and adjacent islands as a case study. The methodology combines community-based research, ethnohistorical research and desktop survey, archaeological surveys and surface sampling for chronology, environmental surveys and geomorphological observations and GIS modelling. An exploration of Narungga narratives about past land and seascapes and Narungga economic and socio-cultural contexts observed from the time of European invasion and colonisation for the broader Yorke Peninsula/Guuranda region are positioned in dialogue with these syntheses to provide context and to set the end point of the trajectory being investigated. These strands of evidence are then discussed to provide a preliminary outline of the path taken to Narungga society observed at contact.

5.1 Community-Based Research

The research forms part of a collaborative research project between Flinders University, the University of South Australia and the Narungga Nation Aboriginal Corporation (NNAC) and the Point Pearce Aboriginal Corporation (PPAC). The community based component of this research builds on, and is complementary to, previous collaborative projects with the Narungga community which have considered the archaeology, history and cultural significance of the area encompassing Point Pearce Mission/Burgiyana, Point Pearce Peninsula/Burgiyana and its adjacent waters and islands (Fowler 2015; Fowler et al. 2014; Fowler et al. 2019; Liebelt et al. 2016; Mollenmans 2014; Roberts et al. 2013; Roberts et al. 2019). These previous projects highlight the importance and benefits of collaborative research. As English (2002) stated, it is by understanding the historic and contemporary interaction between Aboriginal peoples and their landscape that greater social benefits can be generated.

Community-based research was deemed important to ensure the research is culturally respectful (Atalay 2012; Colwell-Chanthaphonh and Ferguson 2008). The relevant Narungga organisations provided formal written approvals at the commencement of the project including from the peak Narungga body, the Narungga Nation Aboriginal Corporation (NNAC) and Point Pearce Aboriginal Corporation (PPAC). Community stipulations were outlined by the organisations and these have been strictly adhered to, such as not disclosing site coordinates in any information or publications except those provided back to the community bodies or as required by government permits.

Community-based research included community consultation throughout the research process, Narungga participation in fieldwork and shared exploration of traditional Narungga narratives and knowledge about past landscapes and seascapes to ensure the culturally sensitive incorporation of community knowledge, both traditional and contemporary perspectives in the research outcomes. Narungga narratives about past landscapes and seascapes are explored following a 'dialogical model' by exploring the past together as Narungga and non-Narungga academics, and in collaboration with the broader Narungga community (see Roberts et al. 2019). Protocols for undertaking these aspects of the research have also received ethics approval (Project No. 7150) from the Flinders University Social and Behavioural Research Ethics Committee (SBREC).

Further consultation and feedback was sought throughout the project for approval for fieldwork and for permission to undertake limited sampling. Permission to undertake sampling also required approval from Abroiginal Affairs and Reconciliation (AAR) the responsible state government body. This permit process also included additional community consultation. Narungga/PPAC community representatives participated in fieldwork and provided the cultural context to the archaeological heritage sites recorded in this research (McNiven 2003; Roberts et al. 2016a). Professor Lester-Irabinna Rigney, Narungga academic, also guided the research process as a Adjunct Supervisor for this PhD research.

5.2 Ethnohistorical Research and Desktop Survey

Archival research including museum and oral histories collections were important sources of information to complement and beter understand the archaeological data collated during this resaerch. It must be acknowledged that much groundwork pertaining to Narungga ethnohistorical research has already been collated in prior research projects and by Narungga individuals and groups from NNAC and PPAC community organisations (e.g., Fowler 2015; Fowler et al. 2014; Fowler et al. 2019; Graham and Graham 1987; Liebelt et al. 2016; Mollenmans 2014; NAPA 2006; Roberts et al. 2013; Roberts et al. 2019; Wanganeen 1987).

Archival research was undertaken to identify records that contain information of relevance about the Narungga coastal economy in the ethnographic/recent periods. Ethnohistorical sources included colonial newspaper records, government archives, settler diaries and the artworks of colonial artists. Databases included AIATISIS, Museum of Victoria, South Australian Museum, State Library of New South Wales, State Library of South Australia and Trove.

Database searches were undertaken using basic keyword searches (e.g., individual search terms such as 'Point Pearce') and advance keyword searches (e.g., time period + locality + 'fishing'). Search results were then reviewed to identify new keywords that may lead to additional sources of information.

Bringing together the research results allowed for a more complete ethnohistorical record to be collated than could be achieved when considering each source document in isolation.

A review of prior archaeological surveys and AAR site card records was also undertaken to identify previously recorded Narungga heritage for the case study region (see Wood and Westell 1998; Wood et al. 2003). More recently, a number of collaborative research projects have been undertaken with the Narungga and Point Pearce communities which have focused on the Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi specifically in relation to fish traps, post-contact maritime culture and the impacts of marine transgression in the region (e.g., Fowler et al. 2014, 2015, Mollenmans 2014; Roberts et al. 2013, 2016, 2019).

Desktop survey also included a review of the existing literature covering a range of fields encompassing the natural history of Yorke Peninsula/Guuranda including the physical landscape (geology, soil types, hydrology and geomorphological processes), biodiversity and climate settings that exist in Yorke Peninsula/Guuranda today and in the past. Much of the source South Australian natural history data and aerial photography imagery is available in online databases:

- Naturemaps SA (DEWNR www.naturemaps.sa.gov.au);
- South Australian Resources Information Geoserver (PIRSA https://sarig.pir.sa.gov.au);
- Geological Survey of South Australia—Department for Energy and Mining, the Government of South Australia, Geoscientific Data (GSSA): 100K South Australia Surface Geology. Retrieved 6 November 2019 from <http://energymining.sa.gov.au/minerals//geoscience/geological_survey/data>.
- Elvis - Elevation and Depth - Foundation Spatial Data (Elvis fsdf.org.au): Elevation - Western Yorke Peninsula LiDAR 2021.
- Geoscience Australia (Whiteway 2009); and
- SA Gazetteer.

Data from these sources include aerial photography land survey images, geological surveys, DEM topography and bathymetry data and biodiversity data. Data layers and survey data from this research were modelled in GIS software including ARCGIS, Grass GIS and QGIS software packages. Aerial photography land survey images allowed for visual inspection of the whole of the proposed study area and distinguishing natural from altered landscapes (e.g., as a result of farming and mining) and allowed for the identification, location and extent of the variety of the range of coastal environments within the study area. This provided the opportunity to plan more targeted survey of the case study when fieldwork took place.

5.3 Archaeological and Geomorphological Field Survey

Fieldwork was carried out at Point Pearce Peninsula/Burgiyana in 2016, 2017 and 2023 and on Wardang Island/Waraldi in 2023. Localities that were recorded were primarily archaeological sites but also included the range of environments (these include terrestrial, salt marsh swamp, coastal environments including coastal dunes, beaches, rocky reefs, tidal flats and a small island) that occur within the case study area (after Beaton 1985). Previously recorded sites (e.g., Wood and Westell 1998, Wood et al. 2003) were also surveyed.

Archaeological sites that were recorded included coastal and inland sites. Site mapping included defining sites boundaries, recording surface artefacts and identifying faunal and shell samples material suitable for radiocarbon dating. Geomorphological observations were also made to identify evidence for the landscape history of the case study area (e.g., Pleistocene dunes, former seaways and coastlines) which may have influenced change in the range of activities undertaken in this region over time. Narungga/Point Pearce community participants identified many of the sites that were recorded and also provided knowledge of the environment and hazards as well as community knowledge and insights of fishing, fish species and behaviours. Community participants also shared cultural knowledge reflecting the deeper significance and cultural attachment Narungga have to their land and waters (after McNiven 2003:329).

Site coordinates were recorded using a Garmin GPSmap 62 GPS with the following settings:

- Position format UTM UPS
- Datum: GDA 94
- Map Spheroid: GRS 80

Elevation measurements included in this thesis are as plotted by the Garmin GPSmap62 GPS with error +/- 3 metres. General photographic images were recorded using Nikon D3100 camera with AF-S NIKKOR 18–55 mm 1:35–5.6 G lens. Close-up images of small samples were recorded using Nikon D3100 camera with Tamron SP AF 90 mm F/2.8. Macro 1:1. Filter size: ØØ 55 mm (Model 272EN II) macro lens.

5.4 GIS and Marine Transgression Modelling

Field work data collected during the research was mapped in GIS. GPS data was downloaded from the GPS using DNRGPS software. The DNRGPS software was also used to convert the GPS data to ARCGIS format. Maps were generated using GIS software (QGIS, GRASS GIS, ARCGIS/ARCMAP version 10.4.1). Distance and area measurements included in this thesis were measured using the ARCMAP version 10.4.1 measurement tool. Elevation measurements recorded during fieldwork were as plotted by the Garmin GPSmap62 GPS with error +/- 3 metres.

An aim of this research was to investigate the geomorphic processes impacting the case study area in order to distinguish coastal and terrestrial sites associated with former coastlines and environments. Investigating these processes can also provide insights into site preservation and visibility. GIS was also used for palaeogeographic modelling incorporating South Australian geography, geology, topography and bathymetry data as well as natural history data to model past landscapes/seascapes.

Much South Australian natural history data is available in GIS layer files which provided the source data for modelling the Yorke Peninsula/Guuranda natural environment and landscape history. GIS software was also used for marine transgression and hydrology modelling. Miller (2006) noted that soils 'provide a historical record of the conditions under which they were formed'. Formation factors include, but are not limited to 'climate, organisms, relief, parent material and time' Miller (2006). Soils may change over time, but these processes are 'usually slow enough that the effects of long term conditions can be observed decades after a condition is gone' Miller (2006). Understanding the connections between formation factors and present-day soil attributes 'allow historical reconstructions of the landscape, hydrology, wildlife habitat, and potentially other areas of interest' Miller (2006).

Miller (2006) noted that water is a dominant force in soil formation and is 'the underlying driver of soil formation within relief and climate'. Hydrological tools (algorithms) available in GIS and other software when applied to terrain relief layers (DEMs) provide the opportunity to model water flow and accumulation as well as identify depressions/basins where water may have pooled within a landscape. Soil survey data (Hall et al. 2009a, 2009b) and hydrological modelling data (e.g., BOM 2020; GA 2020) are available as GIS layers for the case study area and broader region (indeed coverage is available for the whole of the Australian continent). Such data sources, in conjunction with methods proposed by Miller (2006), provided the opportunity to reconstruct landscape history of the case study area.

This research also combined a number of approaches in order to create a marine transgression model, as well as to contextualise this model in relation to the ethnography and archaeology of Yorke Peninsula/Guuranda (Roberts et al. 2019). Marine transgression, as it impacted this region, was modelled by combining existing literature for sea-level rise in this region (primarily Lewis et al. 2013 but also Belperio et al. 2002; Lambeck and Chappell 2001; Lambeck and Nakada 1990) with bathymetric data for the waters surrounding Yorke Peninsula/Guuranda.

Bathymetric and topographic data (digital elevation model) for Australia was sourced from the 2009 Bathymetric Grid of Australia published by Geoscience Australia (Whiteway 2009). This dataset produced by Geoscience Australia and the National Oceans Office provides a 9 arc second (0.0025° or ~250m at the equator) bathymetric grid for Australian waters (Whiteway 2009: 1). In addition, 1 metre LiDAR data published by Department of Environment and Waters was available for the Yorke Peninsula/Guuranda coastal margin.

These datasets were imported into GIS software (QGIS, Grass, ArcGIS) to create DEM models and maps for the case study area as well as at the regional and continental scale (where relevant to this research). The bathymetric and topographic information sources were used to form a baseline (contemporary) 3D model of the case study area. The 3D model in conjunction with data for sea-level rise provided the opportunity to model marine transgression in this region. This model shows how the peninsula, waters and islands in this region developed over time (see Roberts et al. 2019). Archaeological data was obtained during fieldwork undertaken during 2016 and 2017 at Point Pearce Peninsula/Burgiyana and 2023 for Wardang Island/Waraldi. This was combined with data from prior archaeological surveys (Wood and Westell 1998; Wood et al. 2003) to provide archaeological context to the marine transgression model.

5.5 Radiocarbon Dating

Fieldwork to collect samples for age determination took place on Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi (case study area) in March 2023. Narungga/Point Pearce participants guided the fieldwork. Nineteen archaeological samples including marine shell, eggshell and soil sediment that would be suitable for radiocarbon dating were identified, recorded and collected. These samples were collected in order to obtain age determinations for a range of site types. Another focus was environmental sampling (e.g., non-artefactual marine shell) which aimed to obtain age determinations for palaeoenvironments within the case study area. All samples were exposed on the surface. Samples were extracted using a trowel and any loose sediment was removed. Samples were placed in alfoil packet and stored in plastic zip-lock bag.

Samples underwent AMS radiocarbon dating conducted by the University of Waikato, New Zealand. Samples surfaces were cleaned and washed in an ultrasonic bath. Samples were acid washed using 0.1N HCl, rinsed and dried. Samples were also tested for recrystallization. Sample dates were adjusted for marine reservoir effect. Marine reservoir effect accounts for the difference in concentration of radiocarbon (14C) between ocean and atmosphere. Unrounded Conventional Radiocarbon Ages (CRAs) were calibrated using the OxCal 4.4.4 (Bronk-Ramsey 2021); r5; Marine data from Heaton et al. (2020) Delta R(-146,42).

Dye (1994) investigated potential variation in sample ages, in particular, for herbivorous marine shell species collected from environments with limestone substrate due to uptake by the organism of 'old' carbon from the environment. Old carbon may be absorbed either 'indirectly into the organism's carbonate through consuming algae which ingested the limestone, or directly by molluscs scraping and dissolving the limestone as they browse'.

Dye's (1994) research on the Hawaiian Islands identified average apparent increase in age of up to 620 years. As a result, it is possible that there may be some uncertainty with the sample dates collected in our fieldwork due to the presence of limestone substrate in the case study area. However, it should be noted that while the case study area is underlain by limestone substrate the adjacent waters that would have been the habitat for the living shell are predominately rocky reefs formed from the basement bedrock rock outcrops of Wallaroo Group, Aagot member and Arthurton Granite geological formations. These issues will be explored in subsequent chapters.

5.6 Summary

This research adopted a multidisciplinary approach to investigate the Narungga Aboriginal heritage of Yorke Peninsula/Guuranda. The research is a collaborative project with Narungga Nation Aboriginal Corporation (NNAC) and the Point Pearce Aboriginal Corporation (PPAC) who have expressed an interest in their past heritage being scientifically investigated. The methods adopted in this research include community-based research to ensure the research is culturally sensitive. Ethnohistorical research provides insights into the recent history of Narungga Nation. Fieldwork focused on the case study area for this research at Point Pearce Peninsula/Burgiyana and on Wardang Island/Waraldi. Fieldwork included archaeological survey to document Narungga heritage sites in the case study area. Surface samples, primarily shell, were collected at some sites for radiocarbon dating to help establish site chronology. Fieldwork also included geomorphological observations to document the present-day environment and identify preserved evidence for the landscape history of the region. Data collected during this research was collated in GIS software and combined with data layers that record the physical geography and biodiversity of Yorke Peninsula/Guuranda today. GIS was also used to model the sea-level history of Yorke Peninsula/Guuranda.

6. RESULTS

This chapter outlines the data collated during this research beginning with a review of the sea-level history of Spencer Gulf modelled in GIS to provide context to the present-day physical geography of the case study area. The range of environments recorded in the literature and during fieldwork survey for the case study area are a consequence of this sea-level history. Results from prior archaeological surveys and community-based archaeological fieldwork at Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi undertaken during this research provide a record of Narungga material culture preserved in the case study area today. Narungga culture, demography and economy documented in ethnohistorical sources provide the context to the Narungga heritage sites surveyed during this research and reflect the recent Aboriginal history of the region prior to European invasion. Radiocarbon date results from primarily marine shell samples collected from selected Narungga heritage sites are outlined to situate the preserved heritage within the landscape history of the region.

6.1 Spencer Gulf Sea-Level History

The known history of sea-level rise covering the last interglacial period to the present is compiled from Belperio et al. (2002); Burne (1982); Hill et al. (2009); Lambeck and Chappell (2001); Lambeck and Nakada (1990) and Lewis et al. (2013). Combining these datasets in conjunction with the Bathymetric Grid of Australia (Whiteway 2009) in GIS allowed for modelling the landscape impacts of sea-level fluctuations for the Yorke Peninsula/Guuranda region and broader Australia for the period following the last interglacial.

The last interglacial period spans the earliest recorded evidence for human occupation from c.65 Kya (Madjebebe Rockshelter, Northern Territory), when sea levels were 78 metres lower than present, as well as the broader settlement of Australia (Clarkson et al. 2017; Tobler et al. 2017). In South Australia the earliest record for human occupation is at Warratyi Rockshelter c.49 Kya when sea levels were 50 metres lower than today (Hamm et al. 2016). In the period 65 Kya to 30 Kya prior to the onset of the LGM sea levels fluctuated between 78 metres and 50 metres lower than today before falling to c.125 metres BPSL at the height of the LGM 20 Kya (Figure 14).

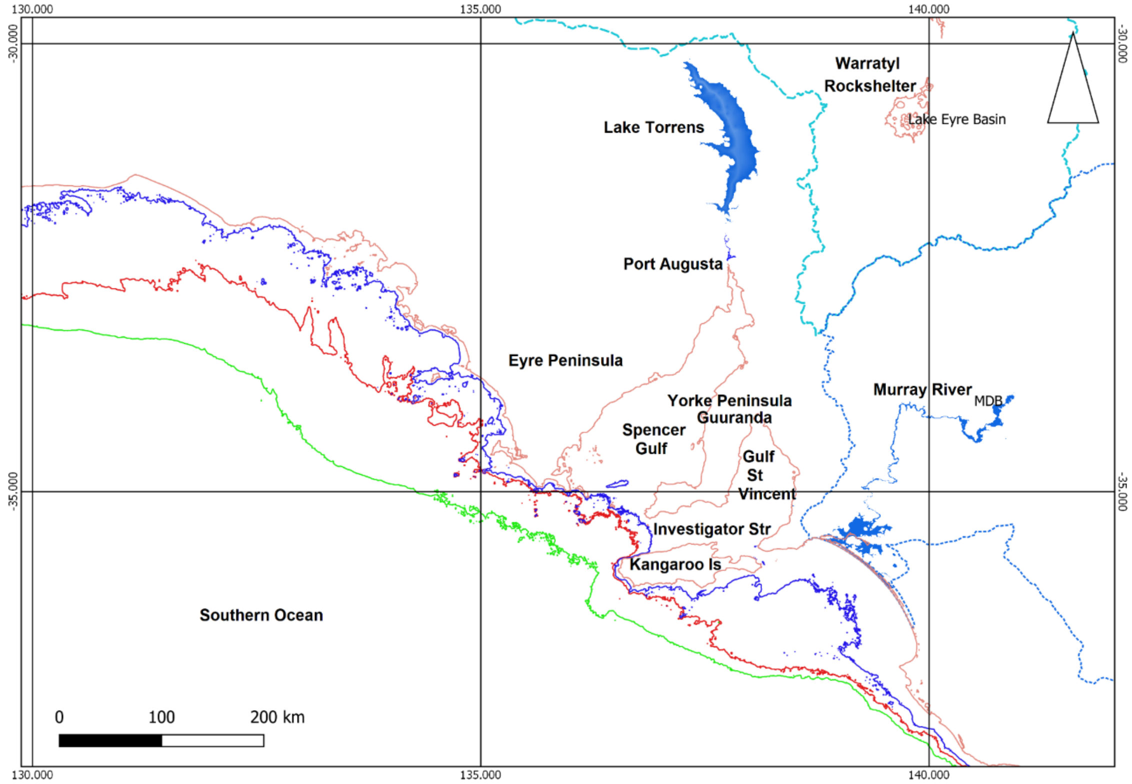


Figure 14: South Australian coastline during settlement of Australia 68 Kya (red line 78 metre BPSL) to 30 Kya (blue line 50 metre BPSL).

Tobler et al. (2017), based on DNA research, suggested that the region encompassing Yorke Peninsula/Guuranda was settled 40,000 years ago and was the meeting point of easterly and westerly coastal migrations. Yorke Peninsula/Guuranda was a landlocked plateau during this period overlooking palaeo-valleys that are the present-day Spencer Gulf, Gulf St Vincent and Investigator Strait. Kangaroo Island was also connected to the mainland as an extension of the Mount Lofty Ranges.

Figure 15 charts post-LGM sea-level rise in South Australia illustrating the timing for the creation of gulf waters, Kangaroo Island, Wardang Island/Waraldi and the present-day coastline. Spencer Gulf most recently forms from 11,800 years ago when post LGM sea-level rise exceeds 50 metres BPSL, the present-day water depth at the entrance to the gulf (Figure 16).

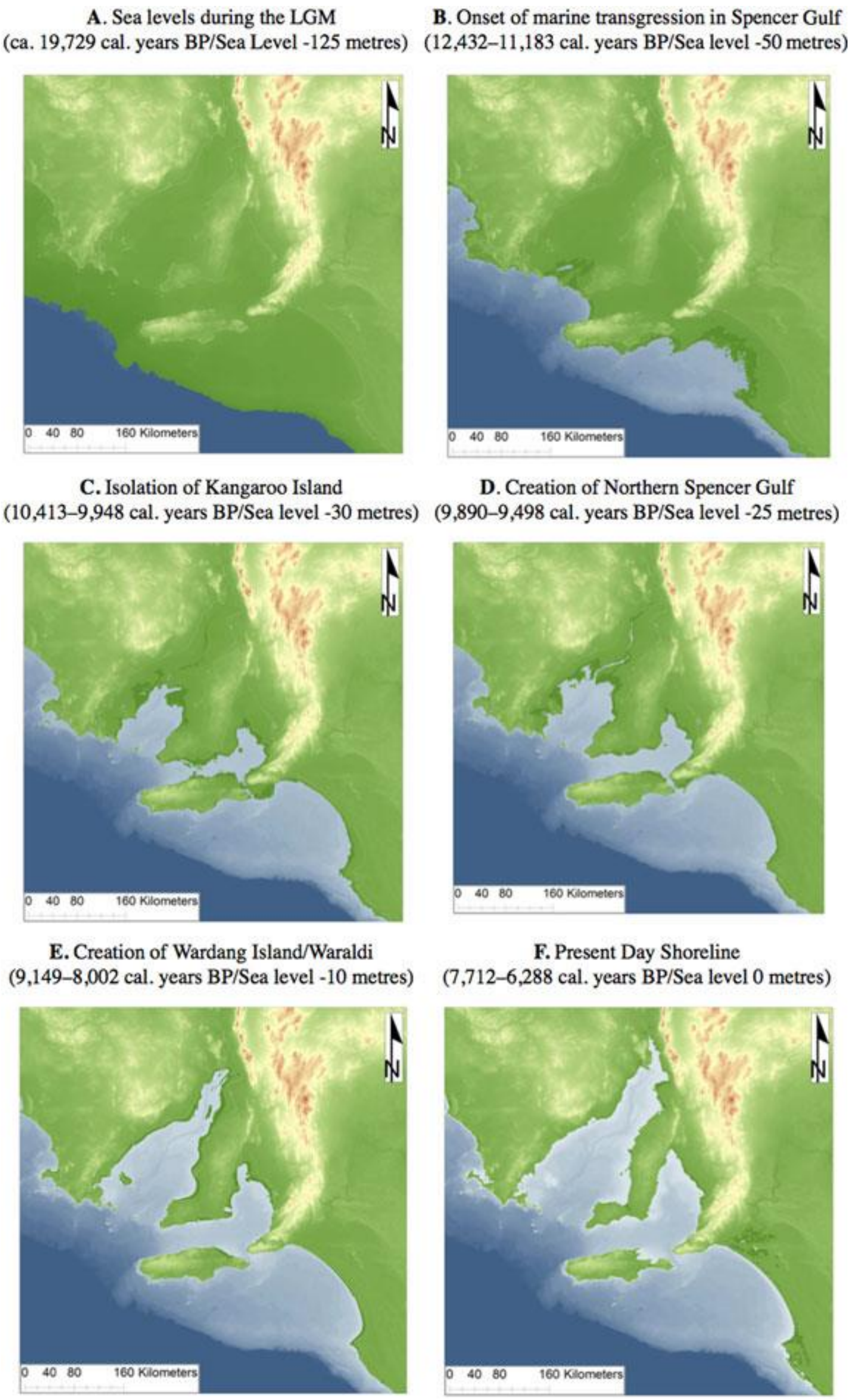


Figure 15: South Australia post LGM sea-level rise sequence (from Roberts et al. 2019).

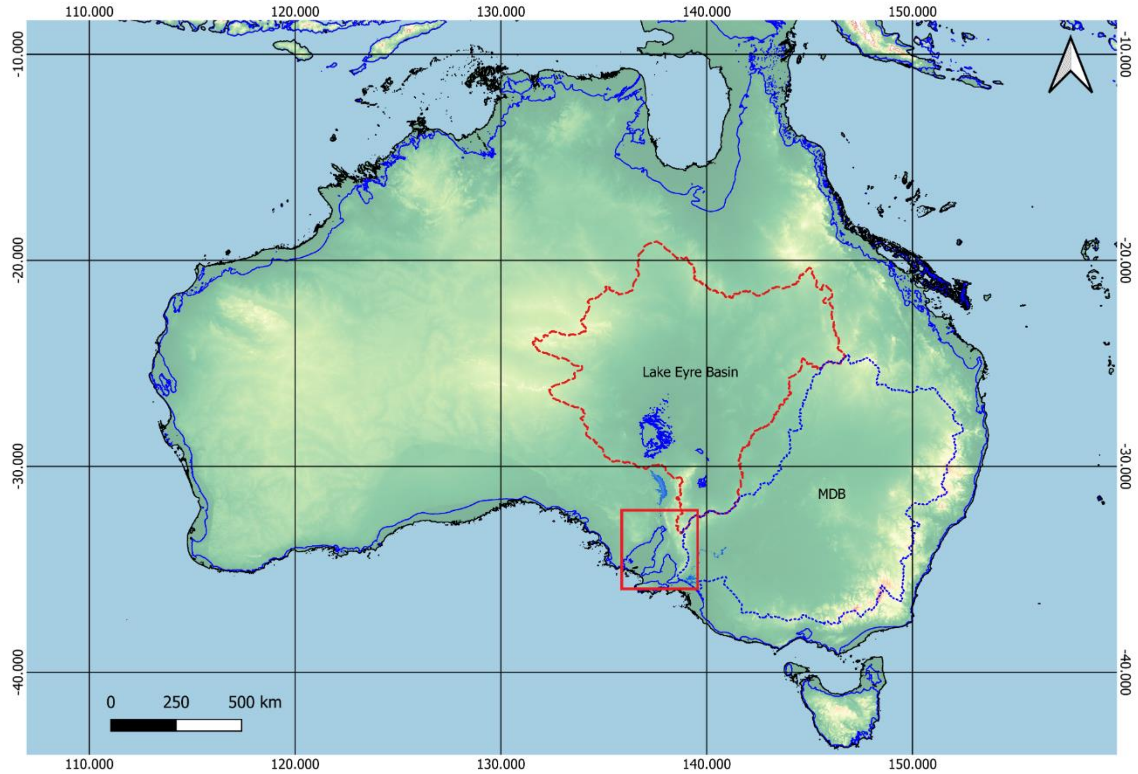


Figure 16: Australian landmass extent 50 metres BPSL 11,800 years ago. Blue line represents coastline today. Map created in GIS 2009 Bathymetric Grid of Australia published by Geoscience Australia (Whiteway 2009).

Spencer Gulf is 77 km wide at its entrance with north/south length of 320 km covering an area of 7,500 km^2 which represents the total area of gulf lands submerged by sea-level rise during the Holocene. The topography of the sea floor of Spencer Gulf provides insights into the pre- sea-level rise submerged landscape (Figure 17). The gulf north of Wallaroo/Wadla-waru has a V-shaped east west cross section with central drainage running north south (Flinders Channel). South of Wallaroo/Wadla-waru, the sea-floor topography widens and deepens towards the entrance to the gulf.

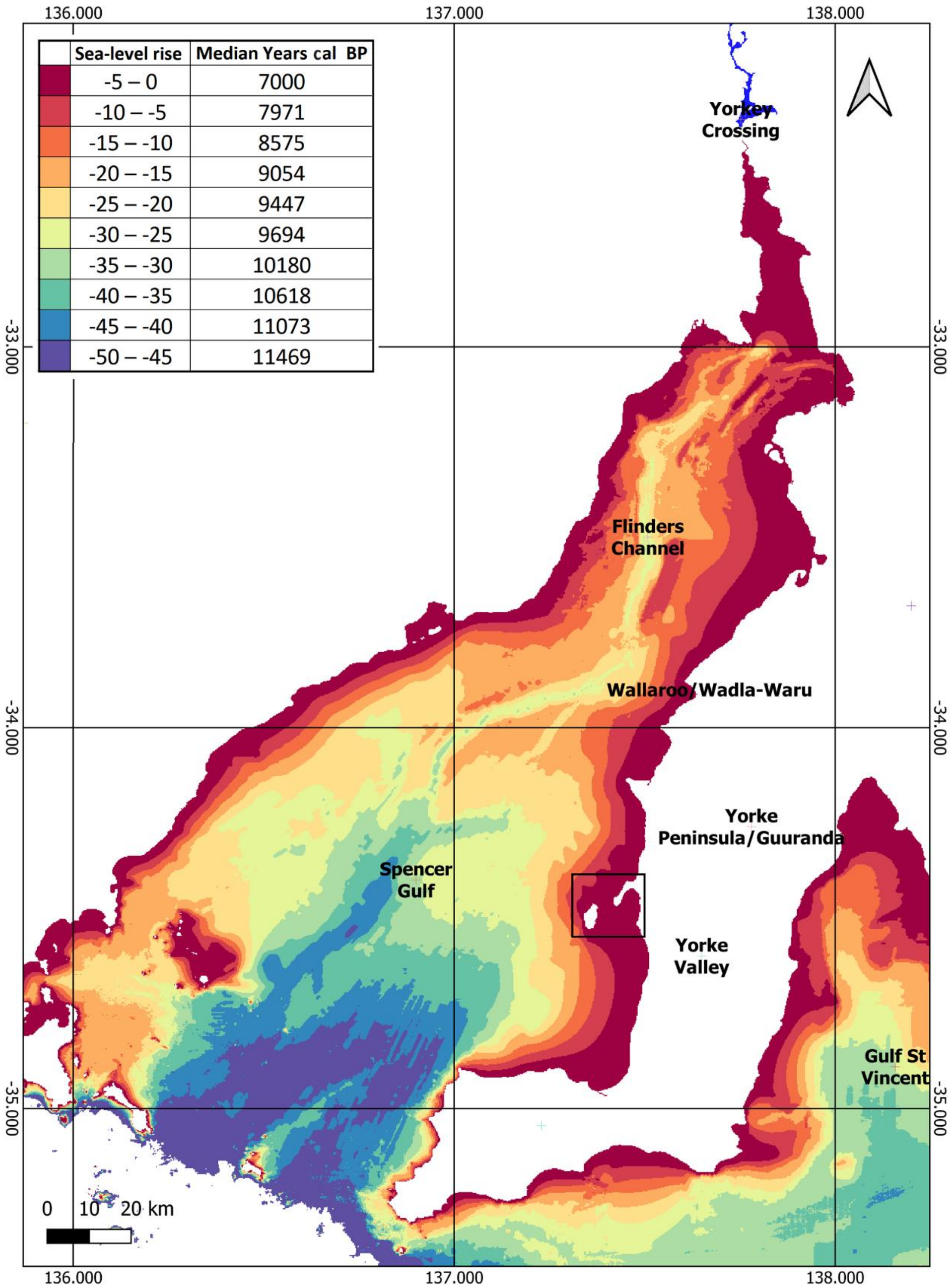


Figure 17: Post LGM marine transgression in Spencer Gulf c.11,500–7,000 cal Years BP (shaded relief in five metre increments).

Table 8 charts the sea-level history for the case study area. Wardang Island/Waraldi and its adjacent islands were connected to the mainland until sea levels are 5 metres below present and the land link is breached (ca 8,506–7,436 cal years BP) (Roberts et al. 2019). Sea levels reach their present height approximately 7,712–6,288 cal BP followed by a 3–4 metre-highstand in this region c.6,000 BP with subsequent relative fall in sea level to current heights because of hydro-isostasy (Belperio et al. 2002:153; Burne 1982; Lewis et al. 2013:129). Samples collected by Burne (1982) were a combination shell, shell hash beds and *Posidonia* sp. (sea grass) root fibres.

Table 8: Holocene Sea-Level History in Spencer Gulf (after Burne 1982).

Period	Change in relative sea level
6,000–4,000 years BP	Highstand of +3 metres to +2 metres
4,000–3,000 years BP	Sea-level fall from +2 metres to +1 metres
3,000–2,000 years BP	Sea-level fall from +1 metres to +0.5 metres
2,000 years BP–Present	Sea-level fall from +0.5 metres to +0 metres

6.2 Environment

The physical geography of Point Pearce Peninsula/Burgiyana (Figure 18) is generally low lying (less than 5m above present sea level) and is thus sensitive to sea level fluctuations (GSSA 2019). The maximum elevation is c.20 metres above sea level in the western and southern parts of the Point Pearce Peninsula/Burgiyana (Whiteway 2009).

Acidic sulphate soils, associated with former mangrove environments, cover the neck of land adjacent to the mainland in the east with a fringe of coastal dunes along the north coast (Fitzpatrick et al. 2014). Shrub land covers the central and northern portion of the west of the peninsula (DEWNR 2017). The surface layer is generally red sandy loams or hard pan calcrete, overlain in coastal areas by mid to late Holocene coastal dunes formed from white calcareous sands.[16] The southern portion of the peninsula has been cleared and is now used as farmland.

The west coast of Point Pearce Peninsula/Burgiyana south of Reef Point has a length of c.12.5 kilometres. The coastal environment varies between sandy beach backed by Holocene coastal dunes with nearshore sea grass (*muuya*) meadows. The dunes are stabilised by shrubs with vegetation greater than one metre (DEWNR 2017). Sandy beaches along the west coast are interrupted by sand

[16]While not specific to the case study area, Wynne (1980:16–17) provided the following general description for the quaternary sediments that cover much of Yorke Peninsula/Guuranda: '…these quaternary sediments include sheet and modular Kunkar (limestone, or calcrete) crusts which are very common in the District, coastal sand dunes comprised mainly of carbonate sand, aeolianite cliffs comprised of windblown sand in various stages of cementation, shelly beach deposits and various alluvial clays and silts'.

and rock beach with inter-tidal rock outcrops and reefs and backshore cliffs dating from the Pleistocene. Coastal shrubs grow behind the elevated ridge.

The inter-tidal and nearshore marine environment adjacent to Point Pearce Peninsula/Burgiyana coast comprise sand and mud flats, sea grass (*muuya*) meadows and rock outcrops and reefs. These environments are home to a rich variety of shellfish, fish, seals, sea birds and marine flora. The rock outcrops and reefs are volcanic in origin but have undergone much change producing a range of rock types since the time of volcanic activity 1,735 Mya (Field Geology Club of South Australia Incorporated 1997:35–36).

On Point Pearce Peninsula/Burgiyana away from the foreshore environment there is little evidence for natural rock outcrops that are found along the coast. The coastal dunes, red sand layers and limestone substrate outlined above are more recent in origin and overlie the basement geological rock formations. As outlined in chapter 4, fish and shellfish species are/were important in the culture and economy of the Narungga community who harvested a wide variety of species from the coastal and marine environment. The marine environment also included risks, for example, from sharks.

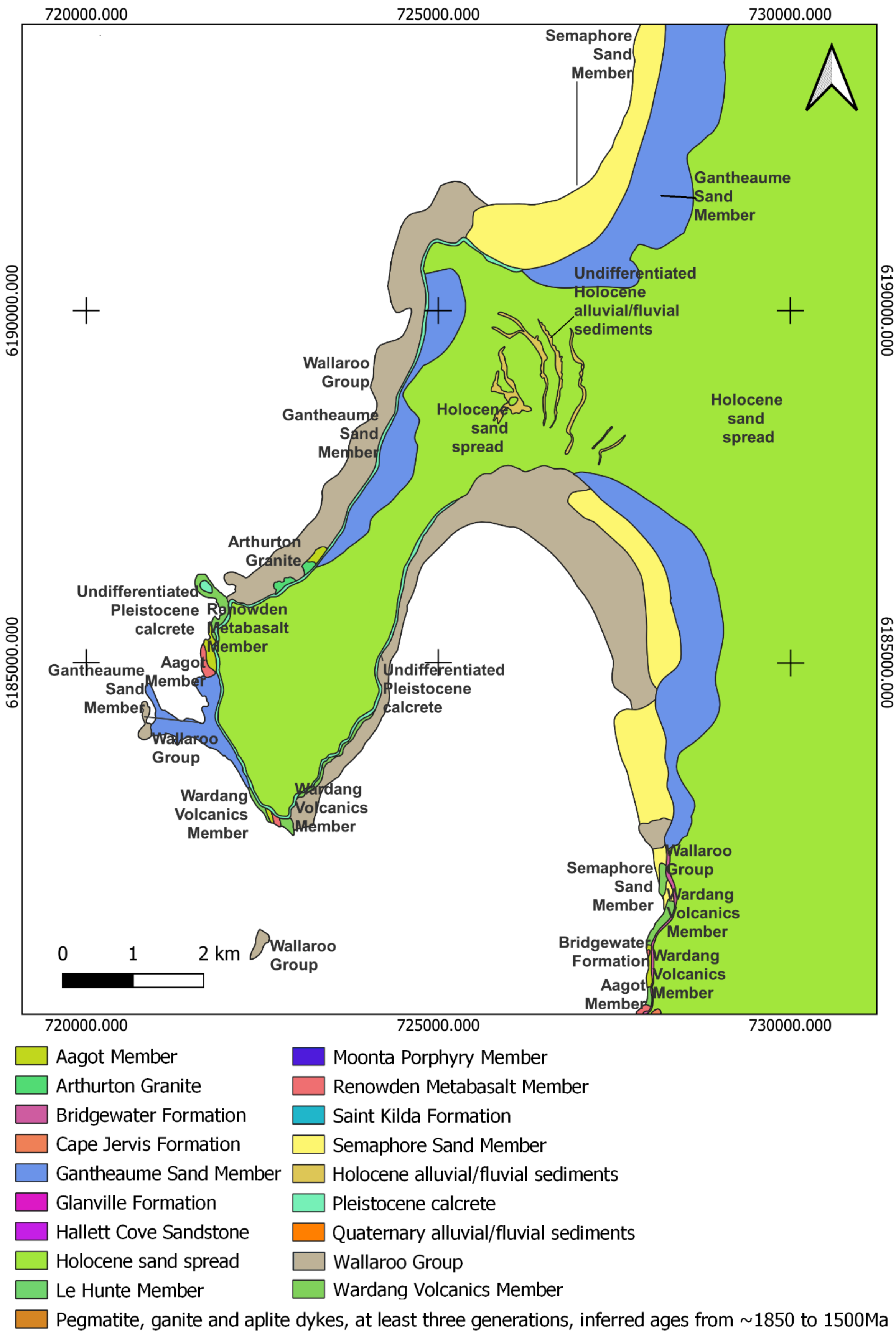


Figure 18: Point Pearce Peninsula/Burgiyana case study area coastal geological formations and Holocene sand spread (Gantheaume Sand Member, Semaphore Sand Member, Holocene alluvial/fluvial sediments) overlying Pleistocene calcrete (GSSA 2019). See Appendix 6 for full geological descriptions.

Apart from Kangaroo Island, Wardang Island/Waraldi is the largest island off the Yorke Peninsula/Guuranda coast and in present times the island is c.4 kilometres from Point Pearce Peninsula/Burgiyana which is the nearest point on the mainland (Department for Environment and Heritage 2010:19). Wardang Island/Waraldi has a length (north/south) of c.9 kilometres and width (east/west) of c.4 kilometres and with a coastline c.19 kilometres in length (Department for Environment and Heritage 2010:15–19). Wynne (1980:174—see also Bone 1978, 1984, 1985) stated that Wardang Island/Waraldi contains 'the wide variety of coastal types which one would expect to be associated with the different wave energy levels; and this makes it an invaluable miniature of the Yorke coast' (Figure 19) (GSSA 2019). As Wynne (1980:175) described:

> Wardang Island has a medium to high energy coast on its west side, and a low energy coast on its eastern, lee side. The western coast contains several pocket beaches separated by rocky headlands, and there are some quite large sand drifts behind these…The low lying and swampy east coast has samphire areas and a few scattered mangrove trees, and shallow sand and mudflats offshore.

Wardang Island/Waraldi and adjacent islands area are/were economically and culturally significant places for the Narungga community. The islands were places to gather food such as shellfish, sea bird eggs, penguins, bandicoots and fish (Black 1920; *South Australian Register*, 9 March 1884, p. 9). Wardang Island/Waraldi is also important in Narungga 'Dreaming' and has contemporary significance in association with the activities of Point Pearce /Burgiyana Mission and its residents on the island (Fowler et al. 2014; Roberts et al. 2013).

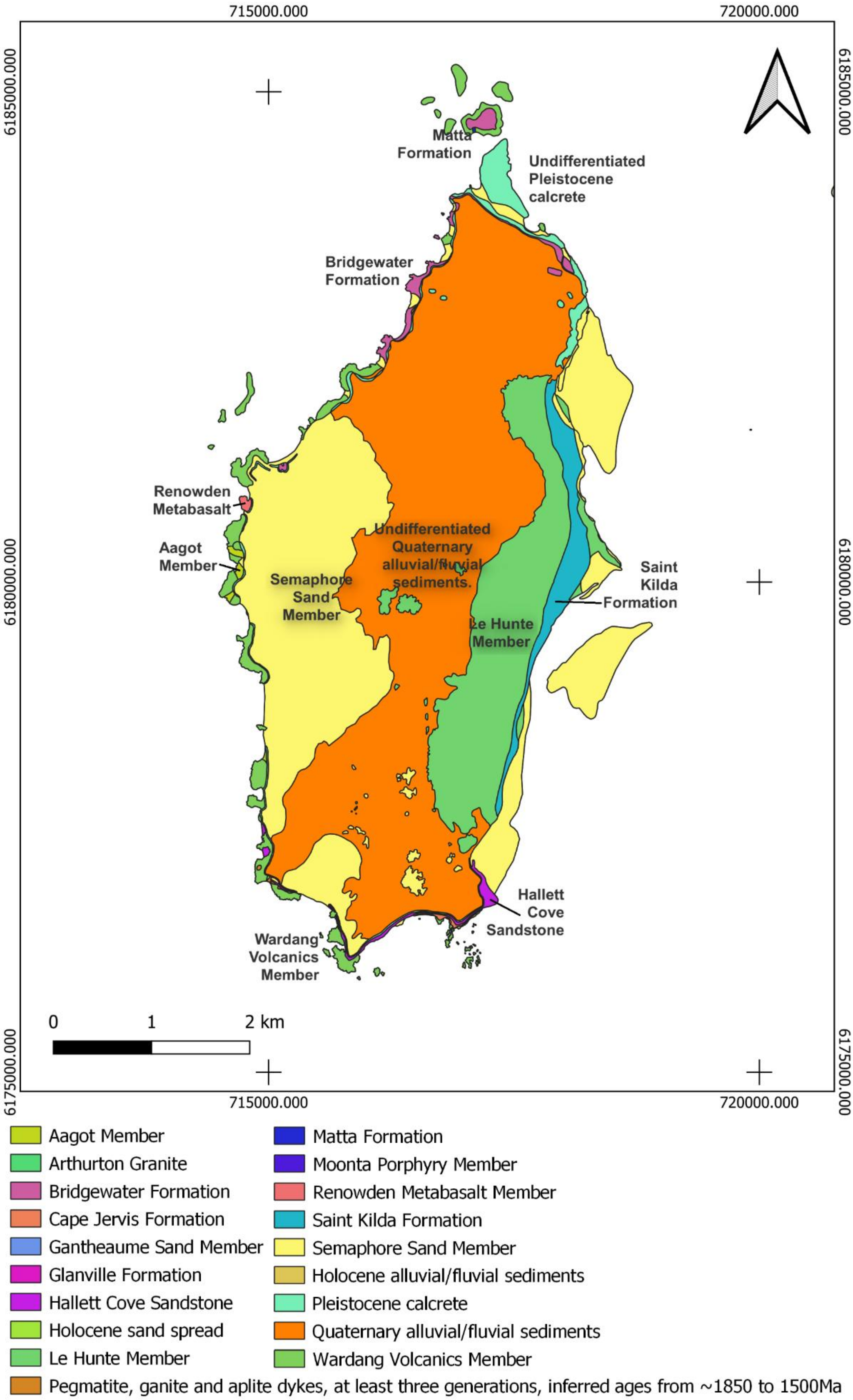


Figure 19: Wardang Island/Waraldi case study area coastal geological formations and surface soil groups (GSSA 2019). Note distinctive sediment history compared to adjacent Point Pearce Peninsula/Burgiyana (Figure 18).

Fieldwork for this research included survey of the range of environments that occur within the case study area. Table 9 lists each environmental zone and associated Narungga heritage outlined in the next sections.

Table 9: Point Pearce Peninsula/Burgiyana coastal environmental zones.

Table of Coastal Environments—Point Pearce Peninsula/Burgiyana[17]					
Location	**Length**	**Inter-tidal and Nearshore**	**Foreshore**	**Backshore**	**Heritage Sites**
North Coast					
Hollywood Beach and north coast.	2 kilometres.	Sand and mud flats.	Sandy beach terminating at sand spit adjacent to reef point in the north west.	Coastal dunes.	Hollywood Beach. The 'Willow' well and water tank. Wood and Westell (1998) site 17.
Reef Point and headland.	1 kilometre.	Inter-tidal rock outcrops and reefs.	Sandy rock strewn beach.	Cliff running north/south backed by coastal shrub land.	Galadri—see Roberts et al. (in prep: 230–232.)
West Coast					
North west coast sandy beach adjacent to Reef Point.	1.5 kilometres.	Sea grass (*muuya*) meadows.	Sandy beach.	Coastal dunes.	Wood and Westell (1998) sites 18–20; hearths, reed beds and soak recorded during this survey and discussed in earlier sections.
Central coast to Point Pearce/Burgiyana Fish Trap.	4.5 kilometres.	Inter-tidal rock outcrops and reefs and sea grass (*muuya*) meadows.	Intermixed sandy and rock strewn beach.	Sandy beach backed by coastal dunes and coastal cliffs backed by coastal shrub land.	Wood and Westell (1998) sites 21, 23, 28; cliff top campsite, Clem Graham Junior's shack, Clem O'Loughlin's shack and adjacent site complex, hearths and earth ovens recorded during this survey and discussed in earlier sections.

[17]Compiled with additional information, including Narungga place names and fishing activities cited in Roberts et al. (in prep. 220–221.)

Point Pearce/Burgiyana Fish Trap to The Point/Bungya (Pungya).	6.5 kilometres.	Inter-tidal rock outcrops and reefs and sea grass (*muuya*) meadows.	Sandy rock strewn beach.	Cliff running north/south backed by coastal shrub land.	Wood and Westell (1998) sites 29–32; Point Pearce/Burgiyana Fish Trap, hearths, shacks, Dolly's Jetty and other landings, Dead Man's Island/Mungari, hearths and earth ovens, lithic raw material sources (primarily quartz) recorded during this survey and discussed in earlier sections.
East Coast					
The Point/Bungya (Pungya) to Boys Point/Yadri (Yuddorie, Yudderie, Yudrie).	7 kilometres.	Tidal and mud flats.	Flat sand beach.	Ridge backed by farmland and scrubland.	Fishing grounds (see Roberts et al. in prep: 218–220.)
South Coast					
The 'Creek'/Winggara (Wingarra, Wingara, Wingera).	2 kilometres.	Tidal and mud flats.	Estuary.	Low lying swamp land.	The 'Creek' fishing grounds—see text.

6.3 Ethnohistorical Sources

Ethnohistorical sources that documented aspects of the economy, social organisation, language and beliefs of the Narungga people are outlined in Chapter 4. The sources reference both intangible heritage and material culture of Yorke Peninsula/Guuranda. Locations referenced in these sources were categorised according to site type and mapped in GIS. Appendix 1, for example, illustrates the locations (not exhaustive) and distribution of lithic tool types recorded in these sources as well as the location of raw material sources used for tool manufacture. Collating this data and mapping in GIS provides the ability to view the Narungga Aboriginal heritage (both tangible and intangible) on Yorke Peninsula/Guuranda at various scales. Figure 20 provides a 'peninsula-wide' view.

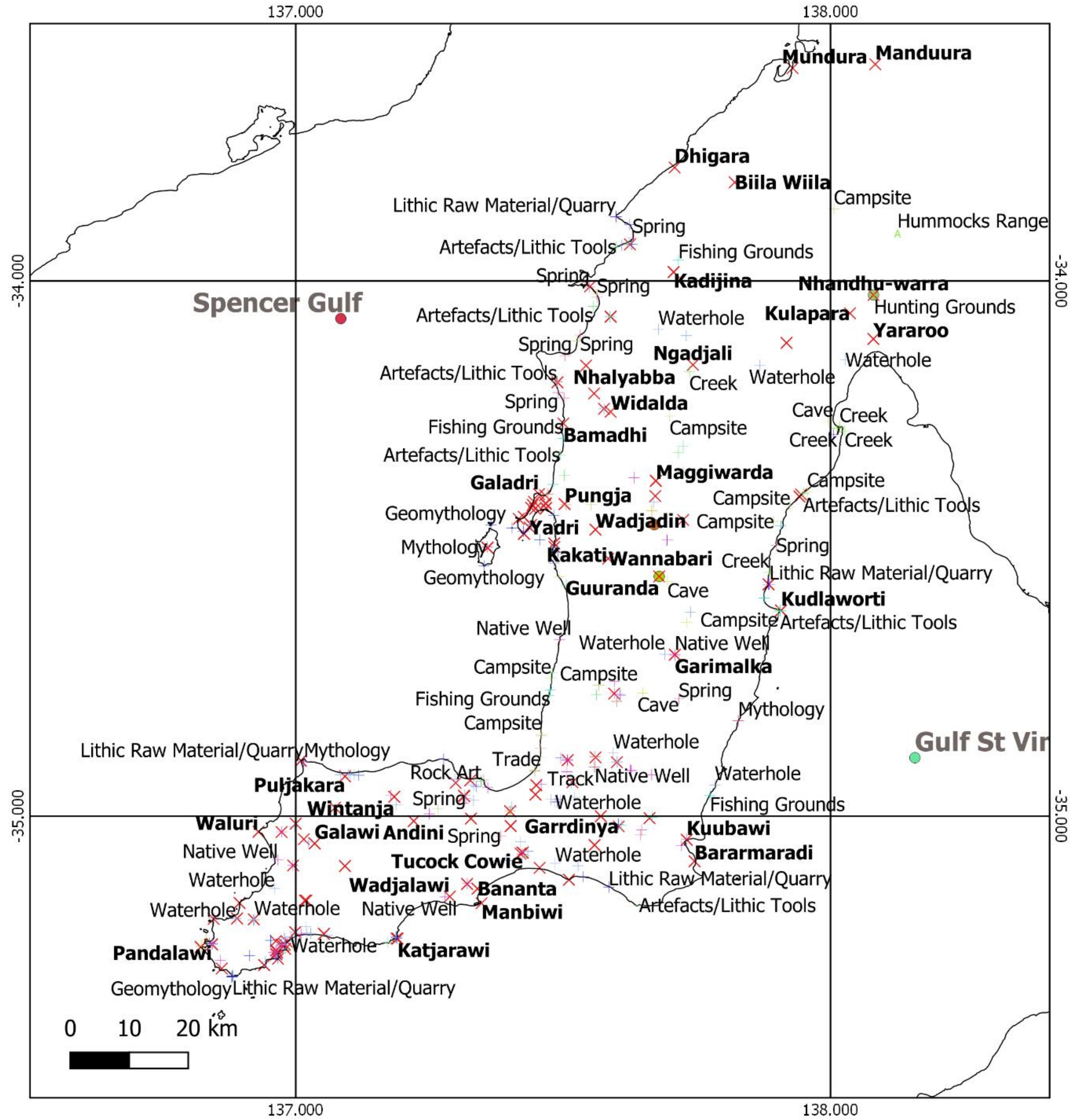


Figure 20: Narungga localities (not exhaustive) referenced in ethnohistorical sources (Narungga place names in bold).

6.4 Prior Surveys

Desktop survey also included reviewing data for prior archaeological research undertaken on Yorke Peninsula/Guuranda (see chapter 4.9). As previously noted, Wood and Westell (1998) and Wood et al. (2003) conducted two of the most comprehensive archaeological surveys of Yorke Peninsula/Guuranda. Wood and Westell's (1998) archaeological survey of Yorke Peninsula/Guuranda included Point Pearce Peninsula/Burgiyana. Sixteen archaeological sites in these surveys were recorded in the case study area—see appendix 2 for full site descriptions. Wood et al.'s (2003) survey of Yorke Peninsula/Guuranda included an archaeological survey of Wardang Island/Waraldi where 16 archaeological sites/complexes were identified and recorded—see appendix 3 for full site descriptions.

Spatial data and site information from these surveys were also collated as archaeology layer in GIS. Figure 21 illustrates general site locations recorded in these surveys.

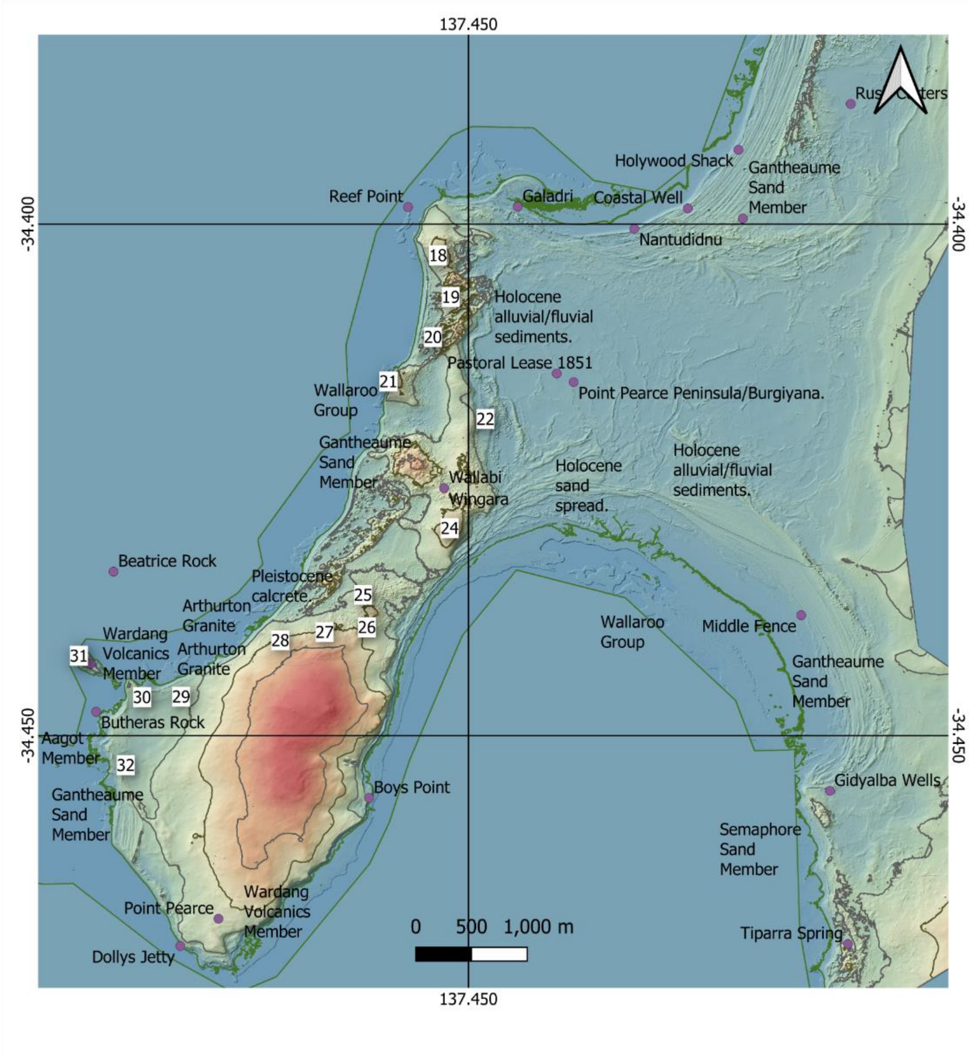


Figure 21: Case study area prior survey general site locations (Wood and Westell 1998). Raster map created in QGIS using 1 metre Lidar Data overlaying hillshade representation of same dataset (z factor exaggeration *10) to highlight topography associated with the geological and sand formations (Zang 2006). Five metre contour lines extracted from raster dataset. Placenames sourced from SA Gazetteer.

6.5 Burgiyana Fieldwork

Fieldwork for this research was undertaken on Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi over a total of thirteen days. Narungga/Point Peace Aboriginal Corporation community representatives participated in and guided the fieldwork and identified and provided cultural context to many of the sites that were recorded. Twenty-seven localities were surveyed during the fieldwork on Point Pearce Peninsula/Burgiyana. Archaeological sites that were recorded included coastal sites and inland sites and more recent sites associated with the heritage of the Point Pearce/Burgiyana former mission and township. Nine marine shell, one sediment sample and one sample of burnt calcrete were collected for radiocarbon dating from five of the Narungga heritage site on Point Pearce

Peninsula/Burgiyana. Figure 22 displays general site locations recorded during fieldwork and associated physical geography and topography (5 metre contour lines) for Point Pearce Peninsula/Burgiyana.

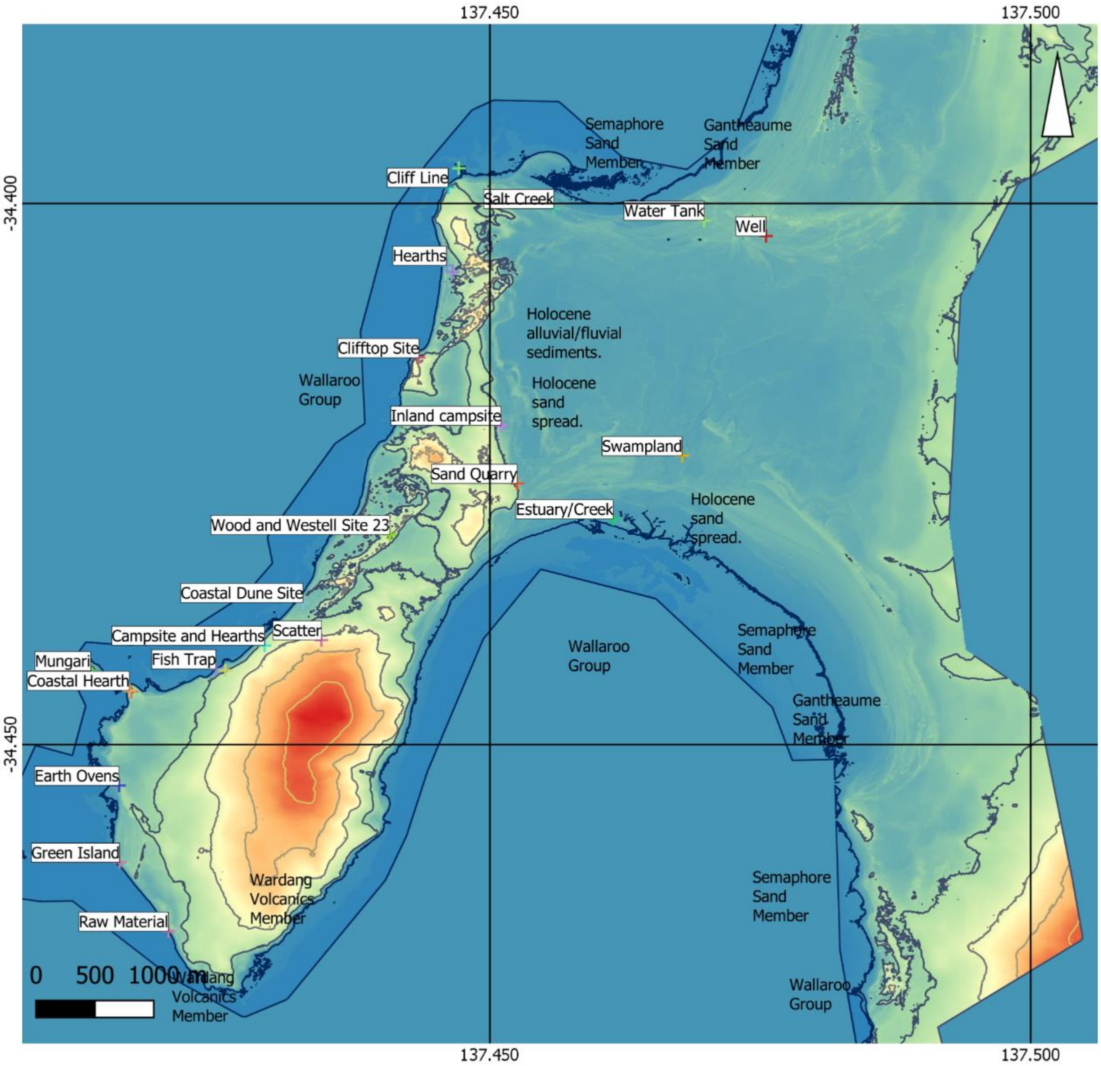


Figure 22: Point Pearce Peninsula/Burgiyana Narungga heritage survey. Map created in GIS using 1 metre resolution Lidar survey data (contours lines are in 5 metre increments).

6.5.1 Willows Well

The northern portion of Point Pearce Peninsula/Burgiyana is important for understanding the availability and location of a regular supply of potable water from groundwater sources in coastal areas. The physical geography of the north coast is predominantly sandy beach c.2 kilometres in length. The beach is backed by Holocene coastal dunes which stretch from the Hollywood Beach near the mainland to Reef Point in the west. The beach and dunes are formed of unconsolidated white bioclastic quartz-carbonate formed during the Holocene (Semaphore Sand Member [Zang 2006]). Potable water is/was available in wells and soaks at shallow levels in this region. Anon. (1879), for example, recorded 15,000 gallons of freshwater per day were drawn from wells at Point Pearce Peninsula/Burgiyana for stock and household use.

Narungga and Point Pearce community members who participated in fieldwork highlighted Willows Well as a local freshwater source. The well and water tank (Figure 23) were built to provide water supply to the Point Pearce Mission and for its farming activities once the mission was established. Water from the well was supplied to the township by pipeline via staging tanks with some of the tanks decorated with images by Narungga people who helped in the construction of this infrastructure (Amy Roberts pers. obs., Wood and Westell 1999).

Figure 23: The 'Willows' Well (top left), windmill (top centre) and tank with Michael Walker in foreground (top right). Disused water tank (bottom), north coast Point Pearce Peninsula/Burgiyana 17/11/2016.

Whilst these structures post-date European invasion—the availability of freshwater all year round meant this region was also important for Narungga people and their economy prior to European invasion. Narungga people camped in the area when the mission station was first established in 1868 (Graham and Graham 1987; Wood and Westell 1999). Freshwater at this location was also a factor in choosing Point Pearce Peninsula/Burgiyana as the location for the Aboriginal mission station (Krichauff 2008). Kühn to Reichel (1867) (in Krichauff 2008:166) recorded:

> …there is good land and very good water, there is a well which has water year in and year out...the Reserve is by the sea, a lot of grass for stock, timber and stone for building, also fish and kangaroos, wallabies, wombat, possum…

Water influences where people to choose to live. Rainfall, topography, hydrology and the water table are all important for understanding the availability of potable water at this coastal location and how this may have changed over time with changes in climate and sea level (see Davidson-Arnott 2012). Water at this location is likely linked to activities associated with the other Narungga heritage sites on Point Pearce Peninsula/Burgiyana and is part of the broader network of freshwater sources on Yorke Peninsula/Guuranda outlined in Chapter 4. Hydrology flow accumulation modelling in Grass GIS illustrates the contribution of topography as a factor in understanding the location of freshwater sources as well as the contribution of rainfall runoff to landward-side coastal erosion and the impact this has on Aboriginal heritage (Figure 24).

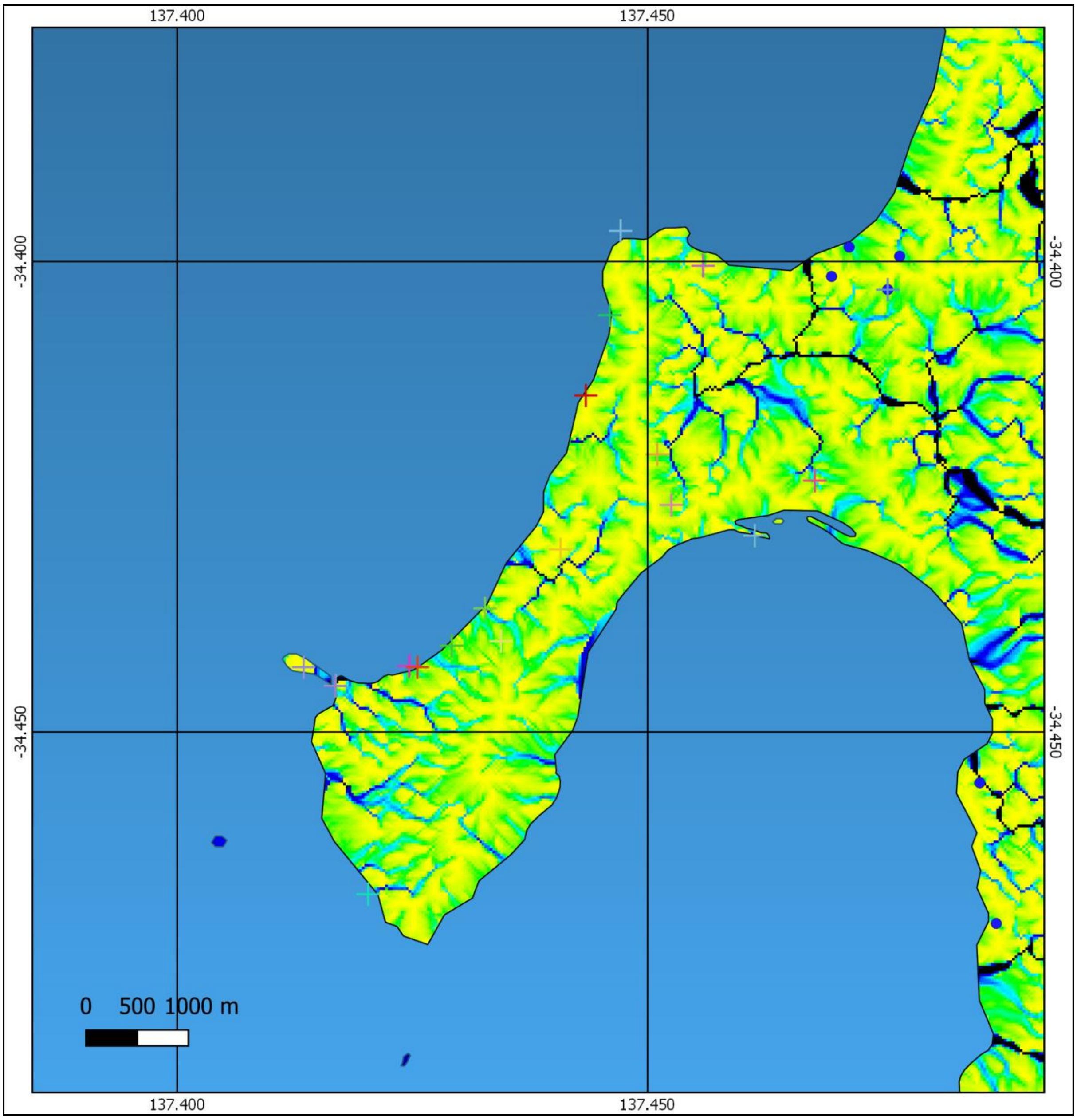


Figure 24: Flow accumulation hydrology modelling for the Point Pearce Peninsula/Burgiyana region. Modelled in Grass GIS software utilising 30 metre DEM data for the Point Pearce Peninsula/Burgiyana region.

6.5.2 Reef Point

The north coast of Point Pearce Peninsula terminates at Reef Point, an elevated headland with a maximum height of 16 metres above present sea level. The point is formed of Pleistocene clays and calcrete fringed by actively eroding low cliffs (Figure 25). Inter-tidal rocky reef platform surrounds the point and extends 320 metres out from the present-day shoreline. The reef system is likely an extension of the former shoreline which has been impacted by coastal erosion that is on-going. Significant storms that preceded fieldwork in 2016 contributed to the coastal erosion that was recorded during this research and also impacted some archaeological sites illustrating the risk to the physical environment and heritage in coastal settings from storm events.

Small channels and rock pools (Figure 25 top) occur throughout the rocky reef system are similar to coastal reefs that were used as natural fish traps recorded in other locations on Yorke Peninsula/Guuranda (see Mollenmans [2014]; Roberts et al. [2015.]). The reef system is also the habitat for rocky reef shellfish species including *Turbo* spp. and *Nerita* spp. (Figure 25 centre and bottom inset) which were an important food resource for Narungga people with the shell being a common component of coastal archaeological assemblages near rocky coasts on Yorke Peninsula/Guuranda.

Figure 25: Reef Point cliff line looking south with adjacent inter-tidal reef system (top inset) 17/11/2016. Reef system habitat includes *Turbo undulata* and *Nerita melanotragus* (centre inset) and *Turbo* spp. (bottom inset)

6.5.3 Reedbed and Hearths

This site on northwest coast of Point Pearce Peninsula/Burgiyana included remnants of 3 hearths located behind foreshore dunes adjacent to a sandy beach 1.5 km in length with nearshore sea grass habitats (Figure 26). The sandy beach lies between Reef Point to the north and a rocky headland in the south. Holocene transgressive dune fields have developed inland from the coast (Gantheaume Sand Member) (Zang 2006) (Figure 27).

Figure 26: View from cliff top artefact scatter looking north to Reef Point 18/11/2016.

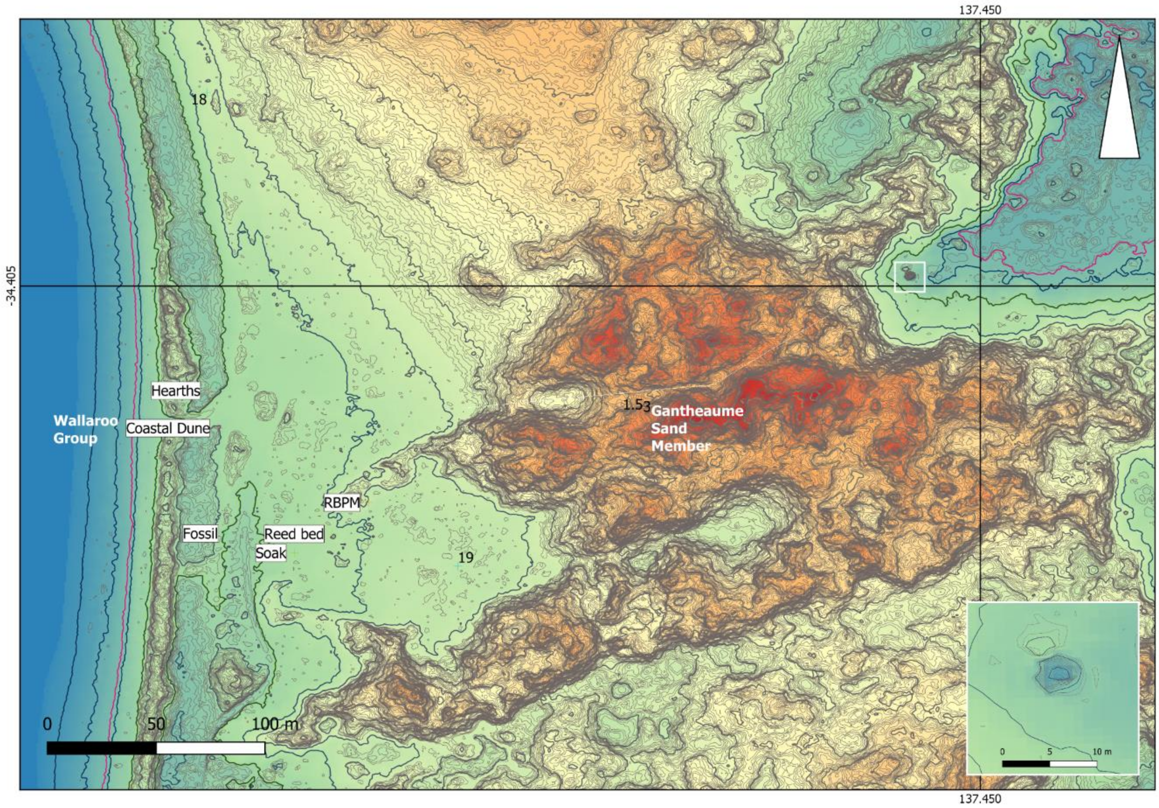


Figure 27: Hearths and reedbeds on the northwest coast Point Pearce Peninsula/Burgiyana. Map includes general location of site 18 (north) and site 19 (east) from Wood and Westell (1998) survey. Map was created in GIS using 1 metre resolution Lidar survey data and illustrates the inland extent of Holocene dune fields (Gantheaume Sand Member) with location of possible 'well feature' (inset). Bold contour lines are in 1 metre increments, fine contour lines are 0.1 metre increments.

Evidence for hearths is primarily charcoal, charcoal colouration of the soil, hearthstones and exposed limestone substrate which show evidence of burning (Figure 28–30). Two hearths were partially covered by overhanging vegetation (indicating that these campfires pre-date the vegetation). The third campfire is bounded by stone including brick indicating more recent use.

Figure 28: Hearth 1 17/11/2016.

Figure 29: Hearth 2 17/11/2016.

Figure 30: Hearth 3 17/11/2016.

The campfires are situated between Wood and Westell's (1998) site 18 (north), site 19 (east) and site 20 (south) also indicating continuing use at this location over time. Faunal remains recorded during these surveys were all rocky shore shell species including black periwinkle (*N. melanotragus*), warrener (*T. undulata*), common dog whelk (*Cellana tramoserica*), tulip shell (*Pleuroploca australasia*) and common limpet (*Celina tramoserica*).

Vegetation at this location includes Coastal Sword Sedge (*Lepidosperma gladiatum*) growing in red loam topsoil within a clearing 85 metres * 60 metres (Figure 31). The red loam soil layer is apparent elsewhere on the peninsula and is the underlying local soil substrate obscured in places by Holocene foreshore dunes and dune fields.

Figure 31: Coastal sword sedge (*Lepidosperma gladiatum*).

Reeds, rushes and sedges are important economic plant species in Aboriginal cultures as a source of food and fibre (Clarke 2014). Reeds were important for Narungga for fibre processing to produce twine used in the manufacture of nets (Tindale 1936:57). Rushes were also used in thatching wurleys and at the mission to manufacture mats and baskets (McArthur 1876; Special Correspondent 1874). Reeds and sedges were also recorded in other areas during this survey, generally in sparse numbers however a number of references are made in historical sources to harvesting rushes at Point Pearce/Burgiyana that indicate rushes were more abundant in the area in the past (Anon. 1867:2; Anon. 1876). DEWNR (2017) records for pre-European vegetation also identify an area of sedge land growing in a strip of land between Point Pearce township and adjacent samphire marsh. This species is recorded as *Gahnia lanigera*. The plant species grows in wet soils and as such the presence of these plants may also indicate areas where fresh-water soaks are located.

6.5.4 Clifftop Artefact Scatter

The clifftop artefact scatter is located on the northwest coast of Point Pearce Peninsula/Burgiyana. This site is located on top of a low headland formed of compacted clay surface (Hindmarsh Clay) c.13 metres APSL that forms the boundary between a 1.5 km long sand beach to the north (see previous section) and rock-strewn beach to the south with inter-tidal rocky reefs and backshore coastal shrub land growing in red soil/clay substrate). The cliff top location of the site provides an outlook over gulf waters as well as vistas of the coastline to the north and south (Figure 32).[18]

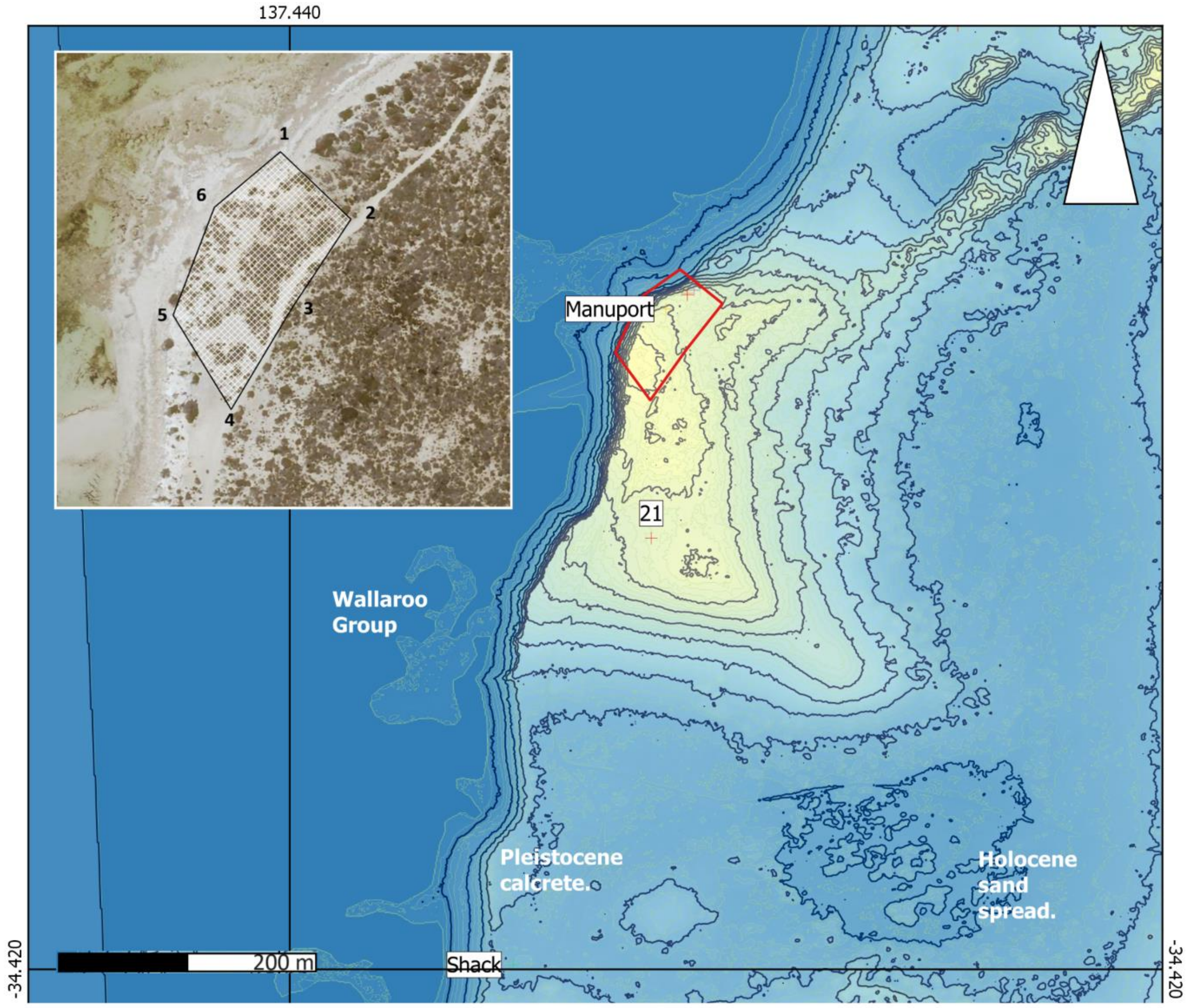


Figure 32: Clifftop artefact scatter northwest coast Point Pearce Peninsula/Burgiyana site map. Map includes general location of site 21 (south) from Wood and Westell (1998) survey. Map was created in GIS using 1 metre resolution Lidar survey data with 1 metre contour lines. Clifftop site is 13 metres APSL with surrounding Holocene sand spread < 5 metres APSL.

The area surveyed (ca 30 metres east/west * 140 metres north/south) was bounded by the cliff-line to the west, a north/south running track to the east and an east/west running track to the south which linked the north track to the beach. The surface on top of the headland has a slight incline sloping downwards towards the edge of the cliff and it appears that water run-off (when raining or during storms) is eroding the surface soil. Numerous retouched flakes (chert and quartz) as well as bottle glass (also possibly flaked) were recorded (Figure 33).

[18] Cliff watching is a recognised Narungga fishing method—see Snell (in Griffiths (1988: 128). Coastal cliffs provide vantage points to survey adjacent waters for fish as well as to warn of the presence of sharks—see further discussion below in Shacks section.

Figure 33: Examples of flaked stone from the headland.

In addition to the lithic artefacts, stone raw material, warrener shell and operculum (*Turbo* spp.) were recorded at this site. The site is situated between Wood and Westell (1998) site 20 (north) and site 21 (south).

6.5.5 Shack Artwork

The late Clem Graham Junior's shack (Figure 34) is situated on the headland overlooking Spencer Gulf. The shack is made from corrugated iron sheeting and is in a state of disrepair with gaps in the wall and the ceiling exposing the interior to the elements. An interior wall of the shack includes fish motif artwork painted by the late Clem Graham Junior. The images were painted/drawn using a black paint or ink which is now fading and in some places parts of the image have been lost (Figure 35). Narungga representative Carlos Sansbury requested the image be recorded in this research to help ensure a record of the artwork is preserved for posterity. Figure 36 provides a sketch of the image reproduced in Adobe Photoshop.

Figure 34: The late Clem Graham Junior's shack looking west 19/11/2016.

Figure 35: Fish motif artwork panel on interior wall of the shack.

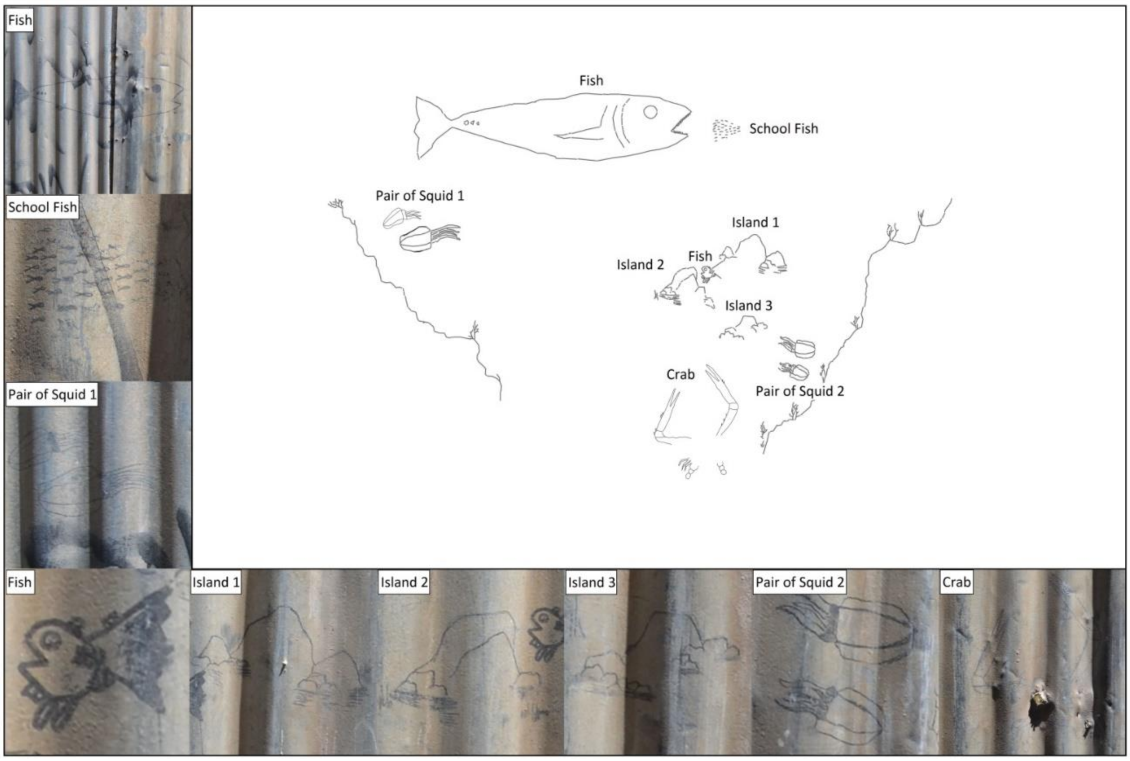


Figure 36: Fish motif artwork sections reproduced in Adobe Photoshop.

Fishing and camping along the coast are important social activities for the Narungga and Point Pearce communities. Carlos Sansbury (Interview 19/11/2016) stated that community people would hold family gatherings camping along the adjacent coast fishing and swimming in the waters adjacent to the shack. The elevated shack site provided a vantage point to watch for fish and warn of the presence of sharks.

6.5.6 Campsite Complex

This site is located on the west coast of Point Pearce Peninsula/Burgiyana north of the late Mr Clem O'Loughlin's shack (Figure 37). Artefacts are exposed in a compacted red soil layer forming a clearing/deflation zone within a Holocene coastal dune field (Gantheaume Sand Member). The dune field at this location extends 400 metres inland from the present shoreline rising to 15 metres APSL and adjoins scrubland to the east.

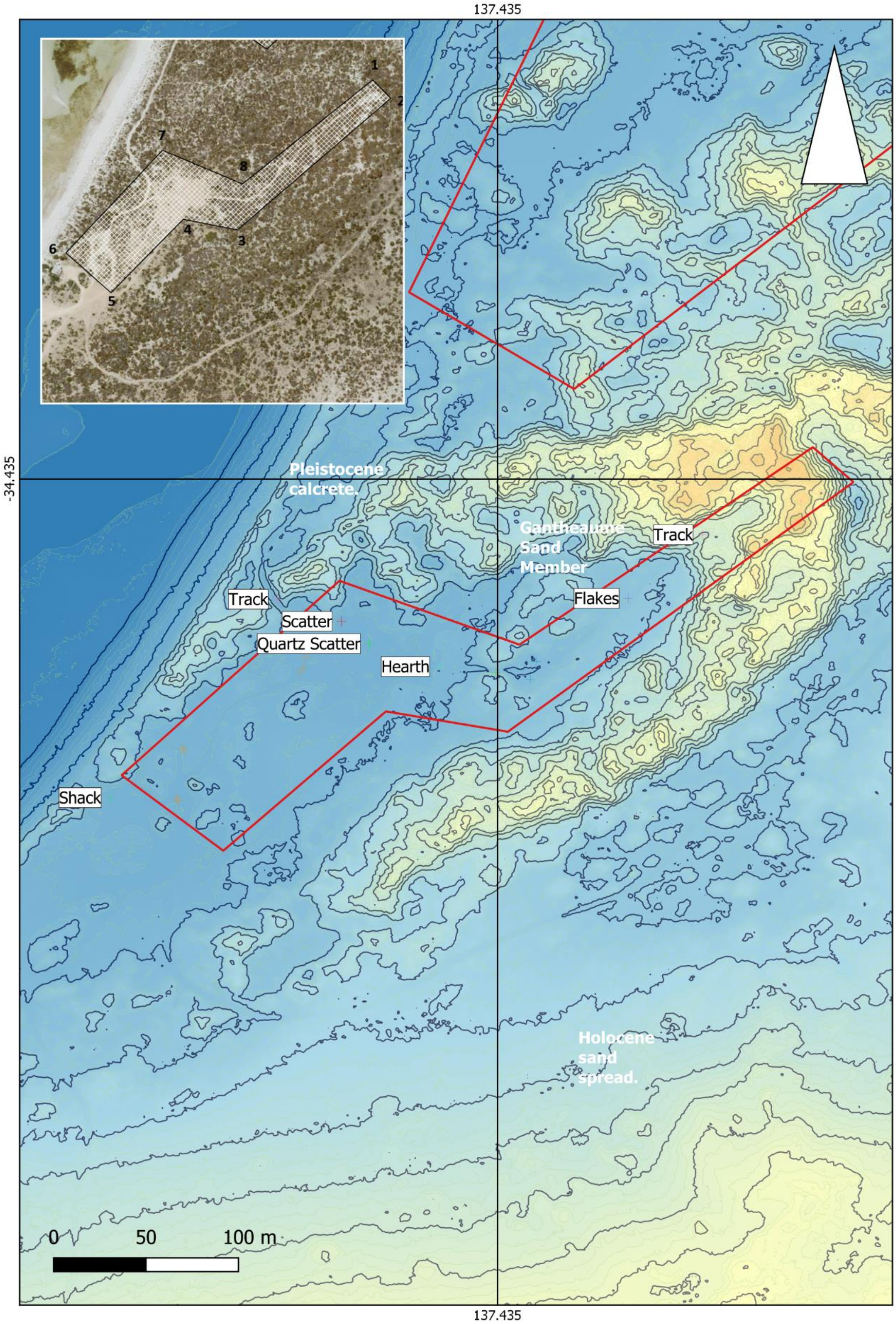


Figure 37: Site map—the late Clem O'Loughlin's shack and adjacent site.

Cultural material included quartz and chert retouched flakes, silcrete grinding stones and hearthstones. Faunal material were primarily rocky coast and sandy beach shell species including cockle (*Katelysia* spp.), warrener (*T. undulata*), common limpet (*C. tramoserica*) and striped periwinkle

(*A. porcata*). Overall, the clearing has been heavily used by vehicles and there are multiple tracks that traverse the site. Small pockets of remnant vegetation remain indicating areas which may have undergone less disturbance (Figure 38).

Figure 38: Clearing in survey area looking south 24/11/2016. Inset—lithic material and shellfish recorded within the clearing survey area.

Cultural material was also abundant along a section (ca 220 metres) of vehicle track (Figure 39) heading northeast through the dune field. Heavy vegetation cover adjacent to the track made it difficult to assess the extent of the site in this area. Undisturbed areas within this site may be fruitful for excavation as cultural material was both scattered on the surface and eroding from the surface soil layer.

Figure 39: Track survey area looking east 24/11/2016. Adrian Mollenmans in background. Inset—lithic retouched flake (top), hearthstone (centre) and grindstone (bottom) within the track survey area.

A striped periwinkle (*A. porcata*) sample (Figure 40) was collected from this site and provided a date of 112.4 +/- 0.3 % cal BP (Wk-56693) providing evidence for recent use and significance for a site which may have greater antiquity. Artefacts recorded during our survey are situated within a pre-Holocene soil layer which has been exposed in the clearing and along the track where erosion has taken place.

Figure 40 Striped periwinkle (*A. porcata*) sample collected 24/3/2023. Age result 112.4 +/- 0.3 % cal BP (Wk-56693).

6.5.7 Coastal Hearths

This site (Figure 6.25) is located on the west coast of Point Pearce Peninsula/Burgiyana north of Mrs Rose Sansbury's shack. The site is 7–8 metres APSL and consists of an extensive scatter of artefacts and shell remains exposed over an area adjacent to a low coastal ridge. Grasses and coastal shrubs grow in thin red soil layer and overly Pleistocene calcrete substrate. The ridge overlooks a coastal beach with inter-tidal rock outcrops of Wallaroo Group, Aagot member and Arthurton Granite geological formations (Figure 41–43). The total area surveyed was 0.01 km^2 and is within the site 28 survey area previously undertaken by Wood and Westell (1998). Two tracks bisected the site which have contributed to site disturbance and caused exposure of some of the cultural material.

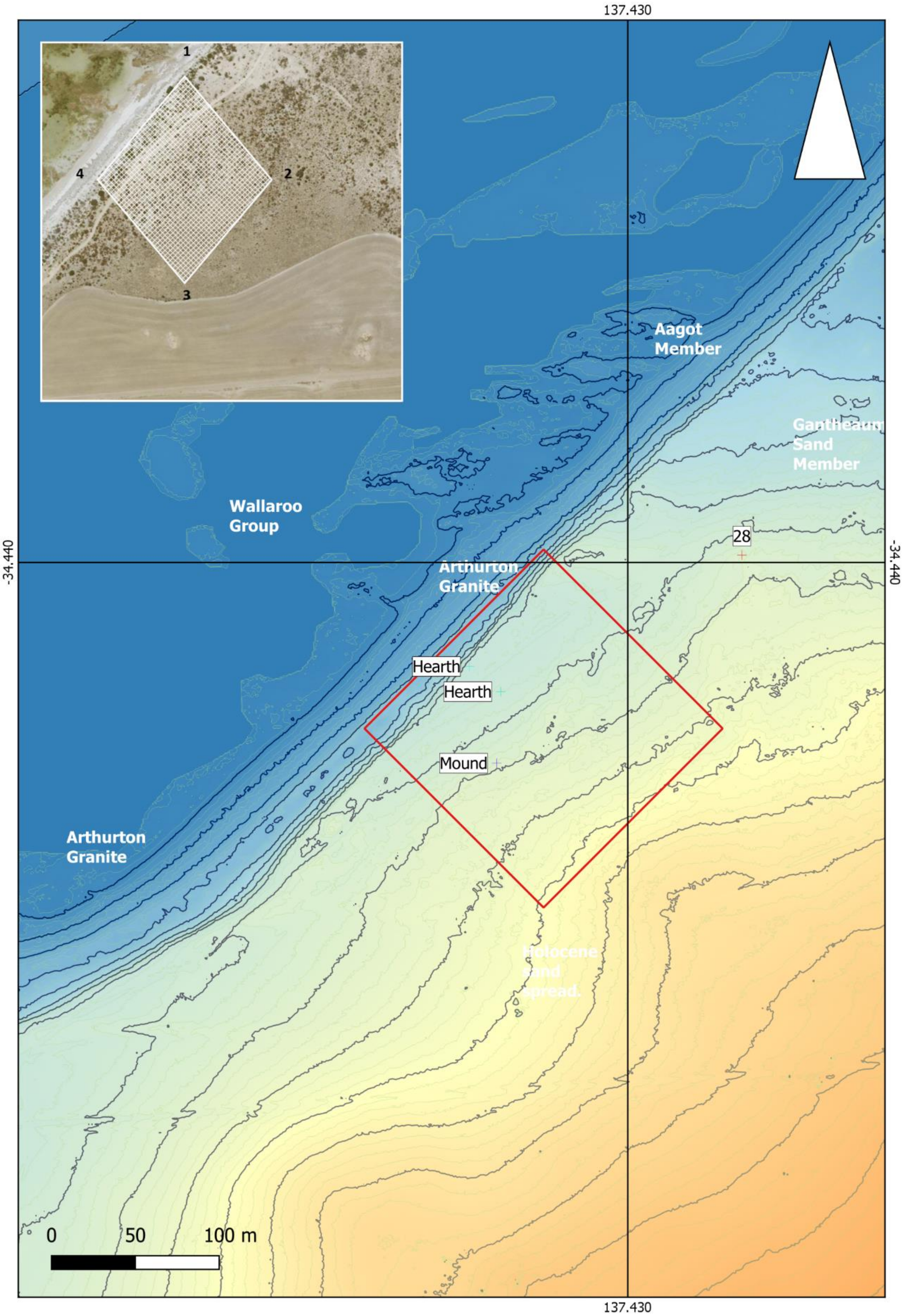


Figure 41: Coastal hearths site on west coast of Point Pearce Peninsula/Burgiyana with location of inter-tidal rock outcrops of Wallaroo Group, Aagot member and Arthurton Granite geological formations. Map was created in GIS using 1 metre resolution Lidar survey data with 1 metre contour lines. Site is 7–8 metres APSL.

Figure 42: Site view looking west to ridge line with exposed Pleistocene calcrete substrate 25/11/2016. Adjacent beach and rocky reef in background.

Figure 43: View of site adjacent to vehicle track with cultural material located in exposed topsoil layer adjacent to the coastal ridge looking south 22/3/2023. Elder Rex Angie and Professor Lester-Irabinna Rigney in foreground.

Cultural material recorded at the site included quartz and chert lithic raw material, cores and retouched flakes, hearthstones and limestone substrate with evidence of burning. Faunal remains included whelk (*C. spengleri*), warrener (*T. undulata*) and black periwinkle (*N. melanotragus*) (Figure 44–Figure 47). Cultural material was exposed on the surface as well as embedded in the topsoil layer indicating that there is some depth to the assemblage. Hearthstones or burnt limestone substrate were also evident in surrounding vegetation. Five shell samples were collected for radiocarbon dating from this site (Table 10). Calibrated age-ranges (95.4% probability range) for the site range from recent times to >7,000 years BP.

Figure 44: Quartz flake 25/11/2016.

Figure 45: Chert core 22/3/2023.

Figure 46: Warrener (*T. undulata*) and bottle glass 25/11/2016.

Figure 47 Hearthstone 25/11/2016.

Table 10: Calibrated age-ranges (95.4% probability range) for coastal hearts site.

Sample Code	Wk Code	Species	Age Cal Years BP (95.4%)
B6S1 warrener	56677	*Turbo* sp.	4,450–4,060
B6S2 whelk	56678	*C. spengleri*	3,200–2,840
B6S3 warrener	56679	*T. undulata*	3,250–2,870
B6S4 periwinkle	56680	*N. melanotragus*	7,790–7,470
B6S5 warrener	56683	*T. undulata*	105–105

6.5.8 Fish Trap

Point Pearce/Burgiyana fish trap site (Figure 48) was previously surveyed in 2012 and 2014 (Mollenmans 2014; Roberts et al. 2015). The fish trap (Figure 49) constructed from stone extends into the sea perpendicular to the shoreline. The fish trap is situated within an outcrop of Arthurton Granite which is the stone used in the construction of the fish trap. The adjacent environment includes inter-tidal and near shore rocky reefs and rock outcrops. The foreshore is primarily sandy beach backed by foreshore dunes which marks the boundary of the contemporary tidal zone. Coastal dunes continue behind the low ridge terminating at a second higher ridge. Hearths and earth ovens (Figure 50) are situated in the coastal scrub between the low and high ridge. Cultural material also included quartz flakes and glass fragments. The land behind the elevated ridge is scrub/farmland overlying Pleistocene calcrete substrate (Figure 51). The ridge top is a vantage point providing views of the surrounding environment and adjacent coastal waters.

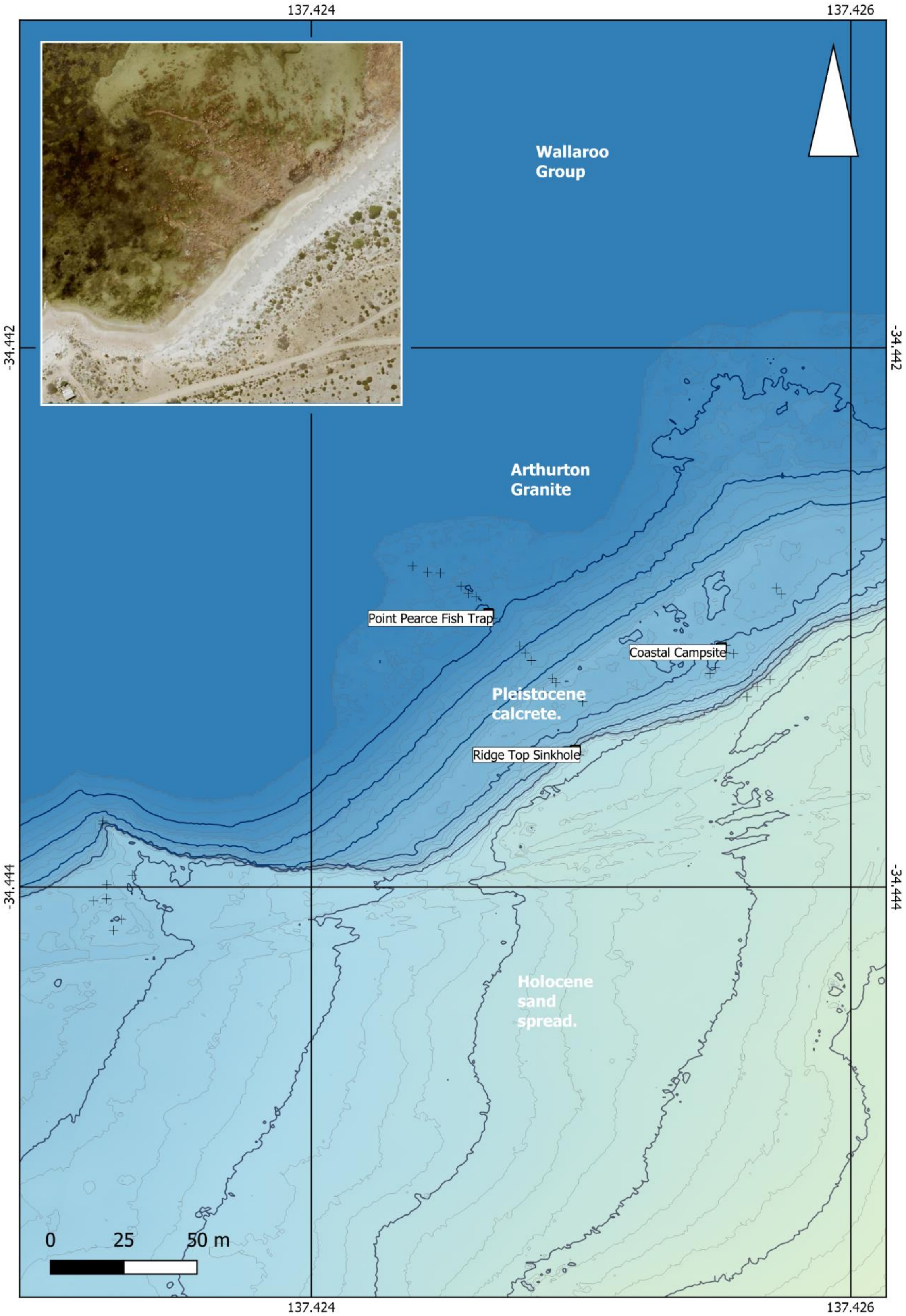


Figure 48: Point Pearce/Burgiyana fish trap and adjacent environment site map. Map was created in GIS using 1 metre resolution Lidar survey data with 1 metre contour lines.

Figure 49: Point Pearce/Burgiyana fish trap looking west 24/11/2016.

Figure 50: Coastal hearth/earth mound site Robert Jones in background looking north 24/11/2016.

Figure 51 Ridge top view to Aunty Rose's shack and the coast to the south of Point Pearce Peninsula/Burgiyana fish trap—exposed Pleistocene calcrete substrate in foreground 24/11/2016.

6.5.9 Coastal Earth Mound

An extensive hearth/earth oven mound comprising a thick layer of charcoal discoloured sands covering an area with dimensions 35 metres by 14 metres is located on the Island Point adjacent to Dead Man's Island/Mungari (Figure 52). The ridge top where the earth oven is situated is c.5 metres APSL.

The earth oven (possibly used for fibre processing/fish net manufacture) has undergone significant erosion. The thickness of the charcoal discoloured soil layer was evident due to this erosion and wombat burrowing (Figure 53). The site has also been subject to disturbance from vehicle traffic as the mound is situated alongside a track.

A sample of exposed earth oven sediment provided a radiocarbon date of 1,360–1,280 cal BP (Wk-56676). Earth ovens may have been reused over time so the radiocarbon age determination can be seen as an 'average' date covering this extended period of use. A shell sample (*Haliotis* sp.) collected from an exposed section the earth oven also provided a radiocarbon date of 960–670 cal BP (Wk-56675). Remnants of a coastal hearth/oven are also exposed/eroding from the ridge face a few metres to the west with detached charcoal-stained calcrete from at the base of the ridge (Figures 54–57). The ridge is actively eroding due to both tidal action and fluvial water run-off.

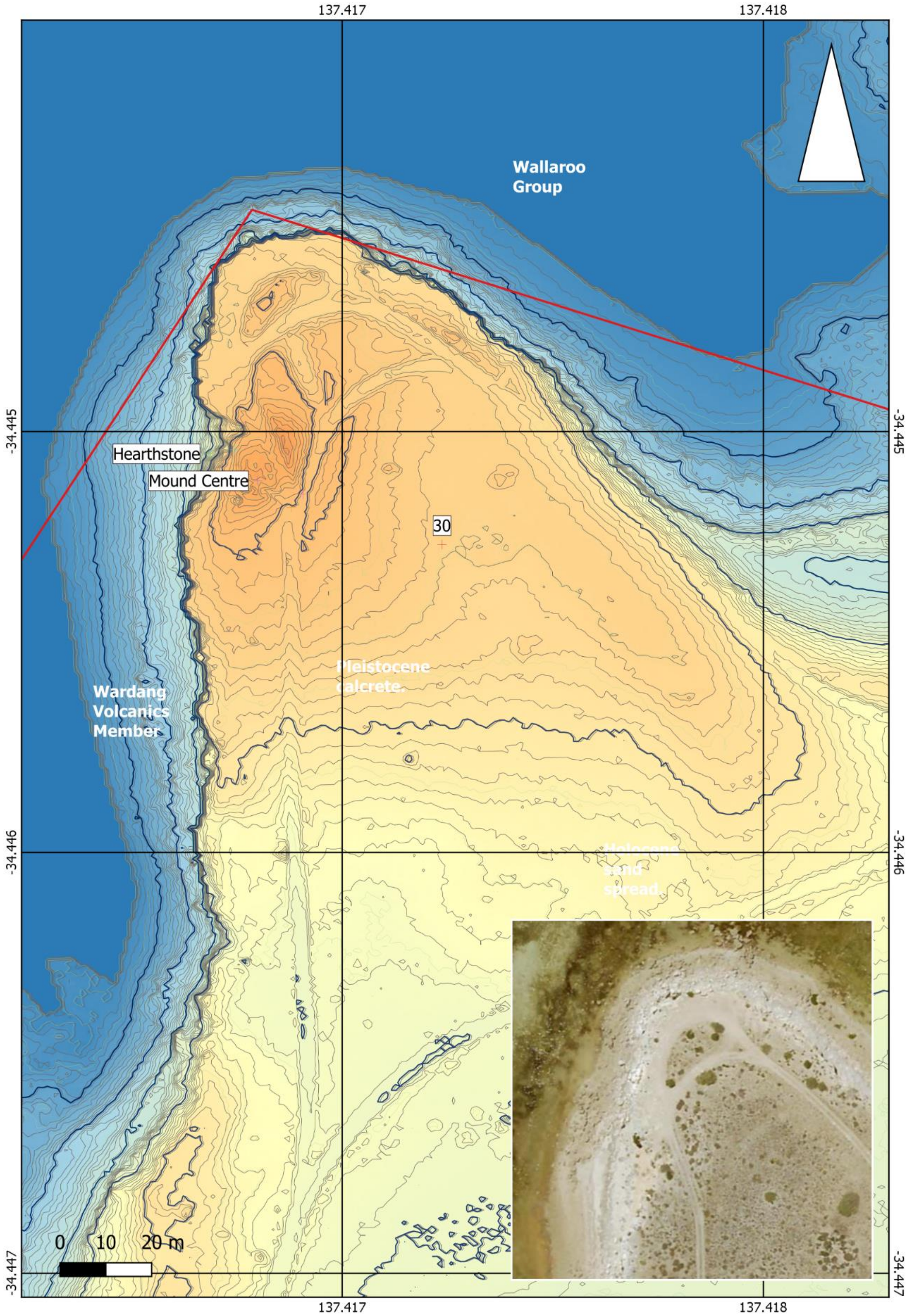


Figure 52: Island Point earth oven site map. Map was created in GIS using 1 metre resolution Lidar survey data. Bold contour lines are in 1 metre increments, fine contour lines are 0.1 metre increments.

Figure 53: Top–Island Point earth oven looking south 1/12/2016 highlighting wombat burrow disturbance (Robert Jones in background). Bottom–Island Point earth oven looking south 22/3/2023 with collapsed burrows (Professor Lester-Irabinna-Rigney in background).

Figure 54: Coastal erosion due to water run-off and its impact on Aboriginal heritage. Island Point adjacent to Deadman's Island/Mungari. Photo 02/12/2016.

Figure 55: Ridge line hearth and erosion.

Figure 56: Ridge line hearth and erosion.

Figure 57: Charcoal stained calcrete at ridge base.

One shell sample and a sample of earth oven sediment (Figure 58) were collected for radiocarbon dating from this site (Table 11). The dates indicate the earth oven was in use >1,000 years ago. Earth ovens may have been reused over time so the radiocarbon age determination can be seen as an 'average' date covering this period of use.

Table 11: Calibrated age-ranges (95.4% probability range) for coastal earth mound site.

Sample Code	Wk Code	Species	Age Cal BP (95.4%)
B7S2 abalone	56675	*Haliotis* sp.	960–670
B7S3 sediment	56676	N/A	1,360–1,280

Figure 58: Exposed earth oven sediment with an embedded quartz flake 22/3/2023.

6.5.10Deadman's Island/Mungari

Dead Man's Island/Mungari (Figures 59–60) is c.300 metres off the coast and is accessible by foot at low tide. Sea level between the mainland and the island increases to 2 metres when at high tide. The island perimeter foreshore has samphire growing amongst sand and rock outcrops. The foreshore terminates at a ridge with the higher section of the island covered by a thin soil layer with grass and salt bush overlying the Pleistocene calcrete substrate (Figure 61). Quartz outcrops formed part of the exposed rock substrate found between the island and the mainland and may be a raw material source for the quartz lithic artefacts found on the island. A small cave (Figure 62) is located on the northern side of the island. Evidence for island use included remains of hearths, hearthstone, quartz retouched flakes and other lithic material, bottle glass fragments and bone (Figures 63–66). The island is low-lying c.5 metres APSL and in an exposed setting adjacent to the coast and within the tidal zone, as such much of the faunal material on the island may be natural in origin.

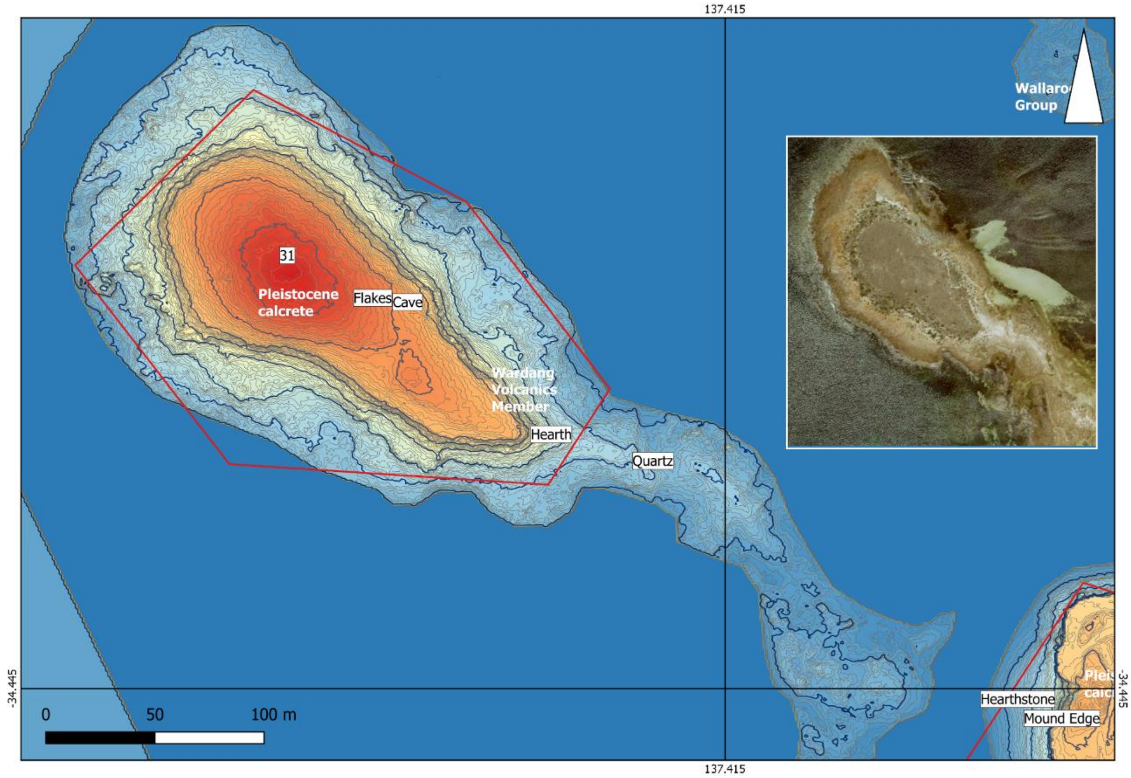


Figure 59: Deadman's Island/Mungari. Bold contour lines are in 1 metre increments, fine contour lines are 0.1 metre increments.

Figure 60: View to Dead Man's Island/Mungari from ridge top earth oven site (see previous section) looking west 1/12/2016.

Figure 61: Dead Man's Island/Mungari foreshore beach with Pleistocene calcrete ridge in background looking west 1/12/2016.

Figure 62: Small cave opening on the north coast of Deadman's Island/Mungari 1/12/2016.

Figure 63: Hearthstone.

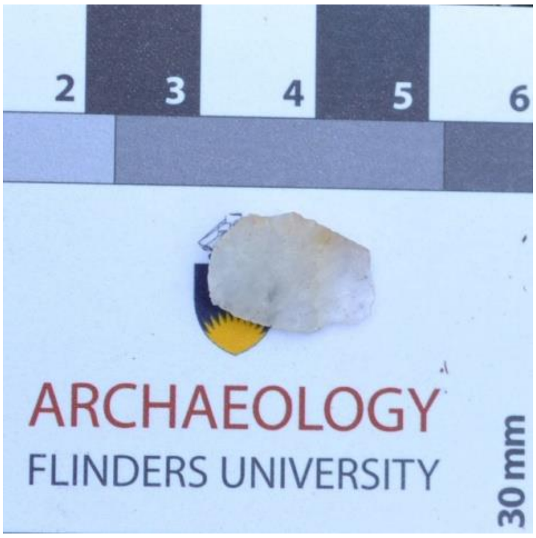


Figure 64: Quartz retouched flake.

Figure 65: Bone fragments–species unknown.

Figure 66: Bottle glass fragment.

6.5.11 Inland Site

The site (site 22 Wood and Westell [1998]) contains artefacts and shell remains covering an area 300 metres * 100 metres (Figures 67–71). This site is 800 metres inland from the nearest coastline in the west. An earth mound, hearths, artefacts and shell remains are exposed on/near a Holocene gypseous clay surface three metres above sea level. A stranded beach ridge and exposed quartz gravels fringe the eastern side of the site and are adjacent to samphire marsh swampland—see next section. Lithic material includes quartz waste flakes. A bottle glass flake was also recorded. Faunal remains include black periwinkle (*N. melanotragus*), cockle (*Katelysia* spp.) and warrener (*T. undulata*).

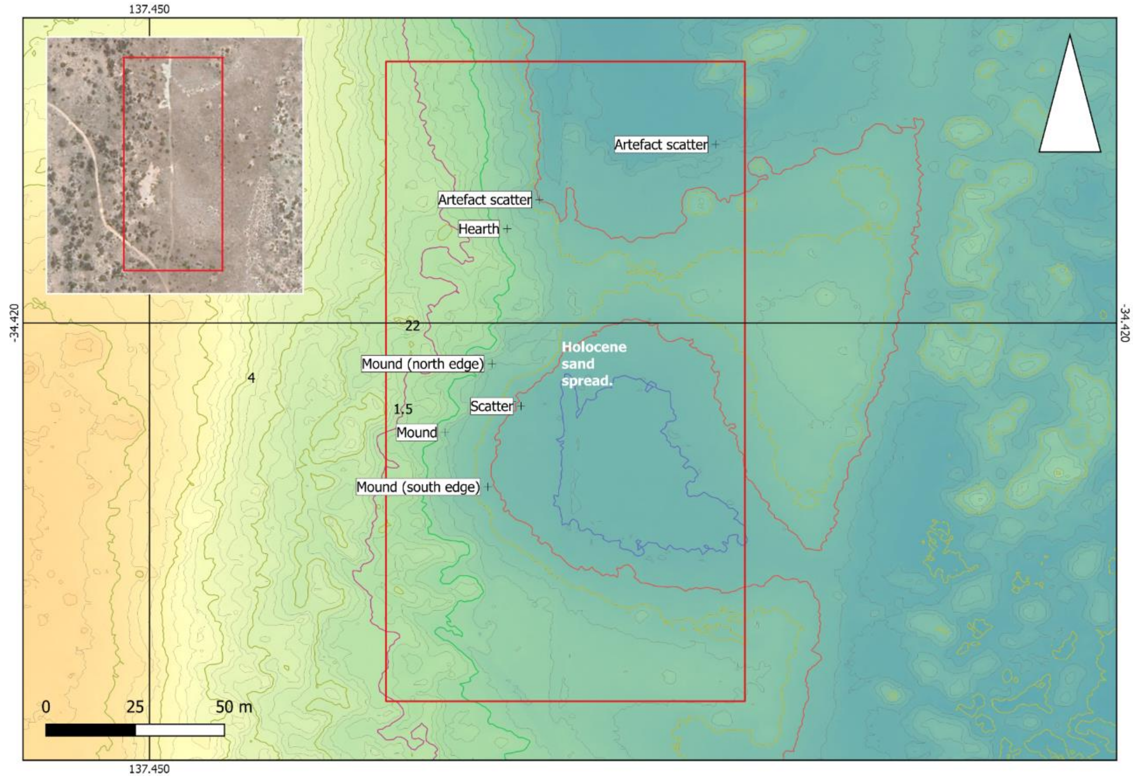


Figure 67: Inland campsite (Wood and Westell [1998] site 22). Bold contour lines are in 1 metre increments, fine contour lines are 0.25 metre increments.

Figure 68: Burnt calcrete.

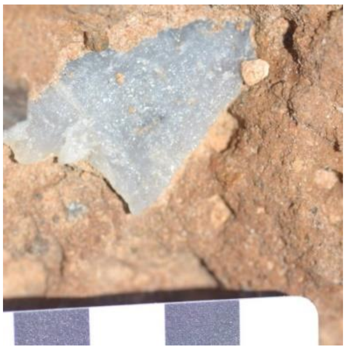


Figure 69: Quartz flake.

Figure 70: Bottle flake fragment.

Figure 71: Earth mound—Chrissy Stockley in the background looking east 2/12/2016.

Black periwinkle (*N. melanotragus*) sample collected from the site (Figure 72) was dated to 3,340–2,960 cal BP (Wk-56695) when relative sea levels were +2 metres to +1.5 metres higher and the site may have been on a shoreline when the samphire marsh swampland to east was covered by sea.

Figure 72: Holocene gypseous clay surface exposure looking west 24/3/2023 with Professor Lester-Irabinna Rigney and Adrian Mollenmans in background. Black periwinkle (*N. melanotragus*) sample collected from the site was dated to 3,340–2,960 cal BP (Wk-56695)

6.5.12Swampland

Samphire marsh <5 metres above present sea level connects the mainland with the west of Point Pearce Peninsula/Burgiyana (Figure 73). During mission days, the area was used for grazing stock and is still crossed by now rusting stock fences. The surface soil is generally white-grey clayey acidic sulphate soils associated with former mangrove environments. Vegetation is mostly samphire, salt bush, grasses and small shrubs. In-situ marine shell deposits, primarily cockle, up to 2.2 kms inland of the present-day shoreline to the south providing evidence that the coastline was further inland in the past. (Figure 74). Pipi shell (*P. deltoides*) samples of natural non anthropogenic origin collected 300 metres inland and one metre above sea level were dated to 320–-10 cal BP and support the idea that the sea was further inland in the past.

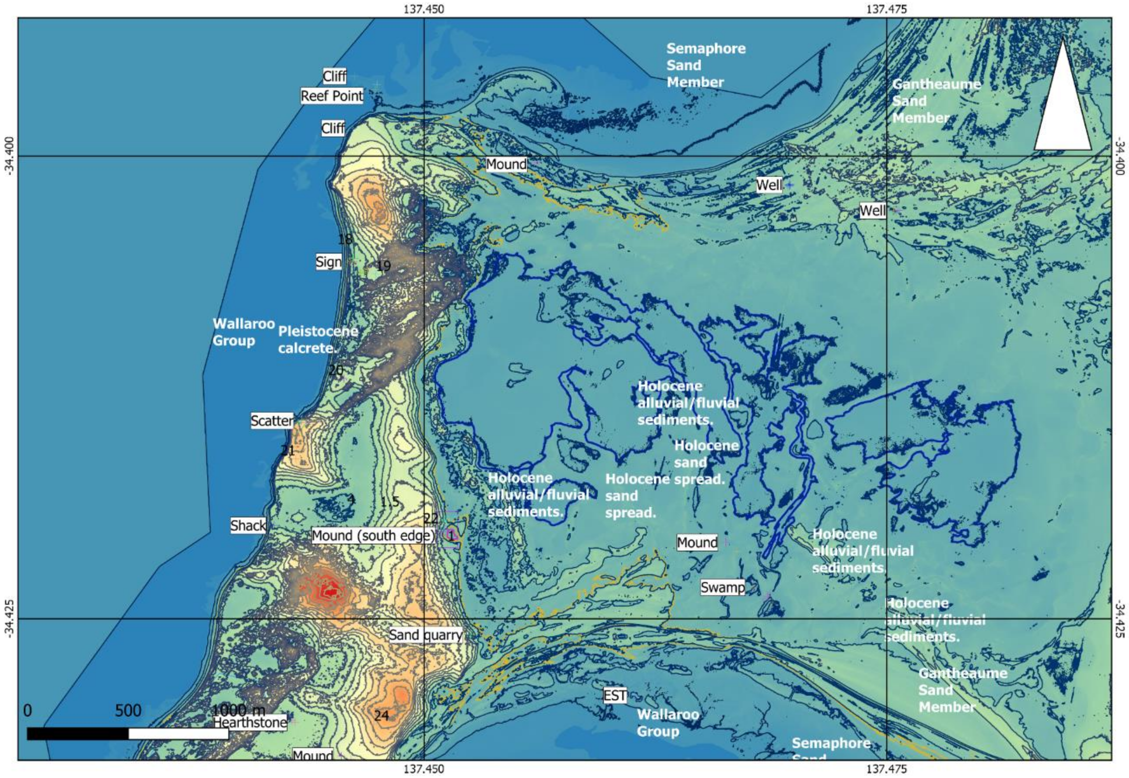


Figure 73: Swampland—1 metre contour line highlighted in blue.

Figure 74: Natural shell midden looking north 2/12/2016. Shell species—cockle (*Katelysia* spp.).

6.5.13 East Coast

The east coast of the peninsula connects with the southern end of the neck of land where the peninsula joins the mainland. All of the terrain behind is now used as farmland that terminates at a low ridge with exposed Pleistocene calcrete substrate that fringes the eastern coastline (Figure 75). The coastline fringes the western side of Port Victoria Bay. The waters of the bay include extensive tidal flats which merge with an estuary at the northern end (Figures 76–77). This location is an important fishing spot for the Narungga community in present times (Carlo Sansbury and Michael Walker interview 17/11/2016).

Figure 75: Coastal limestone ridge. Photo 25/11/2016 looking west.

Figure 76: Estuary. Photo 17/11/2016 looking north.

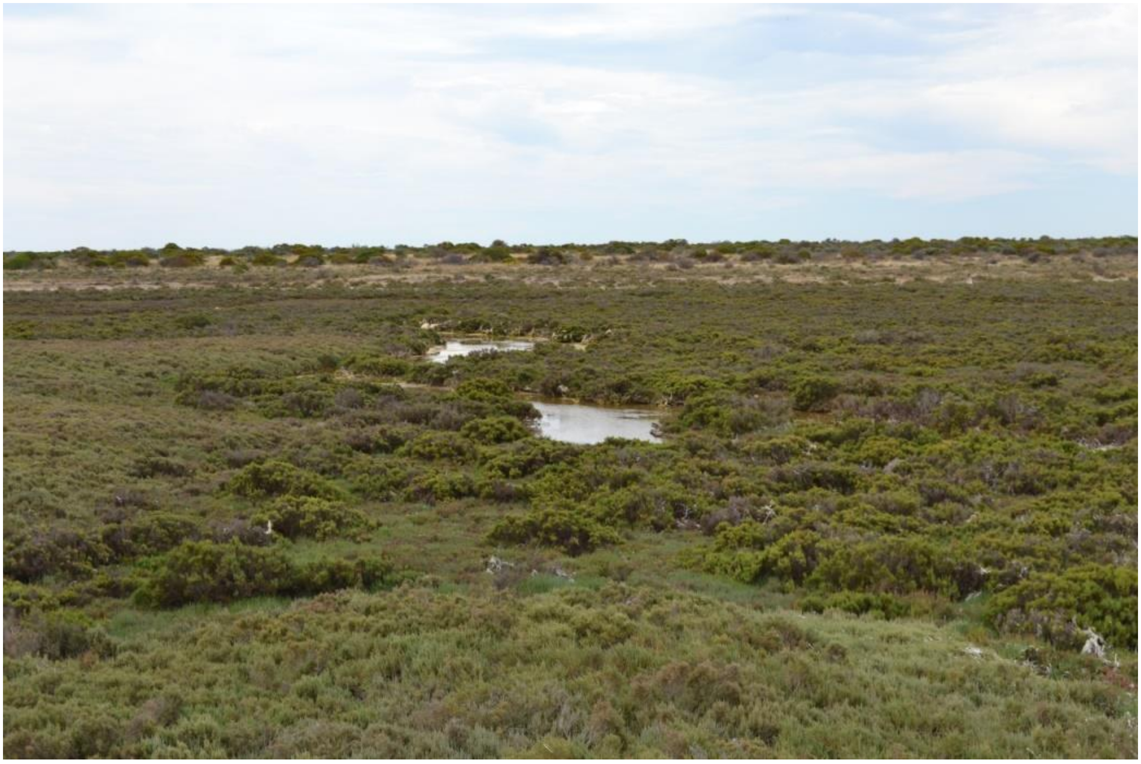


Figure 77: Tidal creeks. Photo 17/11/2016 looking north.

6.6 Waraldi Fieldwork

Fieldwork on Wardang Island/Waraldi took place in March 2023. Four sites were surveyed during this fieldwork session. The sites were originally documented in 2003 (Wood et al. 2003). Eight marine shell and 1 eggshell sample were collected from 3 of the Narungga heritage sites on the island. Figure 78 illustrates the site locations where samples were collected. Sites where sampling took place were selected to be representative of the variety of site types recorded by Wood et al. (2003).

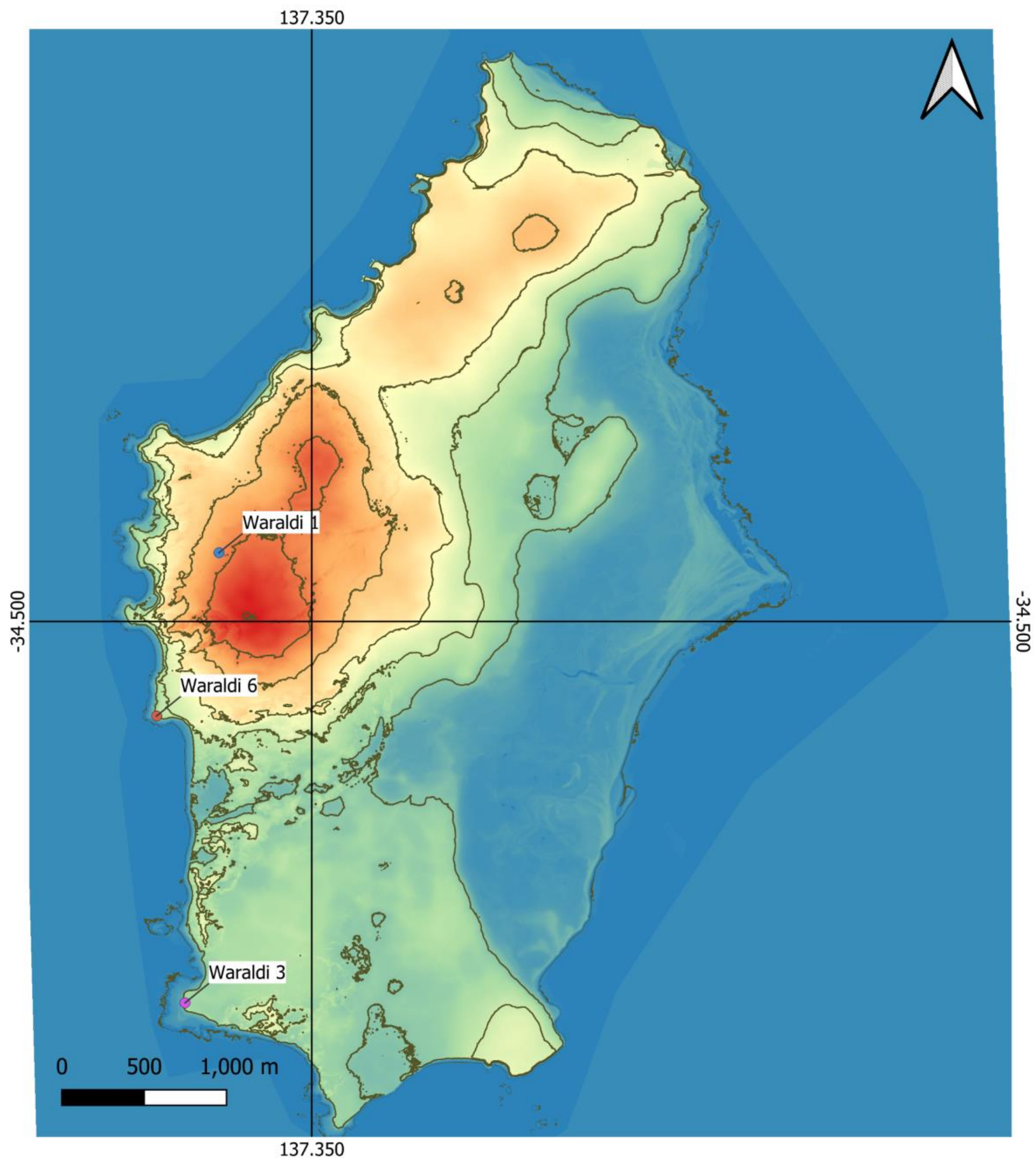


Figure 78: Wardang Island/Waraldi Narungga heritage survey. Map created in GIS using 1 metre resolution Lidar survey data (contours lines are in 5 metre increments).

6.6.1 Inland Site

The site (Figure 79) Wardang Island/Waraldi site 4 was first surveyed by Wood et al. (2003). The site comprises an exposure of shell and artefacts covering an area 0.013 Km^2. The site is c.24 metres above sea level 400–500 metres inland of the west coast of Wardang Island/Waraldi. The assemblage includes a high proportion of large, flaked pieces and cores with cobble cortex with intact knapping floors. Lithic material includes quartz flakes, flaked pieces, cores and blades. Faunal remains (shell) included whelk (*T. orbita*), black periwinkle (*N. melanotragus*) and warrener (*T. undulata*)

Figure 79: Wardang Island/Waraldi inland campsite looking west 23/3/2023. Peter Turner, Adrian Mollenmans and Ian Baker in background.

Four shell samples were collected for radiocarbon dating (Table 12). Sample dates range from recent times to >7000 years BP. A question remains why Narungga returned to this inland location throughout the history of the island.

Table 12: Calibrated age-ranges (95.4% probability range) for inland island site.

Sample Code	Wk Code	Species	Age Cal BP (95.4%)
W1S1 periwinkle	**56684**	***N. melanotragus***	**1,800–1,460**
W1S2 whelk	**56685**	***T. orbita***	**310–-10**
W1S3 warrener	**56686**	***Turbo* sp.**	**3,570–3,230**
W1S4 warrener	**56687**	***T. undulata***	**8,040–7,720**

6.6.2 Flatman Beach Site

This site Wardang Island/Waraldi site 1 surveyed by Wood et al. (2003), is 7–8 metres above sea level comprises a series of exposures along the edge of a low coastal cliff line over approximately 80 metres x 15 metres (Figure 80). The faunal assemblage is dominated by penguin (*Eudyptula minor*) and abalone (*Haliotis* spp). The lithic assemblage is characterised by small flakes manufactured from quartz.

Figure 80: Wardang Island/Waraldi Flatman Beach site looking west 23/3/2023. Adrian Mollenmans and Ian Baker in background.

One shell sample and one eggshell sample were collected for radiocarbon dating (Table 13). Sample dates provide evidence for recent island use in the time before European invasion of Australia.

Table 13: Calibrated age-ranges (95.4% probability range) for Flatman Beach site.

Sample Code	Wk Code	Species	Age Cal BP (95.4%)
W6S1 warrener	**56688**	***T. undulata***	**260–-10**
W6S2 eggshell	**56689**	**Indeterminate**	**450–300**

6.6.3 Hungry Bay

This site, Wardang Island/Waraldi site 3 surveyed by Wood et al. (2003), comprises a small scatter of quartz flakes and flaked pieces along a section of cliff line 6 metres above sea level (Figure 81). Natural shell deposits occur along the adjacent coast. The 'site' appears as a small, localised cluster within a broader background scatter of isolated artefacts and culturally derived shell continuing throughout the immediate area (Wood et al. 2003). Lithic material includes quartz flakes and flaked pieces; and quartzite manuports. Faunal remains include black periwinkle (*N. melanotragus*), dog whelk (*C. spengleri*), common limpet (*C. tramoserica*), warrener (*T. undulata*) and abalone (*Haliotis* spp).

Figure 81: Wardang Island/Waraldi Hungry Bay site looking west 23/3/2023. Adrian Mollenmans in foreground.

Three shell samples were collected for radiocarbon dating (Table 14). Sample dates range from recent times to >4000 years BP.

Table 14: Calibrated age-ranges (95.4% probability range) for Hungry Bay site.

Sample Code	Wk Code	Species	Age Cal BP (95.4%)
W3S1 operculum	**56690**	***Turbo* sp.**	**4,430–4,040**
W3S2 warrener	**56691**	***T. undulata***	**3,550–3,200**
W3S3 whelk	**56692**	***T. orbita***	**115.8–115.8**

6.7 Radiocarbon Dating Results

Table 15 lists the calibrated radiocarbon ages (95.4% probability range) for the samples collected during this research as outlined in the previous sections. Figure 82 displays the sample dates in chronological order. Some clustering of dates is evident across the samples as well as significant gap in sample chronology between 4,450–4,060 cal BP (Wk-56677) and 7,790–7,470 cal BP (Wk-56680).

The age range of samples for Point Pearce Peninsula/Burgiyana spans the period from when the peninsula was first impacted by post glacial sea-level rise until recent times. Sample dates for Wardang Island/Waraldi display a similar pattern to ages observed on Point Pearce Peninsula/Burgiyana and illustrate the long history of island use from the earliest date when present day Wardang Island/Waraldi was likely still attached to the mainland.

Table 15: Radiocarbon Dating Results

Site Name	Site Type	Material Type	Species	Laboratory Code	dC13	F14C%	Result	Age Cal BP
Burgiyana 6	Open Artefact Scatter	Shell	*Turbo torquata*	56683	-0.5 +/- 0.6	105.5 +/- 0.2	105.5 +/- 0.2 %	105
Burgiyana 4	Open Artefact Scatter	Shell	*Austrocochlea porcata*	56693	3.2 +/- 0.6	112.4 +/- 0.3	112.4 +/- 0.3 %	112.4
Waraldi 3	Open Artefact Scatter	Shell	*Thais orbita*	56692	4.0 +/- 0.6	115.8 +/- 0.3	115.8 +/- 0.3 %	115.8
Waraldi 6	Open Artefact Scatter	Shell	Species indeterminate	56689	-9.0 +/- 0.6	95.8 +/- 0.2	346 +/- 15 BP	450–300
Waraldi 6	Open Artefact Scatter	Shell	*Turbo torquata*	56688	2.3 +/- 0.6	93.8 +/- 0.2	516 +/- 15 BP	260–-10
Waraldi 1	Open Artefact Scatter	Shell	*Thais orbita*	56685	-0.5 +/- 0.6	93.1 +/- 0.2	573 +/- 15 BP	310–-10
Burgiyana 1	Environment	Shell	*Plebidonax deltoides*	56694	5.8 +/- 0.6	93.0 +/- 0.2	582 +/- 20 BP	320–-10
Burgiyana 7	Earth Oven	Shell	*Haliotis* sp.	56675	0.7 +/- 0.6	85.1 +/- 0.2	1299 +/- 16 BP	960–670
Burgiyana 7	Earth Oven	Earth oven sediment	Carbon	56676	83.4 +/- 0.2	1456 +/- 19 BP	1456 +/- 19 BP	1360–1280

Site Name	Site Type	Material Type	Species	Laboratory Code	dC13	F14C%	Result	Age Cal BP
Waraldi 1	Open Artefact Scatter	Shell	*Nerita melanotragus*	56684	0.6 +/- 0.6	77.4 +/- 0.2	2062 +/- 16 BP	1800–1460
Burgiyana 6	Open Artefact Scatter	Shell	*Cabestana spengleri*	56678	1.7 +/- 0.4	67.1 +/- 0.1	3199 +/- 14 BP	3200–2840
Burgiyana 6	Open Artefact Scatter	Shell	*Turbo* sp.	56679	2.8 +/- 0.4	66.8 +/- 0.1	3240 +/- 14 BP	3250–2870
Burgiyana 5	Open Artefact Scatter	Shell	*Nerita melanotragus*	56695	1.8 +/- 0.6	66.3 +/- 0.2	3307 +/- 20 BP	3340–2960
Waraldi 3	Open Artefact Scatter	Shell	*Turbo undulata*	56691	3.9 +/- 0.6	64.8 +/- 0.1	3490 +/- 18 BP	3550–3200
Waraldi 1	Open Artefact Scatter	Shell	*Turbo* sp.	56686	2.0 +/- 0.6	64.6 +/- 0.1	3513 +/- 17 BP	3570–3230
Waraldi 3	Open Artefact Scatter	Shell	*Turbo* sp.	56690	3.8 +/- 0.6	59.6 +/- 0.1	4158 +/- 19 BP	4430–4040

Site Name	Site Type	Material Type	Species	Laboratory Code	dC13	F14C%	Result	Age Cal BP
Burgiyana 6	Open Artefact Scatter	Shell	*Turbo* sp.	56677	1.4 +/- 0.6	59.4 +/- 0.1	4178 +/- 18 BP	4450–4060
Burgiyana 6	Open Artefact Scatter	Shell	*Nerita melanotragus*	56680	1.5 +/- 0.6	40.8 +/- 0.1	7205 +/- 24 BP	7790–7470
Waraldi 1	Open Artefact Scatter	Shell	*Turbo undulata*	56687	2.3 +/- 0.6	39.4 +/- 0.1	7475 +/- 25 BP	8040–7720

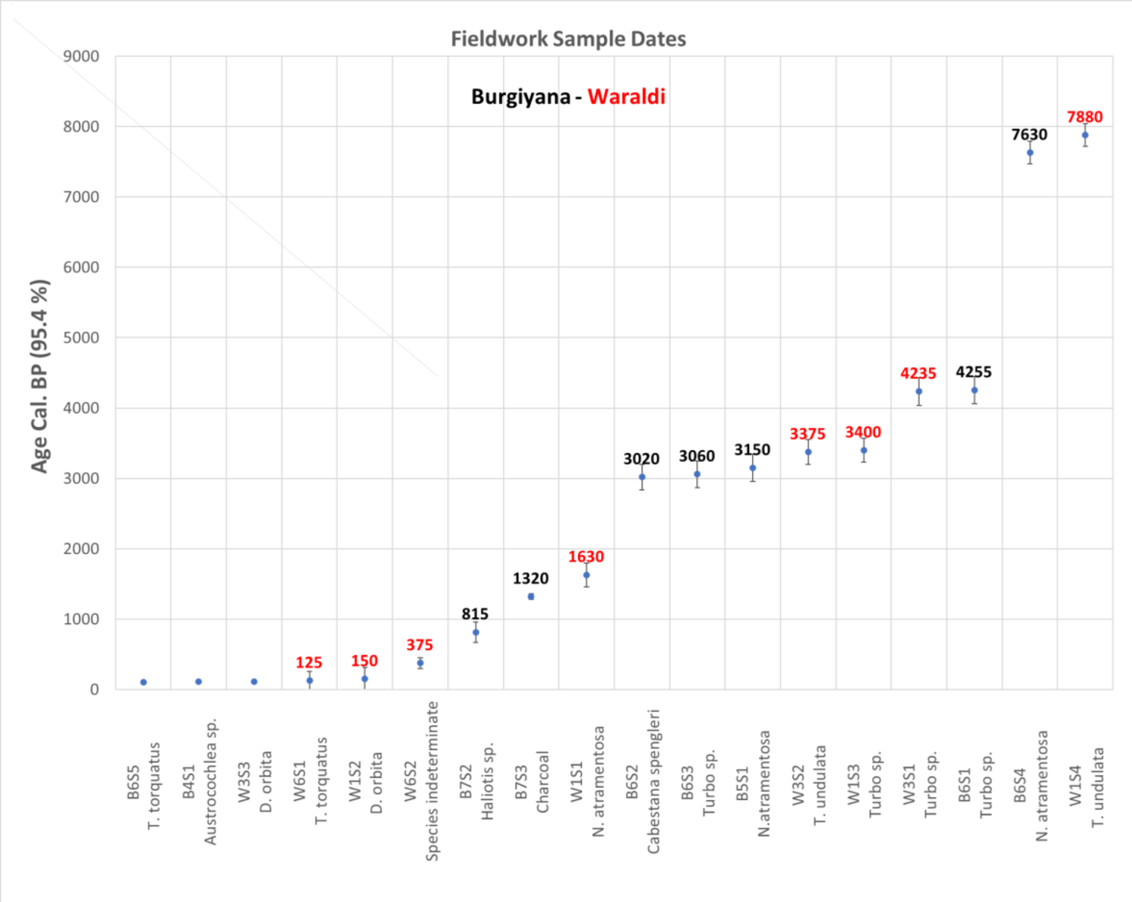


Figure 82: Calibrated radiocarbon ages for the Point Pearce Peninsula/Burgiyana (black font) and Wardang Island/Waraldi (red font). Sample dates from youngest (left) to oldest (right). Note sample B1S1 was an environmental sample collected from a naturally occurring (non-anthropogenic) shell deposit.

6.8 Radiocarbon Dates and Sea-Level History

Table 8 summarised the Holocene sea-level history sequence in Spencer Gulf as outlined below:

- 6,000–4,000 years BP: Highstand of +3 metres to +2 metres
- 4,000–3,000 years BP Sea-level fall from +2 metres to +1 metres
- 3,000–2,000 years BP Sea-level fall from +1 metres to +0.5 metres
- 2,000 years BP–Present Sea-level fall from +0.5 metres to +0 metres

Figures 84–89 chart the impact of the highstand at Point Pearce Peninsula/Burgiyana and on Wardang Island/Waraldi combined with associated sample dates.

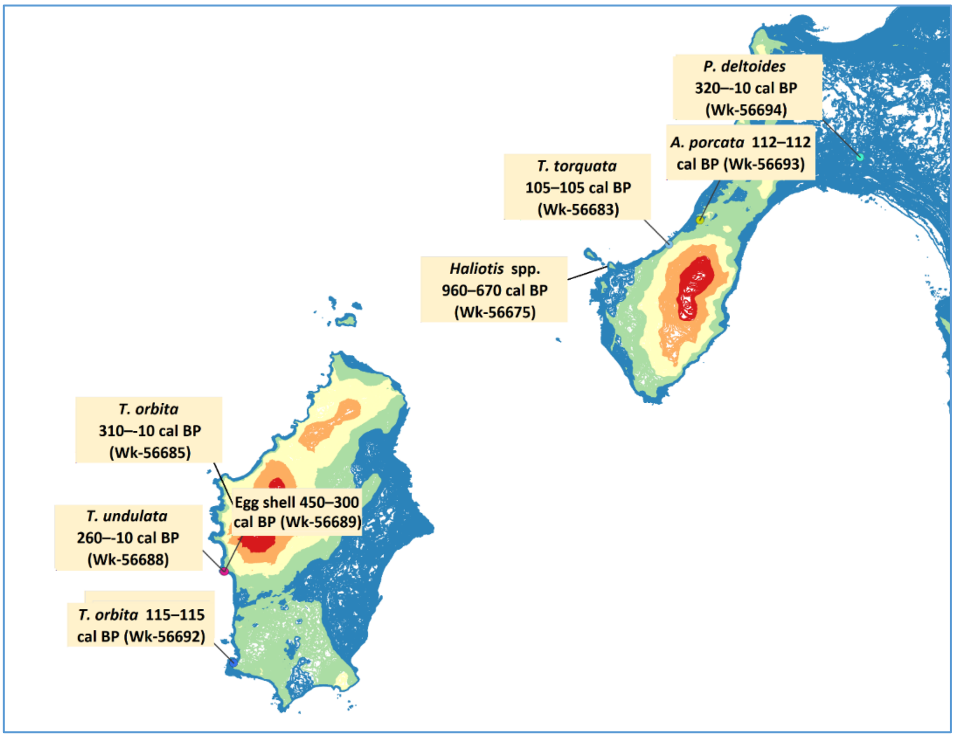


Figure 83: Sample dates 1,000 BP–Present. Sea-level fall to present levels. Map was created in GIS using 1 metre resolution Lidar survey data. 1 metre contour lines.

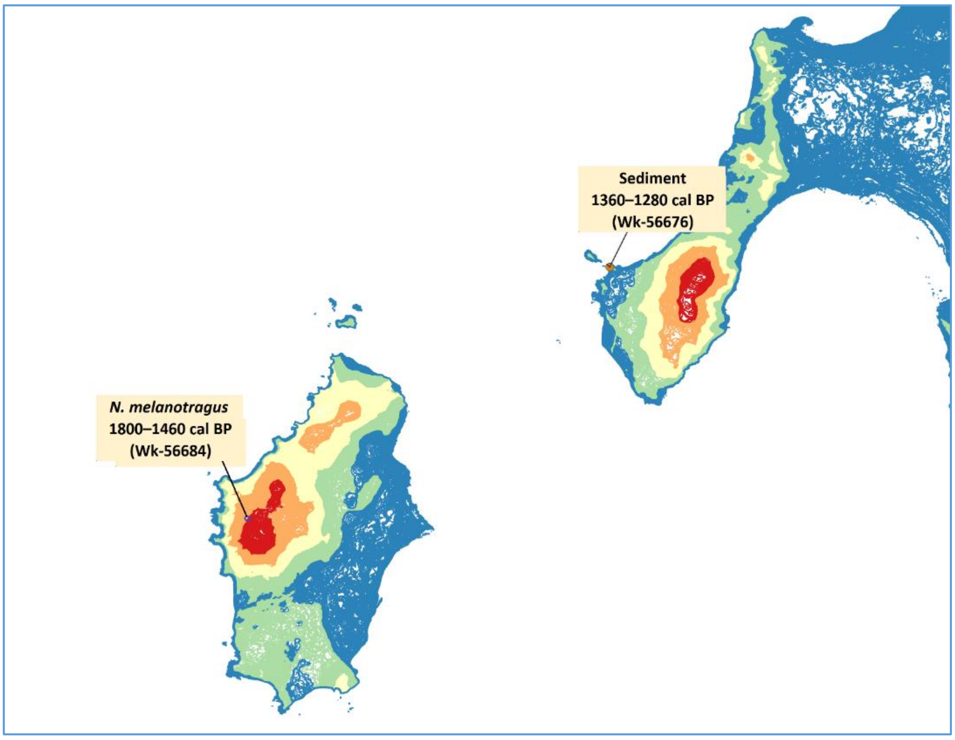


Figure 84: Sample dates 2,000–1,000 BP. Sea-levels are upto +0.5 higher than present. Map was created in GIS using 1 metre resolution Lidasr survey data. 1 metre contour lines.

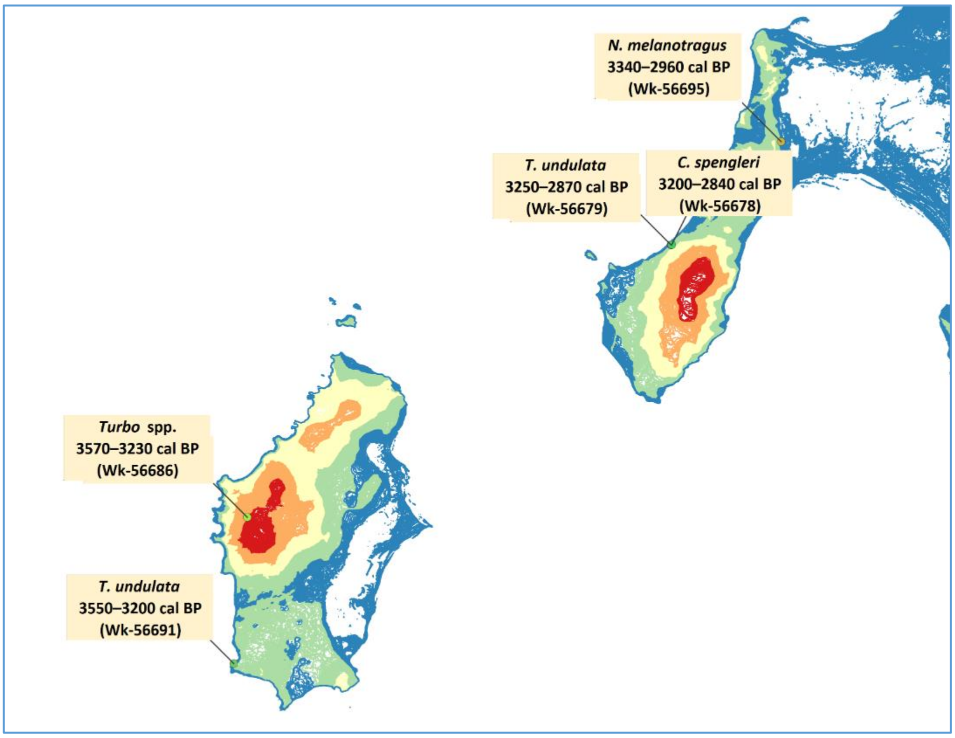


Figure 85: Sample dates 4,000–3,000 BP. Sea-level fall +2 metres to +1 metres. Map was created in GIS using 1 metre resolution Lidar survey data. 1 metre contour lines.

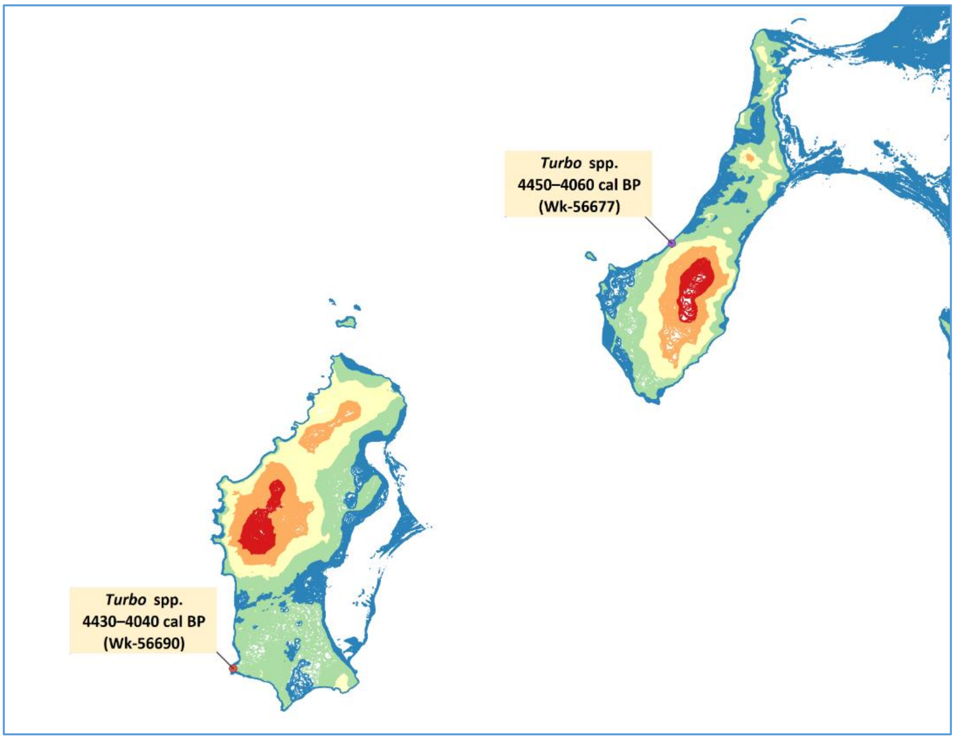


Figure 86: Sample dates 6,000–4,000 BP. Sea-level fall +3 metres to +2 metres. Map was created in GIS using 1 metre resolution Lidar survey data. 1 metre contour lines.

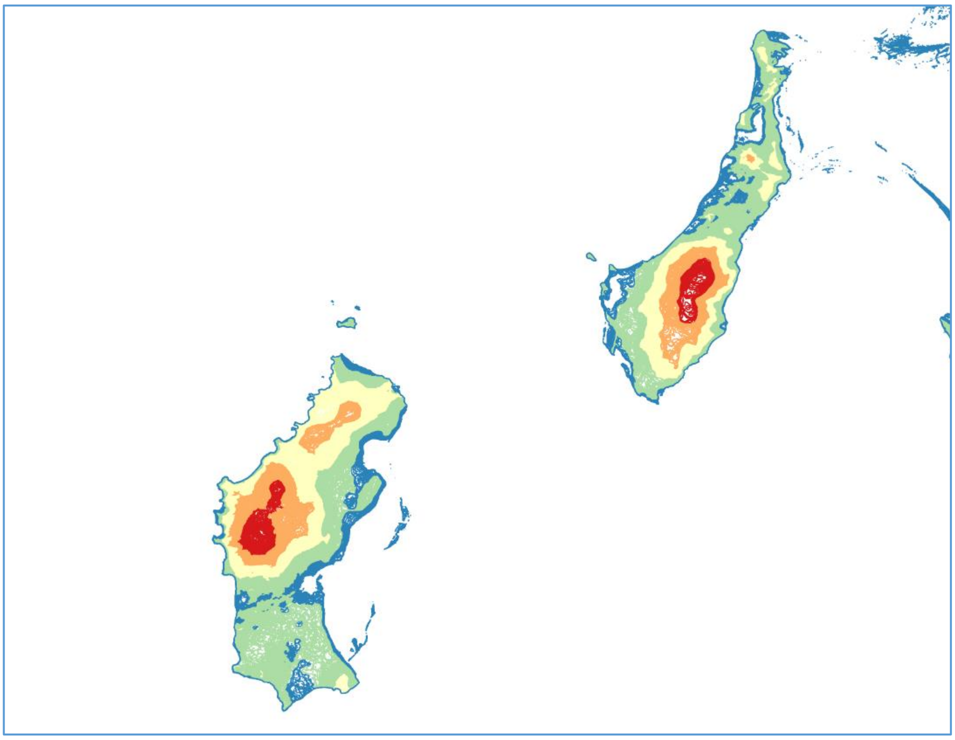


Figure 87: Sea level 6,000 BP +3 metres APSL. Western Point Pearce Peninsula/Burgiyana separated from the mainland. Map was created in GIS using 1 metre resolution Lidar survey data. 1 metre contour lines.

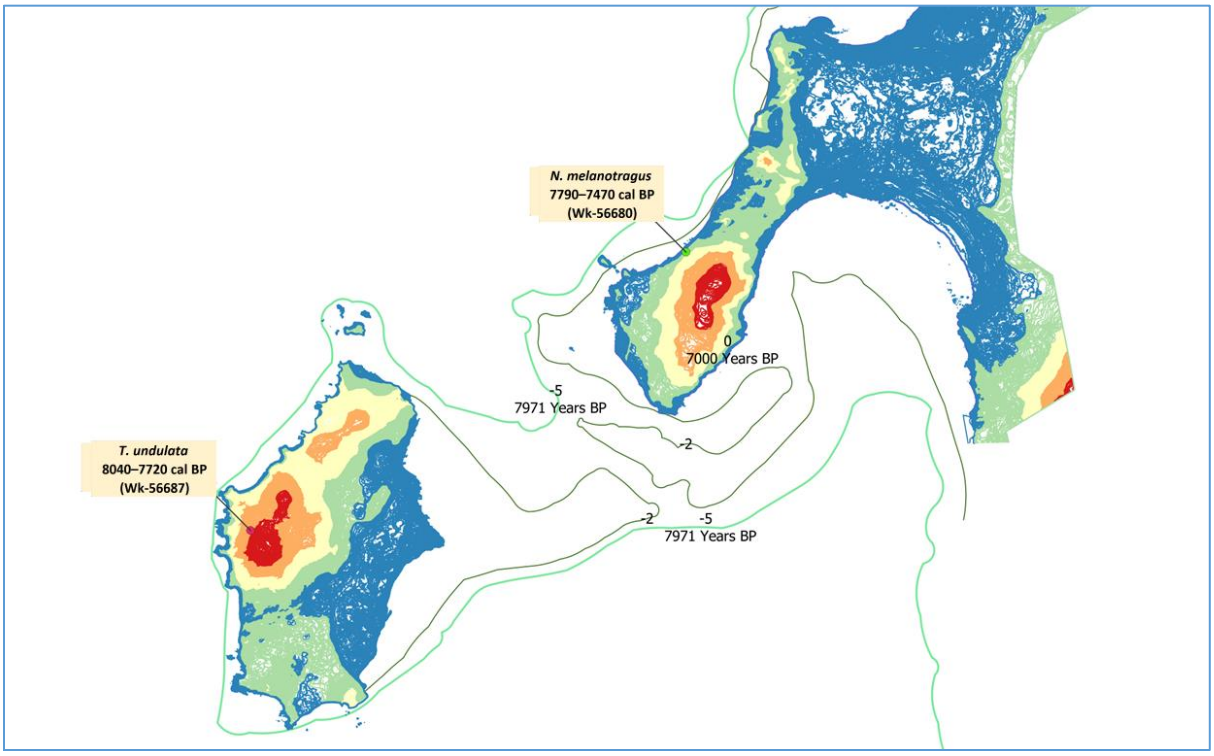


Figure 88: Sea-level rise -5 metres (green contour line) to 0 metres from c.8,000–7,000 BP. Map was created in GIS using 1 metre resolution Lidar survey data. 1 metre contour lines.

6.9 Summary

This chapter outlines the data collated during this research. Data was collected from multiple sources including ethnohistorical information, community interviews and prior archaeological research. The chapter also records new results from archaeological fieldwork and radiocarbon dating. These datasets were combined in GIS with data layers describing the physical geography and biodiversity for the case study area. GIS was also used to model the sea-level history of Yorke Peninsula/Guuranda.

7. DISCUSSION

The literature review chapter provided an overview of research themes that have arisen out of academic research into the culture and economy of peoples living by and from the sea today and in the past. Coastal and island archaeology as a component of this broader research has developed as a sub-discipline to investigate how Indigenous coastal and island resource use has developed over time including investigating the impacts of climate change and sea-level fluctuations that has been a focus of this research. This chapter revisits these research themes considering the data collated during this research. The chapter ends with a review of the research aims and summary of what this research has achieved.

7.1 Shellfish and the Tidal Zone

Research into shellfishing outlined in chapter 2 highlights the importance of shellfish as a food resource for Indigenous coastal communities. Archaeologists have also sought to investigate evidence for shellfishing practices in the past (for example Beaton 1985, 1995, 1998). Research into shell middens, in particular, has been an important component of this research (Beaton 1985, 1995; Cane 1998; Hiscock 2008; Hiscock and Faulkner 2006; Meehan 1982; Morrison 2010, 2014). In this regard, Waselkov (1987:95) defined a shell midden as 'a cultural deposit of which the principle visible constituent is shell' (for example [Gunn 1845]; Meehan [1982]). As noted in chapter 2, middens may differ in size and form and may also be a component of other types of archaeological assemblages (Bailey et al. 2013; Waselkov 1987).

A wide variety of shell species were known by Narungga people and harvested (see table 3). Shellfish could be accessed at many points along the coastline (563 kilometres in length). Wood and Westell (1998) concluded that Yorke Peninsula/Guuranda is essentially a coastline and that no point be classed as truly inland. Jameson (1838) and Snell (in Griffiths 1988) for example provide an early record of the abundance of shellfish along the east coast of Yorke Peninsula/Guuranda at Troubridge Shoals and Milner Point.

Wood et al. (2003), in their broader archaeological survey of Yorke Peninsula/Guuranda identified shell as the dominant type of faunal remains recorded in archaeological sites they surveyed during this research (noting this may be in part due to differential preservation of faunal remains and organic material types in exposed surface sites). Many community members discussed the continued importance of shellfish (including all those in examined in this research) to Narungga people today (pers. comm. at a community meeting in November 2023).

Archaeological surveys on Point Pearce Peninsula/Burgiyana including those undertaken in this research also identified shellfish, including rocky reef and sandy shore species, as the dominant faunal remains in archaeological assemblages. Shell was present as scatters of a variety of shell species rather than in mounds of single species. Limited faunal bone fragments and eggshell were also documented at some sites. Tool types recorded during the survey included flakes, anvils, hammerstones, scrapers, a thumbnail scraper, blades, an adze and cores. Whilst faunal remains were primarily shellfish, the range of tools described did not necessarily correlate with shell processing but rather indicate a wider range of activities were undertaken on Point Pearce Peninsula/Burgiyana and on Wardang Island/Waraldi, but which otherwise may not have been preserved 'Implied resource use model' (Wood et al. 2003).

During fieldwork for this research, nine marine shell, one sediment sample and one sample of burnt calcrete was collected from five Narungga heritage sites on Point Pearce Peninsula/Burgiyana (table 16).

Table 16: Radiocarbon Dating Results—Point Pearce Peninsula/Burgiyana.

Sample ID	Age Cal BP (95.4%)
B6S5 Warrener	***T. torquata*** **105–105 cal BP (Wk-56683)**
B4S1 Warrener	***A. porcata*** **112–112 cal BP (Wk-56693)**
B1S1 Pipi Shell	***P. deltoides*** **320–-10 cal BP (Wk-56694)**
B7S2 Abalone	***Haliotis*** **sp. 960–670 cal BP (Wk-56675)**
B7S3 Sediment	**Sediment 1,360–1,280 cal BP (Wk-56676)**
B6S2 Whelk	***C. spengleri*** **3,200–2,840 cal BP (Wk-56678)**
B6S3 Warrener	***T. undulata*** **3,250–2,870 cal BP (Wk-56679)**
B5S1 Periwinkle	***N. melanotragus*** **3,340–2,960 cal BP (Wk-56695)**
B6S1 Warrener	***Turbo*** **sp. 4,450–4,060 cal BP (Wk-56677)**
B6S4 Periwinkle	***N. melanotragus*** **7,790–7,470 cal BP (Wk-56680)**

Figure 89 illustrates sample radiocarbon dates by age. The age range of samples span the period from when Point Pearce Peninsula/Burgiyana was first impacted by post glacial sea-level rise c.8,000 BP until recent times. Noting there is a gap of 3,200 years between 4,255 and 7,630 years ago. This is the first work that provides any significant work on chronology on Yorke Peninsula/Guuranda and provides significant understanding of the antiquity of shellfishing in the case study area which is particularly significant for Narungga people.

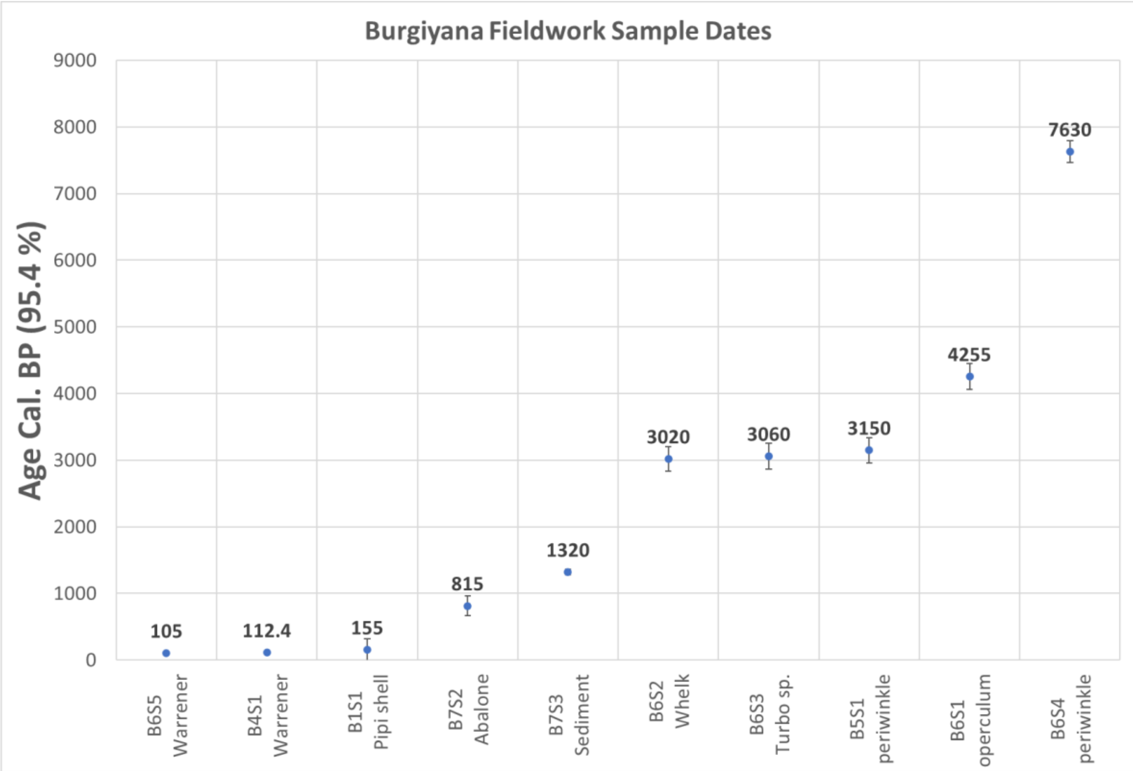


Figure 89: Calibrated radiocarbon ages (95.4% probability range) for the Point Pearce Peninsula/Burgiyana sample dates from youngest (left) to oldest (right). Note sample B1S1 was environmental the sample collected from naturally occurring shell deposits.

7.2 Coastal Fisheries and Marine Resources

Researchers have also investigated the development of more specialised coastal economies which involve the extension of the coastal resources use to encompass fishing practices and accessing a broader a range of resources from near shore and marine environments. This could also include the development of specialised skills, knowledge and technologies (e.g., fishing, knowledge of fish behaviour and the development or adaptation of technologies to suit the harvesting of fish in marine environments such as barbed speaks, fishhooks, fish nets and fish traps). Beaton (1985) described attributes that may be indicative of more specialised coastal and marine focussed economies summarised above and listed in full in chapter 2.

As noted in chapter 3, in addition to shellfish, Spencer Gulf, Investigator Strait and St Vincents Gulf adjacent to Yorke Peninsula/Guuranda are also habitat to more than 200 migratory and reef fish species (Shepherd et al. 2014). Table 4 in chapter 3 lists fish species with economic and cultural significance for Narungga people (list not exhaustive). The length of the Yorke Peninsula/Guuranda coastline provided Narungga people access to fish at many points along the coast. As outlined in chapter 4, harvesting of fish at individual locations on the peninsula were often timed to coincide with the arrival of migratory fish species. Ethnohistorical and Narungga sources summarised in chapter 4 reflect the importance of fish as a resource for Narungga people (Fisher c.1964–1968; Fisher 2006; Mountford 1936, Snell in Griffiths 1988; Thom 1953; Tindale 1936).

Thematically, Narungga fishing is a prominent theme in the ethnohistorical and Narungga resources reviewed for this research. Gladys Elphick reflected (in Fisher c.1964–1968) 'we were fishers from a long time past'. Fish were caught by netting, by spearing and in fish traps (Carmichael 1988; Fisher c.1964-1968; Fisher 2006; Hill and Hill 1975, Jameson 1838; Mollenmans 2014; Mountford 1936, Parsons 1979, 1987; Roberts et al. 2015; Snell in Griffiths 1988; Thom 1953; Tindale 1936).

The absence of fish remains (e.g., bone, otoliths) at the locations explored in this research may be a product of differential preservation as discussed in previous chapters. Hill and Hill (1973:43) observed the presence of otoliths at some of the sites they documented which they state indicate 'the best fishing spots'. They note for example, that thousands of snook and mulloway otoliths were recorded at one campsite at Chinaman's Well near Point Pearce Peninsula/Burgiyana.

Fish traps and earth ovens (that may have been used to produce fibre for fish net manufacture) provide some of the archaeological evidence for Narungga fishing practices recorded in this research. As noted in chapter 6, a sediment sample collected from the earth oven provided a radiocarbon date of 1,360–1,280 cal BP (Wk-56676). This provided the first recorded date for this type of archaeological feature for Yorke Peninsula/Guuranda. The fish trap to the north was previously assessed to have been constructed within the last 1,000 years on the basis of sea level modelling (Mollenmans 2014).

7.3 Watercraft and Islands

Watercraft and islands have been a particular focus of coastal and island archaeological research as it encompasses people developing skills and technologies required to undertake open water travel to harvest offshore marine resources and provide access to islands (e.g. Bowdler 1995; Rowland 2015; Sim and Wallis 2008). Archaeological research into island use in Australia has primarily focussed on Australia's present-day islands which formed during the Holocene following post-glacial sea-level rise.

The individual examples of island use outlined in chapter 2 illustrate the different ways Aboriginal peoples could engage with the islands they accessed (Memmott et a. 2006). Researchers have also considered the timing of island use in conjunction with the impacts of sea-level rise, climate change and island biogeographic factors which may have contributed to abandonment of some islands at times during the Holocene (Sim and Wallis 2008).

Researchers such as Fullager (2015) in relation Great Glennie Island, adjacent to Wilson's Promontory, Victoria, and Draper (2015) in relation to Kangaroo Island, South Australia and other island/island groups along the southern Australia coastline explored the motivations for island visitation. As noted in chapter 2, motivations could include access to rare resources, for ceremonial purposes, accidental landings, fleeing from conflict and to access island food resources during shortages on the mainland (Gaughwin and Fullagar 1995).

Wardang Island/Waraldi and adjacent islands are/were economically and culturally significant places for the Narungga community. The islands were places to gather food such as shellfish, sea bird eggs, penguins, bandicoots and fish (Black 1920). Wardang Island/Waraldi is also important in Narungga 'Dreaming' (see chapter 4.5) and has contemporary significance in association with the activities of Point Pearce/Burgiyana Mission and its residents on the island (Fowler et al. 2014, 2015; Roberts et al. 2013).

Roberts et al. (2013) noted: 'prior to the use of European style vessels Narungga people crossed the channel to Wardang Island by other means and there are various accounts of such events'. In addition to watercraft, it is important to recognise that skills in the water (swimming, fishing and diving—see for example Gunn 1845) are an important component of engagement with the marine environment.[19] Ethnohistorical and Narungga sources record the island was accessed by swimming or wading (Black 1920:88; Fowler 2015:306; Graham and Graham 1987:53; Hill and Hill 1975:38; Roberts et al. 2013:81–82; Wood and Westell 1998:18–19).

Narungga Elder, Cecil Graham (now deceased), recorded memories of such crossings passed down to him describing the purpose of such visits was for 'butterfishing'. As noted in chapter 4, butterfish or strongfish (*D. nigricans*) are particularly significant for Narungga people. The Narungga community identify themselves and are known by broader South Australian Aboriginal communities as the 'Butterfish Mob' (Mollenmans 2014; Roberts et al. in prep.).

Black (1920:88) also noted the risk of such crossings such as from shark attack. As Black (1920:88) recorded:

> When crossing to Wardang Island the blacks [sic] would wade out to [mungari] and swam the rest of the distance. Mrs. Newchurch's grandfather and grandmother told her that

[19] See also watercraft discussion in Fowler (2015).

> while the swimmers were in the water the old men sat along the shore and sang an incantation to keep the sharks away. No one was allowed to move until the party landed on the island. When ready to return they made a signal across the water and the singing began again.

Fowler (2015) reconstructed the likely crossing routes as outlined in chapter 4. Wardang Island/Waraldi is 4 kilometres from the nearest point on the mainland on southwest coast of Point Pearce Peninsula/Burgiyana which is a measure of the effort that would have been required to access the island. Archaeological surveys on Wardang Island/Waraldi including this research were primarily coastal sites with the dominant faunal remains at all locations also being shellfish (Wood et al. 2003). Shellfish identified included: *T. undulata*, *N. melanotragus*, *P. australasia, T. orbita* and *Haliotis* spp. Penguin bone (*E. minor*) were also recorded at seven sites. The shell and penguin remains indicate that the assemblages post-date the period of coastal formation and islandisation.

In contrast to the Wood and Westell (1998) survey at Point Pearce Peninsula/Burgiyana survey, there are fewer tool types recorded in the survey on Wardang Island/Waraldi and the material of manufacture was exclusively quartz or quartzite. Sites on Wardang Island/Waraldi are also generally smaller in size with fewer artefacts. Table 17 compares Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi surveys results (including Wood and Westell 1998; Wood et al. 2003 surveys).

Table 17: Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi surveys (Wood and Westell 1998; Wood et al. 2003) comparison of lithic tools, material of manufacture and faunal remains.

Point Pearce Peninsula/Burgiyana	
Tool types	Flakes, anvil, hammerstones, scrapers, thumbnail scraper, blades, adze, cores.
Raw material	Quartz, quartzite, chert, silcrete, basalt, granite, glass.
Faunal remains	Abalone, black periwinkle, cockles, common limpet, dog whelk, mussel, razorfish, striped periwinkle, tulip shell, warrener.
Average area	26,150 metres^2
Average number of lithic artefacts	307
Wardang Island/Waraldi	
Tool types	Flakes, blades, cores.
Raw material	Quartz, quartzite.
Faunal remains	Abalone, dog whelk, limpet, periwinkle, warrener, bettong, penguin.
Average area	13,758 metres^2

Average number of lithic artefacts	100

During fieldwork for this research, eight marine shell and one eggshell sample were collected from three Narungga heritage sites on Wardang Island/Waraldi (Table 18).

Table 18: Radiocarbon Dating Results—Wardang Island/Waraldi.

Sample ID	Age Cal BP (95.4%)
W3S3 Whelk	***T. orbita* 115–115 cal BP (Wk-56692)**
W6S1 Warrener	***T. undulata* 260–-10 cal BP (Wk-56688)**
W1S2 Whelk	***T. orbita* 310–-10 cal BP (Wk-56685)**
W6S2 Eggshell	**Eggshell 450–300 cal BP (Wk-56689)**
W1S1 Periwinkle	***N. melanotragus* 1,800–1,460 cal BP (Wk-56684)**
W3S2 Warrener	***T. undulata* 3,550–3,200 cal BP (Wk-56691)**
W1S3 Warrener	***Turbo* sp. 3,570–3,230 cal BP (Wk-56686)**
W3S1 Operculum	***Turbo* sp. 4,430–4,040 cal BP (Wk-56690)**
W1S4 Warrener	***T. undulata* 8,040–7,720 cal BP (Wk-56687)**

Figure 90 illustrates Wardang Island/Waraldi sample radiocarbon dates by age. Sample dates for Wardang Island/Waraldi display a similar pattern to ages observed on Point Pearce Peninsula/Burgiyana and illustrate the long history of island use as well as from the earliest date when present day Wardang Island/Waraldi was likely still attached to the mainland ca 8,000 years ago. Similar to sample dates obtained for Point Pearce Peninsula/Burgiyana, there is a gap of c.3,600 years between 4,235 and 7,880 years ago which is explored in more detailed later in this chapter.

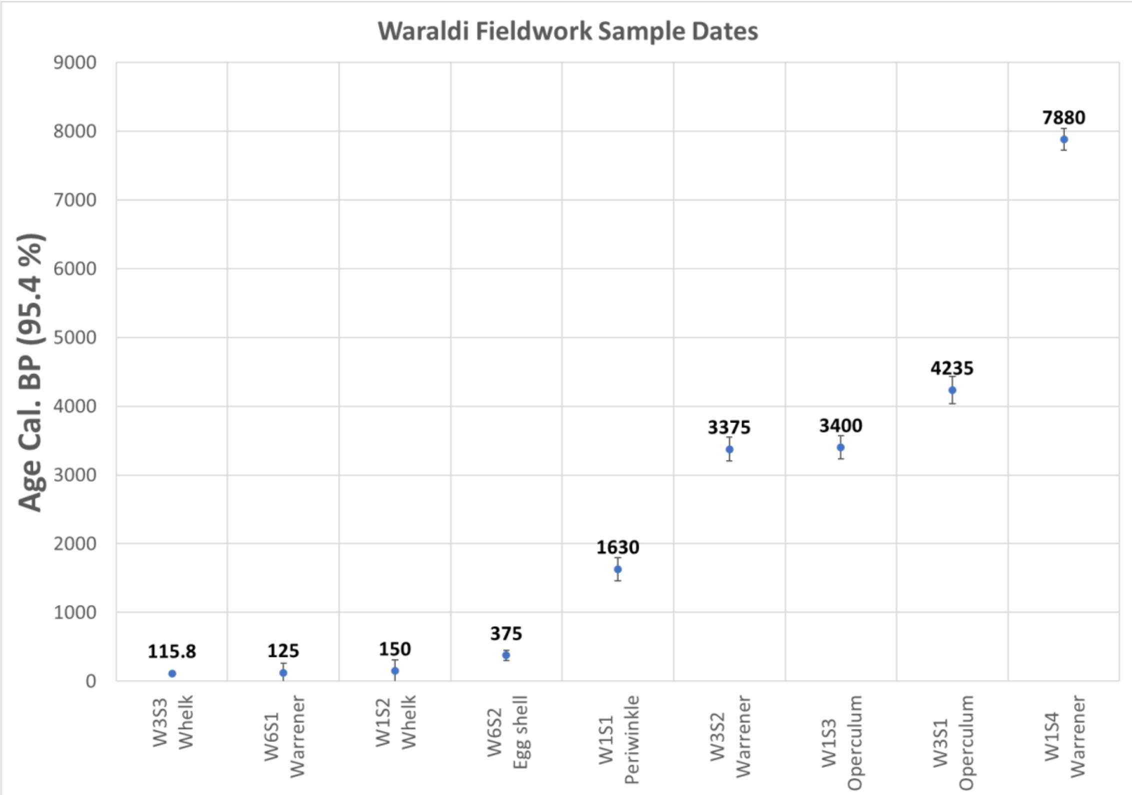


Figure 90: Calibrated radiocarbon ages (95.4% probability range) for Wardang Island/Waraldi. Sample dates from youngest (left) to oldest (right).

7.4 Resource Use Models

The preceding sections outlined research that was generally focussed on the economic and functional components of resource use in the Holocene. As outlined in chapter 2, many researchers have emphasised that cultural change and demographic patterns in Aboriginal societies during the Holocene have been influenced by climate variability and the impact this has on available resources (e.g., Beaton 1985; Hiscock 2008:172–175; Rosendahl et al. 2015; Sim and Wallis 2008; Woodroffe et al. 1988). Researchers have proposed subsistence models linked to the concept of 'environmental determinism' (Wright Jr 1993):

- 'Optimal foraging theory' which argues that resource use choice is governed by harvesting efficiency.
- The 'broad spectrum revolution' which emphasises the role/development of a diversified resource base in response to environmental stress (Zeder 2012).
- Comparison between 'open access resource pools' where there is little or no restriction on resource use (which can lead to over-harvesting) and 'common resource pools' which consider social controls (e.g., resource ownership, tenure or customary law) that govern and manage resource use (see Campbell and Butler 2010).

Campbell and Butler (2010) in their investigation of resource use by hunter-gatherer communities in the Pacific Northwest, North America identified flexible resource use ('broad spectrum model'), as well as 'beliefs and social institutions (including ownership, regulation, rituals and monitoring)' ('common resource pool model') were both important for ensuring sustainable harvesting of salmon spanning 7500 years. In addition, Campbell and Butler (2010) also argued that an understanding of how the Indigenous peoples of the region sustainably managed salmon fisheries had contemporary relevance by providing important insights to help address contemporary declines in salmon populations in their area of their research as a result of overfishing and habitat degradation. As outlined in chapter 2, other researchers investigating resource use in hunter-gatherer communities have also recognised the role of traditional ecological knowledge (TEK) and traditional social customs and spiritual beliefs that govern resource use (e.g., McNiven 2004; Memmott et al. 2006).

Ethnohistorical and Narungga sources outlined in chapter 4 reflect that, fish and shellfish species were important both in the economy and culture of Narungga people at the time of European invasion. Narungga TEK included knowledge of individual marine species (see table 3 and 4) and their habits (Mountford 1936). This is summed up by recollections of the late and knowledgeable Narungga man Tim Hughes (in Betty Fisher 2006) referred to in chapter 4:

> What was undertaken at the head of the Gulf? Tim [Hughes] told me that the men knew the fish would be there in numbers. He could remember walking up the coast of the Peninsula and watching the shoals of fish being herded along by the sharks, "just like a sheepdog herds sheep" he said. They were heading them for the areas at the head of the gulf. "Our old people knew all those things. Our old people didn't need a University. We had all the sciences – the geology – we knew the land; biology – we knew our Law and we knew every plant and bush and tree, every bird and animal and fish…".

Narungga resource use took place in the context of broader social customs and spiritual beliefs (common resource pool). Gillen (ca 1894–1898) for example in relation to an individual's 'totemic' affiliations stated Narungga had a 'special proprietorial interest' in relation to their *Paru* (totem inherited from the father) and Kuyia (sub-totem) species which Gillen linked with food restrictions. The role of social customs and spiritual beliefs governing resource use is also reflected in Narungga narratives. The Narungga 'Dolphin' narrative recounted in chapter 4 describes a beneficial relationship with this species which is not hunted because of the dolphin's behaviour of herding fish into shore.

Klynton Wanganeen (in Mollenmans 2014) commented in relation to Narungga fish trap research that the Narungga fish traps were constructed so as not to disrupt fish and their natural habitats and to state that fish traps were also important for the education of young people in the community:

> Also it should be remembered that the fish traps were made and modified so as not to interrupt the fish habitat while being used as a tool for educating our young about the differing species habits in relation to the habitat and tidal movements, seasonal matter and feeding etc. This ensured that the hunting prowess of our people continued to be of the highest calibre. We are able to still catch fish regardless of the weather due to our educational processes.

As noted in Chapter 4, Narungga fishing technology combined with knowledge of the behaviour of different fish species meant fish could be harvested at different quantities to suit the demands of the Narungga community from small family groups to large community gatherings (Fisher c.1964-1968; Fisher 2006; Hill and Hill 1975; Tindale 1936). It is important to recognise that in addition to harvesting coastal and marine resources, terrestrial game was also hunted and include kangaroo, emu and wallaby species reflecting a 'flexible resource use' model which could also provide choice in times of scarcity (see Campbell and Butler 2010, Meehan 1982).

7.5 Climate Change

As noted in chapter 3, the long-term climate trend on Yorke Peninsula/Guuranda has been from a colder and drier climate during the LGM to a wetter more temperate climate today (Ray and Adams 2001/2002; Williams et al. 2013, 2015). A more detailed climate history for Yorke Peninsula/Guuranda is limited. Evidence from Kangaroo Island, however, indicates that cold and dry conditions continued until approximately 7000 BP (Lampert 1981:15–22—see also Draper 1991:13). The climate became wetter in the following 2200 years. After 4,800 BP, conditions became increasingly drier again until about 2000 BP when climate conditions became like the present (Lampert 1981:15).

Table 19 summarises the Holocene climate history for broader Australia proposed by Williams et al. (2015—see also Williams et al. [2018]). Williams et al. (2015:9–10) argued that the appearance of middens, the greater exploitation of marine resources and the initiation and use of offshore islands occurs during the interim period following the end of the Holocene climate optimum and the subsequent onset of ENSO arid conditions. It should be noted that the synthesis proposed by Williams et al. (2013) is based on analysis of data for preserved sites.

Table 19: Holocene climate history for Australia (from William et al. [2015]).

Period	Climate Impact
The Holocene climate optimum (9–6 kya)	Coincides with rapid expansion, growth and establishment of regional populations, including across the arid zone (conditions at this time allowed longer 'patch residence' times which led to more sedentary lifestyles and allowed low level food production in some parts of the continent
The subsequent onset of ENSO conditions (4.5–2 kya)	Resulted in 'population fragmentation, abandonment of marginal areas, and reduction in ranging territory'
Climate amelioration as a result of La Nina conditions (post 2 kya)	An intensification of the mobility strategies and technological innovations that were developed in the mid-to-late Holocene' resulting in population expansion and utilisation of the whole continent.

Williams et al. (2018) consider the impacts of sea-level fluctuations over time and the differential impacts of sea-level rises in areas where there is shallow relief compared to procumbent coastlines. It should be noted that the end of Holocene climate optimum coincides with the post-glacial sea-level rise highstand. Coastal sites in the period leading up to the peak of the highstand would have been submerged.

Sample radiocarbon dates for research for Wardang Island/Waraldi and Point Pearce Peninsula/Burgiyana highlight a gap in chronology between 4,450 – 4,060 cal BP (Wk-56677) and 7,790 – 7,470 cal BP (Wk-56680). As noted in chapter 2, Sim and Wallis (2008) argued that there was a general 'hiatus' in island use until around 4,500 to 4,000 years ago when climate conditions in the northern part of the continent are thought to have improved because less storm activity made conditions for open-sea travel by watercraft more favourable. As noted above, the period of the gap also spans the period of post-glacial sea-level rise highstand with relative sea levels up to 3 metres higher than present sea level c.6,000 years ago. Western Point Pearce Peninsula/Burgiyana, for example, was likely isolated from the mainland at the peak of the highstand which may have impacted coastal resource use in the area during this time. For example the Willows Well freshwater site would have been inundated during a time when sea levels were three metres higher than today.

Further research, including radiocarbon dating of sites would serve to clarify whether the hiatus revealed in the results for this research are a real effect or whether they are only a preliminary selection of the dates that may be collected. However, on the face of it such a 'hiatus' is entirely plausible given the results of the palaeogeographic modelling undertaken in this project combined with comparisons to archaeological interpretations that have been proffered for other parts of Australia.

Narungga narratives are linked to both the contemporaneous seascape but also include narratives that align with the regional sea-level history of Yorke Peninsula/Guuranda and a time when sea levels were lower, and the region was dry land. Narungga knowledge also include important beliefs and narratives in relation to individual marine species/totems (Gillen c.1894–1898; Fisher c.1964-1968; Fisher 2006; NAPA 2006; Mountford 1936, Tindale 1936). As noted in chapter 4, Gillen in Mulvaney et al. (1997:436) summarised: 'the Narung-ga have traditions about every natural feature and they have preserved the Native names which they evidently use amongst themselves'.

Roberts et al. (2019) explored the complexities associated with such narratives and whether they reflect preserved memory of past events as some researchers have argued (e.g., Nunn and Reid 2016:11—see also Campbell 1967). As Roberts et al. (2019) noted, other researchers have questioned (e.g., Henige 2009) whether oral traditions can persist over such a time depth or have questioned their accuracy and the appropriateness of using them as empirical evidence to corroborate scientific knowledge.[20]

Narungga narratives, for example, encompass beliefs about the origins of the Yorke Peninsula/Guuranda seascape at different scales including creation of Spencer Gulf, islands in Investigator Strait and gulf waters as well as individual features in the seascape (Gillen c.1894–1898; Johnson 1922; Mountford 1936; NAPA 2006; Roberts et al. 2019; Smith/Unaipon 1930; Sutton 1888; Tindale 1936).

Roberts et al. (2019) highlighted 'these narratives form a highly significant system of knowledge' and were 'considered together by the Narungga and non-Narungga authors' in their paper 'to generate a new dialogue about Aboriginal traditions and scientific data'. The dialogue between the Narungga knowledge systems and palaeogeographic mapping (see figure 15) reveals a strong concordance for events/time slices inclusive of the onset of marine transgression, the creation of northern Spencer Gulf and the formation of some islands—while also establishing that there are deeper complexities

[20] As noted in chapter 4, Minc (1985:39) also highlighted that group memories of past subsistence crises, preserved in oral traditions, can play a role in providing strategies for traditional communities to cope with subsequent crises.

inherent within Narungga narratives that demonstrate layers of meaning at multiple scales (Robert et al. 2019).

7.6 Coastal Geomorphology

Geomorphological factors as noted in chapter 2 e.g., Cherry et al. 2012 (change in island land-use patterns over time); Rick et al. 2013 (palaeocoasts and associated peri-coastal sites including high ground vantage points); Tait Elder et al. 2014 (coastal evolution due to sea-level fluctuations and other factors) are important considerations for understanding changing patterns of land use over time. Geomorphological observations during fieldwork for this research provided insights into the landscape history of Point Pearce Peninsula/Burgiyana.

In particular, the swampland connecting western Point Pearce Peninsula/Burgiyana with the mainland was identified as a dynamic environment which has undergone significant change from the time when the case study area was first impacted by post LGM sea-level rise. The area is currently comprised of samphire marsh growing in acid-sulphate soils. The acid sulphate soils are associated with former mangrove environments. In addition, radiocarbon dating results for shell samples collected in inland areas of the swampland provided dates of 320–-10 cal BP (Wk-56694) and 3,340–2,960 cal BP (Wk-56695) which support the idea that the sea intruded further inland in this area in the past and the western portion of the Point Pearce Peninsula may have been separated by a seaway when sea levels were higher during the Holocene highstand.

This research also identified how coastal geomorphology can impact the preservation of archaeological heritage in coastal settings. This research recorded damage that had occurred along the coast as a result of the impact of recent storms in the weeks preceding fieldwork. Impacts that were identified were the deposition of large amounts of sea grass and other debris being washed ashore with sections of dunes had been washed away to a height of 2 metres.

Erosion was also evident along cliffs. Cliff lines at Reef Point and adjacent to Dead Man’s Island/Mungari on Point Pearce Peninsula/Burgiyana were undercut by tidal action and storms surges. Erosion due to water run off was also observed as an issue at some locations. As discussed previously, hearths along the cliff line adjacent to Dead Mans’ Island/Mungari were impacted by water run off as well as coastal erosion with sections of the hearth having been washed away and hearthstones detached from the cliff and lying at the base of the cliff below.

The above observations also provide some insights into the potential impacts on archaeological heritage in submerged landscapes impacted by post-glacial sea-level rise. They also provide important insights into the potential impacts of future climate change and associated sea-level rise on preserved archaeological heritage in coastal settings and low-lying environments. This issue is of significant concern for many Narungga people (pers. comm. Professor Lester-Irabinna Rigney 2023).

7.7 Summary

This research provides new data for a largely undocumented and distinctive environmental and geographic region of southern Australia. The research builds on the body of coastal and archaeological research that has taken place elsewhere in Australia and internationally. This chapter considered the data from this research within the broader research themes (e.g., resource use models, the role of TEK and seascapes) that have come out of prior research into coastal and island archaeology in Australia and elsewhere.

Narungga and ethnohistorical sources collated during this research describe the nature of specialised coastal economies on Yorke Peninsula/Guuranda. The sources reveal Narungga people used a range of technologies and strategies to gather marine foods (e.g., netting, spearing, fish traps, shellfish collecting and the use of islands). Narungga TEK included knowledge of marine species and their behaviours, tides and associated lunar/astronomical phases linked to seasonal resource availability. The Narungga coastal economy was embedded within wider cultural practices and narratives that governed resource use and embodied Narungga spiritual connection to land and waters.

Narungga narratives linked to both the contemporaneous seascape as well as narratives that align with the regional sea-level history of Yorke Peninsula/Guuranda were also explored. GIS was an important tool for modelling sea-level history and coastal geomorphology for Spencer Gulf. Radiocarbon sample dates obtained during this research combined with insights into the sea-level history for Spencer Gulf modelled in GIS provide the first chronology for coastal resource use on Yorke Peninsula/Guuranda spanning 8,000 years from when the Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi case study area was first impacted by post LGM sea-level rise. GIS and geomorphological observations during fieldwork were also important for identifying the impacts of sea-level rise and coastal erosion has had on site preservation and the visibility of archaeological heritage in the case study area.

This research was undertaken as a collaborative project with the Narungga community. A community-based research approach was adopted to ensure the appropriate incorporation of Narungga knowledge about the use and significance of the sea and islands including contemporary perspectives in the research outcomes.

8. CONCLUSIONS

This chapter revisits the research questions and aims outlined in chapter 1 considering the data collated during this research. A focus of this research was to investigate the archaeology and natural history of Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi case study area in order to provide insights into the emergence of the Narungga Holocene coastal and marine economy on Yorke Peninsula/Guuranda.

Narungga and ethnohistorical sources collated during this research describe the nature of specialised coastal economies on Yorke Peninsula/Guuranda. The sources reveal Narungga people used a range of technologies and strategies to gather marine foods (e.g., netting, spearing, fish traps, shellfish collecting and the use of islands. Narungga TEK included knowledge of marine species and their behaviours, tides and associated lunar/astronomical phases linked to seasonal resource availability. The Narungga coastal economy was embedded within wider cultural practices and narratives that governed resource use and embodied Narungga spiritual connection to land and waters. The Narungga archaeological heritage recorded during this project sits within this broader cultural context.

The case study area, in turn, was deemed important for undertaking this research as it provides a microcosm of the range of environments and coastal landforms that are found on wider Yorke Peninsula/Guuranda. As noted in chapter 1, Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi are part of the lands of the Point Pearce Aboriginal Corporation which include Point Pearce/Burgiyana township a former mission established in 1868 and thus the Narungga community has a strong and continuing attachment with this region spanning the pre- and post-contact period (Graham and Graham 1987; NAPA 2006; Wanganeen 1987).

Fieldwork for this research was undertaken on Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi over a total of thirteen days. Narungga/Point Peace Aboriginal Corporation community representatives participated in and guided the fieldwork and identified and provided cultural context to many of the sites that were recorded. Twenty-seven localities were surveyed during the fieldwork on Point Pearce Peninsula/Burgiyana. Archaeological sites that were recorded included coastal sites and inland sites and more recent sites associated with the heritage of the Point Pearce/Burgiyana former mission and township. Four sites were surveyed on Wardang Island/Waraldi and were all sites that were previously surveyed by Wood et al. (2003).

Prior archaeological surveys by Wood and Westell (1998) and Wood et al. (2003) conducted two of the most comprehensive archaeological surveys of Yorke Peninsula/Guuranda and provided important data for this research. In particular, Wood and Westell's (1998) recorded sixteen archaeological sites on Point Pearce Peninsula/Burgiyana. Wood et al.'s (2003) survey of Yorke Peninsula/Guuranda included an archaeological survey of Wardang Island/Waraldi where 16 archaeological sites/complexes were also identified and recorded.

This is the first work that provides any significant work on chronology on Yorke Peninsula/Guuranda. The research provides a preliminary chronology for the coastal and island archaeology of Yorke Peninsula/Guuranda, South Australia with a focus on Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi case study area in Spencer Gulf. Sample dates for this research, reveal shellfish resource use spanning 8,000 years following the formation of present-day Spencer Gulf as a result of post-glacial marine transgression during the Holocene. These results are also important as they extend the range of coastal and archaeological research beyond a northern Australian milieu to encompass a largely undocumented and distinctive environmental and geographic region of southern Australia where little was previously known about the time-depth of the emergence of Holocene coastal specialisations.

The earliest dates obtained for Wardang Island/Waraldi and Point Pearce Peninsula/Burgiyana show evidence for shellfishing from when the case study area was first impacted by the marine transgression that followed the LGM at a time when Wardang Island/Waraldi was still connected to the mainland. The earliest dates obtained for Wardang Island/Waraldi and Point Pearce Peninsula/Burgiyana also provide preliminary evidence that shellfish habitats established relatively early along the coast at these locations following inundation as a result of sea-level rise.

GIS was an important tool for modelling sea-level history and coastal geomorphology for Spencer Gulf. In this regard, marine transgression modelling was also important for correlating palaeoshorelines and the impacts of the Holocene highstand with each of the radiocarbon dating samples obtained for this research. GIS and geomorphological observations during fieldwork were also important for identifying the impacts of sea-level rise and coastal erosion has had on site preservation and the visibility of archaeological heritage in the case study area.

Ethnohistorical sources also record the significance of Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi is also important in Narungga 'Dreaming' and has contemporary significance in association with the activities of Point Pearce /Burgiyana Mission and its residents on the island (Fowler et al. 2014; Roberts et al. 2013, Roberts et al. in prep). As outlined in chapter 6, recent sites associated with the heritage of the Point Pearce/Burgiyana former mission and township were also recorded during fieldwork. Sites included campsites, shacks, shack artwork and Willows Well. Ethnohistorical sources also record the significance of nearshore islands.

This research builds on a number of collaborative research projects have been undertaken with the Narungga and Point Pearce communities which have focused on the Point Pearce Peninsula/Burgiyana and Wardang Island/Waraldi (Fowler et al. 2014, 2015, 2019; Mollenmans 2014; Roberts et al. 2013, 2016, 2019). This research was undertaken as a collaborative project with the Narungga community. A community-based research approach was adopted to ensure the appropriate incorporation of Narungga knowledge about the use and significance of their heritage on Yorke Peninsula/Guuranda including contemporary perspectives in the research outcomes.

As noted in chapter 7, further research, including radiocarbon dating of sites would serve to clarify whether the hiatus revealed in the results for this research are a real effect or whether they are only a preliminary selection of dates that may be collected. Further research into the potential impacts of future climate change and associated sea-level rise on preserved archaeological heritage in coastal settings on Yorke Peninsula/Guuranda is also recommended.

9. REFERENCES

Aboriginal Studies Curriculum Committee n.d. *The Story of Buthera's Rock: A Story of the Narungga People of Yorke Peninsula.* Retrieved 19 February 2019 from <http://www.sacsa.sa.edu.au/ATT/%7BED328759-E05D-49B0-96C5-6A421127B4DF%7D/socres.htm>.

Anonymous (Anon.) The southern coast of New Holland. *Sydney Gazette and New South Wales Advertiser* Saturday 2 July 1836, p.2.

Anonymous (Anon.) Horse stealing. *The South Australian Advertiser* Saturday 30 November 1867, p.2.

Anonymous (Anon.) Yorke's Peninsula Aboriginal mission. *The South Australian Register* Friday 5 May 1876, p.17.

Anonymous (Anon.) Fresh water wells at Point Pearce. *The South Australian Advertiser* Tuesday 8 April 1879, p.6.

Anonymous (Anon.) Yorke Peninsula place names: history of their origin. *The Pioneer* Wednesday 19 March 1923, p.3.

Atalay, S. 2012 *Community-Based Archaeology.* Berkley: University of California Press.

Bailey, G.N., J. Harff and D. Sakellariou (eds) 2017 *Under the Sea: Archaeology and Palaeolandscapes of the Continental Shelf*. Cham: Springer.

Bailey, G.N., K. Hardy and A. Camara (eds) 2013 *Shell Energy. Mollusc Shells as Coastal Resources.* Oxford and Oakville: Oxbow Books.

Bannerman, N. and C. Jones 1999 Fish-trap types: a component of the maritime cultural landscape. *The International Journal of Nautical Archaeology* 28(1):70–84.

Barker, B.C. 1991 Nara Inlet 1: Coastal resource use and the Holocene marine transgression in the Whitsunday Islands, central Queensland. *Archaeology in Oceania* 26(3):102–109.

Barker, B.C. 2004 *The Sea-People: Late-Holocene Maritime Specialisation in the Whitsunday Islands, Central Queensland (Terra Australis 20).* Canberra: ANU E Press.

Beaton, J.M. 1985 Evidence for a coastal occupation time-lag at Princess Charlotte Bay (North Queensland) and implications for coastal colonization and population growth theories for Aboriginal Australia. *Archaeology in Oceania* 20:1–20.

Beaton, J.M. 1995 The transition on the coastal fringe of greater Australia. *Antiquity* 69(265):798.

Belperio, A.P., N. Harvey and R.P. Bourman 2002 Spatial and temporal variability in the Holocene palaeo sea-level record around the South Australian coastline. *Sedimentary Geology* 150:153–169.

Bender, B. 1981 Gatherer-hunter intensification. In A. Sheridan and G. Bailey (eds), *Economic Archaeology*, pp.149–157. Oxford: B.A.R.

Benjamin, J., M. O'Leary, J. McDonald, C. Wiseman, J. McCarthy, E. Beckett, P. Morrison, F. Stankiewicz, J. Leach, J. Hacker, P. Baggaley, K. Jerbic, M. Fowler, J. Fairweather, P. Jeffries, S. Ulm and G. Bailey 2020 Aboriginal artefacts on the continental shelf reveal ancient drowned cultural landscapes in northwest Australia. *PLoS ONE* 15(7): e0233912.https://doi. org/10.1371/journal.pone.0233912

Black, J.M. 1920 Vocabularies of four South Australian languages—Adelaide, Narrunga, Kukata and Narrinyeri—with special reference to their speech sounds. *Transactions of the Royal Society of South Australia* 44:76–93.

Bone, Y. 1978 The Geology of Wardang Island, Yorke Peninsula, South Australia. Unpublished Honours Thesis, Department of Geology, University of Adelaide.

Bone, Y. 1984 The Wardang volcanics, Wardang Island, Yorke Peninsula. *Quarterly Geological Notes, Geological Survey of South Australia* 89:2–7.

Bone, Y. 1985 Wardang Island. *Bulletin of the Field Geology Club of South Australia* 14:3–9.

Bourke, P., S. Brockwell, A. Clarke, C. Crassweller, P. Faulkner and D. Guse 2009 Radiocarbon dates from the top end: a cultural chronology for the Northern Territory coastal plains. *Australian Aboriginal Studies* 1:54–65.

Bourke, P., S. Brockwell, P. Faulkner and B. Meehan 2007 Climate variability in the mid-to-late Holocene Arnhem Land region, north Australia: archaeological archives of environmental and cultural change. *Archaeology in Oceania* 42(3):91–101.

Bourman, R.P., C.V. Murray-Wallace and N. Harvey 2016 *Coastal Landscapes of South Australia.* Adelaide: University of Adelaide Press.

Bowdler, S. 1995 Offshore islands and maritime explorations in Australian prehistory. *Antiquity* 69:945–958.

Bronk Ramsey, C. 2009 Bayesian analysis of radiocarbon dates. *Radiocarbon* 51(1):337–360.

Campbell, A. 1967 Aboriginal traditions and the prehistory of Australia. *Mankind* 6(10):476–481.

Campbell, S.K. and V.L. Butler 2010 Archaeological evidence for resilience of Pacific Northwest salmon 541 populations and the socioecological system over the last ∼ 7,500 years. *Ecology and Society 15.* Retrieved 1 July 2015 from <http://www. ecologyandsociety.org/vol15/iss1/art17/>.

Campbell, T. and G.D. Walsh 1947 Notes on Aboriginal camp sites on Yorke Peninsula. *Mankind* 3(11):334–340.

Cane, S. 1998 *A Coastal Heritage: A Review of the Indigenous Heritage Sites on the Australian Coastline.* Canberra: Australian Heritage Commission.

Carmichael, E. 1988 Reminiscences of natives on Yorke Peninsula after closer settlement. *The Journal of the Anthropological Society of South Australia* 26(3):3–6.

Cherry J.F., K. Ryzewski and T.P. Leppard 2012 Multi-period landscape survey and site risk assessment on Montserrat, West Indies. *The Journal of Island and Coastal Archaeology* 7(2):282–302.

Clarke, A. and R. Torrence (eds) 2000 *The Archaeology of Difference: Negotiating Cross-Cultural Engagements in Oceania*. London: Routledge.

Clarkson, C. and L. Wallis 2003 The search for El Nino/Southern Oscillation in archaeological sites: recent results from Jugali-Ya Rockshelter, Wardaman Country, Australia. In D.M. Hart and L.A. Wallis (eds) Phytolith and Starch Research in the Australian-Pacific-Asian Regions : the State of the Art : Papers from a Conference held at the ANU, August 2001, Canberra, Australia. pp.137–152. Pandanus Press: Canberra.

Clarkson, C., Z. Jacobs, B. Marwick, R. Fullagar, L. Wallis, M. Smith, R.G. Roberts, E. Hayes, K. Lowe, X. Carah, S.A. Florin, J. McNeil, D. Cox, L.J. Arnold, Q. Hua, J. Huntley, H.E.A. Brand, T. Manne, A. Fairbairn, J. Shulmeister, L. Lyle, M. Salinas, M. Page, K. Connell, G. Park, K. Norman, T. Murphy and C. Pardoe 2017 Human occupation of northern Australia by 65,000 years ago. *Nature* 547(20):306–310.

Colley, S. 1987 Fishing for facts. Can we reconstruct fishing methods from archaeological evidence? *Australian Archaeology* 24:16–26.

Colwell-Chanthaphonh, C. and T.J. Ferguson 2008 Introduction: The collaborative continuum. In C. Colwell-Chanthaphonh, C. and T.J. Ferguson (eds), *Collaboration in Archaeological Practice: Engaging Descendant Communities*, pp.1–32. Plymouth, United Kingdom: Alta Mira Press.

Connaway, J. 2007 *Fishweirs: A World Perspective with Emphasis on the Fishweirs of Mississippi, Archaeological Report No. 33, Mississippi Department of Archives and History.* Saline, Michigan: McNaughton & Gunn, Inc.

Corbett, D. (ed.) 1973 *Yorke Peninsula: A Natural History.* Adelaide: Department of Adelaide Education, the University of Adelaide.

Curr, E.M. 1886 *The Australian Race.* Melbourne: Government Printer.

David, B., B. Barker and I. McNiven (eds) 2006 *The Social Archaeology of Australian Indigenous Societies.* Canberra: Aboriginal Studies Press.

Davidson-Arnott, R. 2010 *Introduction to Coastal Processes and Geomorphology.* Cambridge: Cambridge University Press.

Davies, E. 1952 The omen of the tea-tree. *The Mail* Thursday 25 March 1952, p7.

Department of Environment, Water and Natural Resources (DEWNR) 2017 Naturemaps SA. Retrieved 5 February 2017 from <www.naturemaps.sa.gov.au>.

Department of Primary Industries and Resources (PIRSA) 2017 South Australian Resources Information Geoserver. Retrieved 5 February 2017 from <https://sarig.pir.sa.gov.au>.

Dougherty A.J., Z.A. Thomas, C. Fogwill, A. Hogg, J. Palmer, E, Rainsley, A.N. Williams, S. Ulm, K. Rogers, B.G. Jones and C. Turney 2019 Redating the earliest evidence of the mid-Holocene relative sea-level highstand in Australia and implications for global sea-level rise. *PLoS ONE* 14(7):e0218430.https://doi.org/10.1371/journal.pone.0218430.

Draper, N. 1991 Cape du Couedic Rockshelter and the Aboriginal Archaeology of Kangaroo Island, South Australia. Unpublished PhD Thesis, Department of Anthropology, University of New Mexico.

Draper, N. 2015 Islands of the dead? Prehistoric occupation of Kangaroo Island and other southern offshore islands and watercraft use by Aboriginal Australians. *Quaternary International* 385:29–242.

Edwardes, A.D. 1934 Lonely islanders happy in isolation. *The Chronicle* Thursday 3 May 1934, p.51.

Elkin, A.P. 1977 *Aboriginal Men of High* Degree. Brisbane: University of Queensland Press.

Elphick, G. 1966–1968 Tapes and Transcripts of Interviews with EM Fisher between 1996–8. Narungga Aboriginal Progress Association (NAPA) Archives, Moonta.

Elvis - Elevation and Depth - Foundation Spatial Data: Elevation - Western Yorke Peninsula LiDAR 2021. Retrieved 4 October 2021 from <Elevation - Western Yorke Peninsula LiDAR 2021>.

English, A. 2002 *The Sea and the Rock gives us a Feed.* Hurstville: NSW National Parks and Wildlife Service.

Field Geology Club of South Australia Incorporated (FGCSA) 1997 *A Field Guide to the Geology of Yorke Peninsula.* Adelaide: Gillingham Printers.

Fisher, B. c.1964-1968 Transcript of Betty Fisher Interview with Gladys Elphick. Tape 1.

Fison, L. and A.W. Howitt 1880 *Kamilaroi And Kurnai*. Melbourne: George Robertson.

Fitzpatrick, R., B. Thomas, R. Merry, S. Marvanck and R.M. Poch 2014 Acid sulphate soils. In Shepherd, S.A., S.M. Madigan, B.M. Gillanders, S. Murray-Jones and D.J. Wiltshire (eds), *Natural History of Spencer Gulf*, pp.92–106. Adelaide: Royal Society of South Australia Incorporated.

Fitzpatrick, S.M., Rick, T.C. and J.M. Erlandson 2015 Recent progress, trends, and developments in island and coastal archaeology. *Journal of Island and Coastal Archaeology* 10:3–27.

Fowler, M. 2015 'Now, are you going to believe this or not?' Addressing Neglected Narratives through the Maritime Cultural Landscape of Point Pearce Aboriginal Mission/Burgiyana, South Australia. Unpublished PhD Thesis, Department of Archaeology, Flinders University of South Australia.

Fowler, M., A. Roberts and L-I. Rigney 2019 The sounds of colonization: an examination of bells at Point Pearce Aboriginal Mission/Burgiyana, South Australia. In Aikas, T. and A-K. Salmi (eds.) *The Sounds of Silence: Indigenous Perspectives on the Historical Archaeology of Colonialism*, pp.15–38. New York: Berghahn.

Fowler, M., A.L. Roberts, F. Graham, L. Sansbury and C. Sansbury 2015 Seeing Narungga (Aboriginal) land from the sea: a case study from Point Pearce/Burgiyana, South Australia. *Bulletin of the Australasian Institute for Maritime Archaeology* 39:60–70.

Fowler, M., A.L. Roberts, J. McKinnon, C. O'Loughlin and F. Graham 2014 'They camped here always': 'Archaeologies of attachment' in a seascape context at Wardang Island (Waraldi/Wara-dharldhi) and Point Pearce Peninsula/Burgiyana, South Australia. *Australasian Historical Archaeology* 32:14–22.

Friends of St Vincent Gulf 2014 Gulf St Vincent. A Precious Asset. Retrieved 27 October 2014 from <http://friendsofgulfstvincent.org.au/resources/booklets/>.

Fullagar, R. 2015 The logic of visitation: tool-use, technology and economy on Great Glennie Island, southeastern Australia. *Quaternary International* 385:219–228.

Fuller, M.K., Y. Bone, V.A. Gostin and C.C. Von Der Borch 1994 Holocene cool-water carbonate and terrigenous sediments of southern Spencer Gulf, South Australia. *Australian Journal of Earth Science* 41:353–363.

Gaughwin D. and R. Fullagar 1995 Victorian offshore islands in a mainland coastal economy. *Australian Archaeology* 40(1):38–50.

Geological Survey of South Australia—Department for Energy and Mining, the Government of South Australia, Geoscientific Data (GSSA) 2019: 100K South Australia Surface Geology. Retrieved 6 November 2019 from <http://energymining.sa.gov.au/minerals//geoscience/geological_survey/data>.

Gerritsen, R. 2001 Aboriginal fish hooks in southern Australia: Evidence, arguments and implications. *Australian Archaeology* 52:18–28.

Giles, T. 1881 Old time memories: Blacks on Yorke's Peninsula. *The Adelaide Observer*, 22 October 1881.

Gillen, F.J. c. 1894–1898 Notes on Habits and Customs of [Australian] Natives. The University of Adelaide, Barr Smith Special Collections.

Gostin, V.A. and S.M. Hill 2014 Spencer Gulf: geological setting and evolution. In S.A. Shepherd, S.M. Madigan, B.M. Gillanders, S. Murray-Jones and D.J. Wiltshire (eds), *Natural History of Spencer Gulf*, pp.21–35. Adelaide: Royal Society of South Australia Incorporated.

Graham, D.M. and C.W. Graham 1987 *As We've Known It: 1911 to the Present.* Underdale: Aboriginal Studies and Teacher Education Centre.

Griffiths, T. (ed.) 1988 *The Life and Adventures of Edward Snell.* North Ryde, New South Wales: Angus and Robertson Publishers.

Gunn, R.C 1845 On the Heaps of recent Shells which exist along the shores of Tasmania. *The Tasmanian Journal of Natural Science* pp.332-336.

Hails, J.R., A.P. Belperio, V.A. Gostin and G.E. Sargent 1984 The sub-marine Quaternary stratigraphy of northern Spencer Gulf, South Australia. *Marine Geology* 61:345–372.

Hall, J. and I.J. McNiven (eds) 1999 *Australian Coastal Archaeology.* Canberra: ANH Publications.

Hamilton, E.L. 1868 *Report from Protector of Aborigines, for half-year ended June 30, 1868.* Adelaide: Aborigines Office.

Hamm, G., P. Mitchell, L.J. Arnold, G.J. Prideaux, D. Questiaux, N.A. Spooner, V.A. Levchenko, E.C. Foley, T.H. Worthy, B. Stephenson and V. Coulthard 2016 Cultural innovation and megafauna interaction in the early settlement of arid Australia. *Nature* 539:280–283.

Heinrich, R. 1972 *Governor Fergusson's Legacy: History of Maitland-Kilkerran.* Adelaide: Gillingham Printers.

Heinrich, R. 1976 *Wide Sails and Wheat Stacks.* Port Victoria: Port Victoria Centenary Committee.

Henige, D. 2009 Impossible to disprove yet impossible to believe: the unforgiving epistemology of deep-time oral tradition. *History in Africa* 36:127–234.

Hercus, L. 1992 *A Nukunu Dictionary.* Canberra: AIATSIS.

Hercus, L. and H. Koch (eds) 2009 *Aboriginal Placenames: Naming and Re-naming the Australian Landscape.* Canberra: ANU E Press and Aboriginal History Inc.

Hill, D.L. and S.J. Hill 1975 *Notes on the Narangga Tribe of Yorke Peninsula.* Adelaide: Lutheran Publishing House.

Hill, P.J., P. De Deckker, C. von der Borch and C.V. Murray-Wallace 2009 Ancestral Murray River on the Lacepede Shelf, southern Australia: late Quaternary migrations of a major river outlet and strandline development. *Australian Journal of Earth Sciences* 56(2):135–157.

Hiscock, P. 2008 *Archaeology of Ancient Australia.* London: Routledge.

Hogg, A.G., Q. Hua, P.G. Blackwell, M. Niu, C.E. Buck, T.P. Guilderson, T.J. Heaton, J.G. Palmer, P.J. Reimer, R.W. Reimer, C.S.M. Turney and S.R.H. Zimmerman 2013 SHCal13 Southern hemisphere calibration, 0–50,000 years cal BP. *Radiocarbon* 55(4):1889–1903.

Hope J. H., R.J. Lampert, E. Edmondson, M.J. Smith and G.F. van Tets 1977 Late Pleistocene faunal remains from Seton rock shelter, Kangaroo Island, South Australia. *Journal of Biogeography* 4:363–385.

Howitt, A.W. 1904 *The Native Tribes of South-East Australia.* London: McMillam and Co.

Hughes, J.H. 1840 Natives of Yorke's Peninsula. *The Adelaide Chronicle*, Tuesday 21 January 1840.

Hughes, P.J., M.E. Sullivan and P. Hiscock 2017 Palaeoclimate and human occupation in southeastern arid Australia. *Quaternary Science Reviews* 163:72–83.

Jeffery, B. 2013 Reviving community spirit: furthering the sustainable, historical and economic role of fish weirs and traps. *Journal of Maritime Archaeology* 8:29–57.

Jessup, R.W. 1967 The late-Quaternary eustatic and geological history of the northern Yorke Peninsula, South Australia. In R.V. Morrison and H.B. Wright (eds), *Correlation of Quaternary Successions Volume 8*, pp.395–406. Boulder, Colorado 1965.

Johnson, J.H. 1922 Our Aborigines. Tribal customs of Yorke's Peninsula. By Marion Bay. Yorke Peninsula Register, Tuesday 24 January 1922, p.4.

Johnson, J.H. 1930a The native tongue. A valuable vocabulary. *The Pioneer*, Friday 12 December 1930, p.1.

Johnson, J.H. 1930b The native tongue. A valuable vocabulary. *The Pioneer*, Friday 26 December 1930, p.1.

Johnson, J.H. 1931a The native tongue. A valuable vocabulary. *The Pioneer*, Friday 16 January 1931, p.1.

Johnson, J.H. 1931b The native tongue. A valuable vocabulary. *The Pioneer*, Friday 9 January 1931, p.1.

Johnson, J.H. c.1898–1900 Vocabulary of Southern Yorke Peninsula Natives. State Library of South Australia Special Collections.

Kenny, M. 1973 Vegetation. In D. Corbett (ed). *Yorke Peninsula. A Natural History*, pp.29–54. Adelaide: Department of Adelaide Education, the University of Adelaide.

Krichauff, S. 2008 The Narungga and Europeans: Cross-Cultural Relations on Yorke Peninsula in the Nineteenth Century. Unpublished Master of Arts Thesis, Discipline of History, School of History and Politics, University of Adelaide.

Kühn, W. and W. Fowler 1886 Yorke's Peninsula, South Australia. In Curr, E.M. (ed.) *The Australian Race: Its Origin, Languages, Customs, Place of Landing in Australia, and the Routes by which it Spread Itself over that Continent (Vol. 2)*, pp.143–145. Melbourne: Government Printer.

Kühn, W.J. 1876 Extract from Rev. W. J. Kühn's Report of the Yorke's Peninsula Aboriginal Mission, for the Quarter Ending Dec. 31, 1875. *The Wallaroo Times and Mining Journal* Wednesday 19 January 1876, p.3.

Lambeck, K. and J. Chappell 2001 Sea level through the last glacial cycle. *Science* 292:679–686.

Lambeck, K. and M. Nakada 1990 Late Pleistocene and Holocene sea-level change along the Australian coast. *Palaeogeography, Palaeoclimatology, Palaeoecology (Global and Planetary Change Section)* 89:143–176.

Lampert, R.J. 1981 *The Great Kartan Mystery.* Canberra: Department of Prehistory, Research School of Pacific Studies, the Australian National University.

Laws, H.M. 1973 Invertebrate animals of the seashore. In D. Corbett (ed.), *Yorke Peninsula. A Natural History*, pp.29–54. Adelaide: Department of Adelaide Education, the University of Adelaide.

Lewis, S.E., C.R. Sloss, C.V. Murray-Wallace, C.D. Woodroffe and S.G. Smithers 2013 Post-glacial sea-level changes around the Australian margin: a review. *Quaternary Science Reviews* 74:115–138.

Liebelt, B., A. Roberts, C. O'Loughlin and D. Milera 2016 'We had to be off by sundown': Narungga contributions to farming industries on Yorke Peninsula (Guuranda), South Australia. *Aboriginal History* 40:89–117.

Lightfoot, K. 1995 Culture contact studies: redefining the relationship between prehistoric and historical archaeology. *American Antiquity* 60:199–218.

Lourandos, H. 1980 Change or stability? Hydraulics, hunter-gatherers and population in temperate Australia. *World Archaeology* 11:245–264.

Lourandos, H. 1983 Intensification: a late Pleistocene-Holocene archaeological sequence from southwestern Victoria. *Archaeology in Oceania* 18:81–97.

Lourandos, H. 1997 *Continent of Hunter-Gatherers.* New Perspectives in Australian Prehistory. Cambridge: Cambridge University Press.

Lourandos, H. and A. Ross 1994 The great 'intensification debate': its history and place in Australian archaeology. *Australian Archaeology* 39:54–63.

MacArthur, R. and E. Wilson 1967 *The Theory of Island Biogeography.* Princeton: Princeton University Press.

Martin, S. 1988 Eyre Peninsula and West Coast Aboriginal Fish Trap Survey. Unpublished report prepared for the South Australian Department of Environment and Planning, Adelaide.

McArthur, J. 1876 A week at the Point Pearce Aboriginal Mission Station. *The Yorke's Peninsula Advertiser and Miners' and Farmers' Journal Supplement* 10 Friday November 1876, p.1.

McCarthy, F.D. 1976 *Australian Aboriginal Stone Implements.* Sydney: The Australian Museum Trust.

McDowell, M., G.J. Prideaux, K. Walshe, F. Bertuch and G. Jacobsen 2015 Re-evaluating the late Quaternary fossil mammal assemblage of Seton Rockshelter, Kangaroo Island, South Australia, including the evidence for late-surviving megafauna. *Journal of Quaternary Science* 30(4):355–364.

McKinnon, J.F., J. Mushynsky and G. Cabrera 2014 A fluid sea in the Mariana Islands: Community archaeology and mapping the seascape of Saipan. *Journal of Maritime Archaeology* 9:59–79.

McNiven, I. 2003 Saltwater people: spiritscapes, maritime rituals and the archaeology of Australian Indigenous seascapes. *World Archaeology* 35(3):329–349.

Meehan, B. 1982 *Shell Bed to Shell Midden.* Canberra: Australian Institute of Aboriginal Studies.

Meillassoux, C. 1973 On the mode of production of the hunting band. In P. Alexandre (ed.), *French Perspectives in African Studies*, pp.187–203. London: Oxford University Press.

Memmott, P., N. Evans, R. Robins and I. Lilley 2006 Understanding isolation and change in island human populations through a study of Indigenous cultural patterns in the Gulf of Carpentaria. *Transactions of the Royal Society of South Australia* 130(1):29–47.

Miller, B.A. 2006 Reconstructing Quaternary Landscapes and Hydrology from Soil Survey Maps. Unpublished Master of Science Thesis, Iowa State University.

Minc, L. 1986 Scarcity and survival: the role of oral tradition in mediating subsistence crises. *Journal of Anthropological Archaeology* 5:39–113.

Mollenmans, A. 2014 An Analysis of Narungga Fish Traps on Yorke Peninsula, South Australia. Unpublished Honours Thesis, Department of Archaeology. Flinders University of South Australia.

Morrison, M. 2014 Chronological trends in late Holocene mound construction across northern Australia: insights from Albatross Bay, Cape York Peninsula. *Australian Archaeology* 79:1–13.

Morse, K., 1988 Mandu Mandu Creek rockshelter: Pleistocene human coastal occupation of Northwest Cape, Western Australia. *Archaeology in Oceania* 23(3):81–88.

Morse, K., 1993 Who can see the sea? Prehistoric Aboriginal occupation of the Cape Range Peninsula. In W.F. Humphreys (ed.), *The Biogeography of Cape Range, Western Australia.* Records of the Western Australian Museum 45, pp.227–242. Western Australian Museum: Perth.

Moss, P., L. Mackenzie, S. Ulm, C. Sloss, D. Rosendahl, L. Petherick, L. Steinberger, L. Wallis, H. Heijnis, F. Petchey and G. Jacobsen 2015 Environmental context for late Holocene human occupation of the South Wellesley Archipelago, Gulf of Carpentaria, northern Australia. *Quaternary International* 385:136–144

Mountford, C.P. 1936 Customs and tribal lore: the last of the Yorke Peninsula Aborigines. *The Chronicle* Thursday 16 July 1936, p.50.

Mountford, C.P. 1952 The story of our peninsula Aborigines. *Pioneer* Friday 29 February 1952, p.8.

Mountford, C.P. and A. Roberts 1969 *The Dawn of Time: Australian Aboriginal Myths in Paintings.* Adelaide: Rigby.

Mulvaney, J., H. Morphy and A. Petch (eds) 1997 *'My Dear Spencer': The Letters of F. J. Gillen to Baldwin Spencer.* South Melbourne, Victoria: Hyland House Publishing.

Nagle, N., K.N. Ballantyne, M. van Oven, C.T. Smith, Y. Xue, D. Taylor, S. Wilcox, L. Wilcox, R. Turkalov, R.A.H. van Oorschot, P. McAllister, L. Williams, M. Kayser, R.J. Mitchell and The Genographic Consortium 2016 Antiquity and diversity of aboriginal Australian Y-chromosomes. *American Journal of Physical Anthropology* 159:367–381.

Narungga Aboriginal Progress Association (NAPA) 2006 *Nharangga Warra: Narungga Dictionary.* Maitland, South Australia: Narungga Aboriginal Progress Association.

Nunn, P.D. and N.J. Reid 2016 Aboriginal memories of inundation of the Australian coast dating from more than 7000 years ago. *Australian Geographer* 47(1):11–47.

Nursey-Bray, M., D. Fergie, V. Arbon, L.-I. Rigney, R. Palmer, J. Tibby, N. Harvey and L. Hackworth 2013 *Community Based Adaptation to Climate Change: The Arabana, South Australia.* Gold Coast: National Climate Change Adaptation Research Facility.

O'Connor, S. 1987 The stone house structures of High Cliffy Island, north-west Kimberley, Western Australia. *Australian Archaeology* 25:30–39.

O'Connor, S. 1992 The timing and nature of prehistoric island use in northern Australia. *Archaeology in Oceania* 27:49–60.

O'Grady, Geoffrey. 1958. Narangga, from Mr J. Lang, Point Pearce. Field notes. manuscript.

Ostapchuk, V. 1969 A Study in Culture Change: The Aborigines of Yorke Peninsula and of Point Pearce Reserve. Unpublished Honours thesis, University of Adelaide.

Parsons, A. 1964 Aboriginal stone implement industry on Yorke Peninsula. *Journal of the Anthropological Society of South Australia* 2(3):2–3.

Parsons, A. 1979 Aboriginal sites on Yorke Peninsula. *Journal of the Anthropological Society of South Australia* 17(1):5–6.

Parsons, A. 1987 Reminiscences of Natives on Yorke Peninsula, after closer settlement. *Journal of the Anthropological Society of South Australia* 25(3):4.

Parsons, A. 1986 *Yorke Peninsula …A Resident's Views.* Yorketown: The Pioneer Printing Office.

Phillips, L.G. 1934 Reminiscences. *The Southern Yorke Peninsula Pioneer* Friday November 1934.

Preiss, K. 1962a Aboriginal rock carving at Point Turton, Yorke Peninsula. *The South Australian Naturalist* 36(2):42.

Preiss, K. 1962b Aboriginal rock carving at Point Turton, Yorke Peninsula. *The South Australian Naturalist* 36(4):32.

Ray, N. and J.M. Adams 2001/2002 A GIS-based vegetation map of the world at the Last Glacial Maximum (25,000–15,000 BP). *Internet Archaeology* 11.

Reimer, P. J., E. Bard, A. Bayliss, J.W. Beck, P.G. Blackwell, C. Bronk Ramsey, P.M. Grootes, T.P. Guilderson, H. Haflidason, I. Hajdas, C. HattŽ, T.J. Heaton, D.L. Hoffmann, A.G. Hogg, K.A. Hughen, K.F. Kaiser, B. Kromer, S.W. Manning, M. Niu, R.W. Reimer, D.A. Richards, E.M. Scott, J.R. Southon, R.A. Staff, C.S.M. Turney and J. van der Plicht 2013 IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 Years cal BP. *Radiocarbon* 55(4):1869–1887.

Rick, T.C. and G.A. Waselkov 2015 Shellfish gathering and shell midden archaeology revisited: chronology and taphonomy at White Oak Point, Potomac River Estuary, Virginia. *The Journal of Island and Coastal Archaeology* 10(3):339–362.

Rick, T.C., J.M. Erlandson, N.P. Jew and L.A. Reeder-Myers 2013 Archaeological survey, paleogeography, and the search for late Pleistocene Paleocoastal peoples of Santa Rosa Island, California. *Journal of Field Archaeology* 38(4):324–331.

Roberts, A. and C.P. Mountford 1969 *The Dawn of Time: Australian Aboriginal Myths in Paintings.* Adelaide: Rigby.

Roberts, A.L. 2001 Native title: using archaeology as evidence. *Alternative Law Journal* 25(6):41–52.

Roberts, A.L. 2011 Archaeology, anthropology and Indigenous Australians: South Australian perspectives and broader issues facing archaeologists in contemporary practice. *Journal of the Anthropological Society of South Australia* 34:38–55.

Roberts, A.L., A. Mollenmans, L-I. Rigney and G. Bailey 2019 Marine Transgression, Aboriginal Narratives and the Creation of Yorke Peninsula/Guuranda, South Australia. *The Journal of Island and Coastal Archaeology* 5(3):305–332.

Roberts, A.L., A. Mollenmans, Q. Agius, F. Graham, J. Newchurch, L.-I. Rigney, F. Sansbury, L. Sansbury, P. Turner, G. Wanganeen and K. Wanganeen 2016b "They planned their calendar…they set up ready for what they wanted to feed the tribe": a first-stage analysis of Narungga fish traps on Yorke Peninsula, South Australia. *The Journal of Island and Coastal Archaeology* 11(1):1–25.

Roberts, A.L., J. McKinnon, C. O'Loughlin, K. Wanganeen, L.-I. Rigney and M. Fowler 2013 Combining Indigenous and maritime archaeological approaches: experiences and insights from the '(Re)locating Narungga Project', Yorke Peninsula, South Australia. *Journal of Maritime Archaeology* 8(1):77–99.

Roberts, A.L., L.-I. Rigney and K. Wanganeen (in prep.). *The Butterfish Mob: Narungga Cultural Fishing.* Adelaide: Wakefield Press.

Robinson, A.C., P. Canty, T. Mooney and P. Rudduck 1996 *South Australia's Offshore Islands.* Canberra: Australian Heritage Commission.

Rosendahl, D., S. Ulm, C. Sloss, L. Steinberger, F. Petchey, G. Jacobsen, E. Stock and R. Robins 2015 Mid-Holocene Aboriginal occupation of offshore islands in northern Australia? A reassessment of Wurdukanhan, Mornington Island, southern Gulf of Carpentaria, Australia. *Quaternary International* 4:1–9.

Rowland, M. 2018 65,000 years of isolation in Aboriginal Australia or continuity and external contacts: an assessment of the evidence with an emphasis on the Queensland coast. *Journal of the Anthropological Society of South Australia.* 42:211–240.

Rowland, M.J. and S. Ulm 2011 Indigenous fish traps and weirs of Queensland. *Queensland Archaeological Research* 14:1–58.

Rowland, M.J., S. Wright and R. Baker 2015 The timing and use of offshore islands in the Great Barrier Reef Marine. Province, Queensland. *Quaternary International* 385:154–165.

Shepherd S.A. and I.M. Thomas (eds) 1989 *Marine Invertebrates of Southern Australia Part II.* Adelaide: South Australian Government Printing Division.

Shepherd, S.A., S.M. Madigan, B.M. Gillanders, S. Murray-Jones and D.J. Wiltshire (eds) 2014 *Natural History of Spencer Gulf.* Adelaide: Royal Society of South Australia Incorporated.

Sim, R. and L.A. Wallis 2008 Northern Australian offshore island use during the Holocene: the archaeology of Vanderlin Island, Sir Edward Pellew Group, Gulf of Carpentaria. *Australian Archaeology* 67:95–106.

Sloss C.R., C.V. Murray-Wallace and B.G. Jones 2007 Holocene sea-level change on the southeast coast of Australia: a review. *The Holocene* 17: 999–1014.

Smith, M. 2001 The Encyclopedia of Informal Education. Retrieved 25 October 2014 from <http://www.infed.org/community//community.htm>.

Smith, W.R. 1930 *Myths and Legends of the Australian Aboriginals.* London: Harrap.

Special Correspondent 1874 Southern Yorke's Peninsula. *The South Australian Register* 9 Monday March 1874, p6.

Stright, M.J. 2005 Archaeological site location, effect of sea-level change. In M.L. Schwartz (ed.), *Encyclopedia of Coastal Science*, pp.38–40. Dordrecht: Springer.

Sutton, T.M. 1888 The Adjahdurah tribe of Aborigines on Yorke's Peninsula. *Proceedings of the Royal Geographic Society of Australasia: South Australian Branch* 11:17–19.

Tait Elder, J., D.M. Gilmour, V.L. Butler, S.K. Campbell and A. Steingraber 2014 On the role of coastal landscape evolution in detecting fish weirs: a Pacific Northwest Coast example from Washington State. *The Journal of Island and Coastal Archaeology* 9(1):45–71.

Taplin, G. (ed.) 1879 *The Folklore, Manners, Customs, and Languages of the South Australian Aborigines.* Adelaide: Government Printer.

Taylor D., N. Nagle, K.N. Ballantyne, R.A. van Oorschot, S. Wilcox, J. Henry, R. Turakulov and R.J. Mitchell 2012 An investigation of admixture in an Australian Aboriginal Y-chromosome STR database. *Forensic Science International: Genetics* 6(5):532–538.

Tauondi College. n.d. *Tauondi College Display.* Adelaide: Tauondi College.

Thom, B.G. and J. Chappell 1975 Holocene sea levels relative to Australia. *Search* 6:90–93.

Thom, G. 1953 A pioneer's story of southern Yorke Peninsula: some native legends. *The Pioneer* Friday 11 September 1953, p.2.

Tindale, N.B. 1936 Notes on the Natives of Southern portion of Yorke Peninsula. *Transactions of the Proceedings of the Royal Society of South Australia* 60:55–70.

Tindale, N.B. and B.G. Maegraith 1931 Traces of an extinct Aboriginal population on Kangaroo Island. *Records of the South Australian Museum* 4:275–289.

Tobler, R., A. Rohrlach, J. Soubrier, P. Bover, B. Llamas, J. Tuke, N. Bean, A. Abdullah-Highfold, S. Agius, A. O'Donoghue, I. O'Loughlin, P. Sutton, F. Zilio, K. Walshe. A.N. Williams, C.S.M. Turney, M. Williams, S.M. Richards, R. Mitchell, E. Kowal, J.R. Stephen, L. Williams, W. Haak and A. Cooper 2017 Aboriginal mitogenomes reveal 50,000 years of regionalism in Australia. *Nature* 544:180–184.

Ulm, S. 2006 *Coastal Themes: An Archaeology of the Southern Curtis Coast, Queensland (Terra Australis 24).* Canberra: ANU E Press.

Van Deur, W.J. 1983 Submerged Dunes of Northeastern Eyre Peninsula. An Investigation into the Age, Origin and Paleoclimatic Implications of Relic Aeolian Landforms. Unpublished Honours Thesis, Department of Geology, University of Adelaide.

Walters, I. 1985 The Toorbul Point Aboriginal fish trap. *Queensland Archaeological Research* 2:38–49.

Walters, I. 1988 Fish hooks: evidence for dual social system in southeastern Australia. *Australian Archaeology* 27:98-114.

Wanganeen, E. (ed.) 1987 *Point Pearce: Past and Present.* Adelaide: South Australian College of Advanced Education, Aboriginal Studies and Teacher Education Centre.

Waselkov, G.A. 1987 Shellfish gathering and shell midden archaeology. In M.B. Schiffer (ed.), *Advances in Archaeological Method and Theory*, pp.93–210. San Diego: Academic Press.

Whiteway, T.G. 2009 *Australian Bathymetry and Topography Grid, June 2009.* Geoscience Australia Record 2009/21.

Williams, A.N., S. Ulm, A.R. Cook, M.C. Langley and M. Collard 2013 Human refugia in Australia during the Last Glacial Maximum and terminal Pleistocene: a geospatial analysis of the 25–12 ka Australian archaeological record. *Journal of Archaeological Science* 40:4612–4625.

Williams, A.N., S. Ulm, C.S.M. Turney, D. Rohde and D. White 2015 Holocene demographic changes and the emergence of complex societies in prehistoric Australia. *PLoSONE* 10(6):e0128661.doi:10.1371/journal.pone.0128661.

Williams A.N., S. Ulm, T. Sapienza, S. Lewis, and C.S.M. Turney 2018 Sea-level change and demography during the last glacial termination and early Holocene across the Australian continent. *Quaternary Science Reviews* 182:144–154.

Wood, V. and C. Westell 1998 Aboriginal Archaeological Site Survey of Yorke Peninsula, South Australian. Unpublished report prepared for the Australian Heritage Commission, Canberra.

Wood, V. and C. Westell 1999 Point Pearce Social History Project, Yorke Peninsula, South Australia. Unpublished report for the Australian Heritage Commission, Parkside.

Wood, V., C. Westell and A.L. Roberts 2003 Results of an Indigenous Archaeological Survey of Yorke Peninsula, South Australia. Unpublished report for Narungga Nations Aboriginal Corporation and Native Title Unit, Aboriginal Legal Rights Movement, Adelaide.

Woodroffe, C.D., J. Chappell and B.G. Thom 1988 Shell middens in the context of estuarine development, South Alligator River, Northern Territory. *Archaeology in Oceania* 23:95–103.

Wynne, A.A. (ed.) 1980 Yorke Coast Protection Division Study Report. Unpublished report for the Coast Protection Board, South Australia.

Yesner, D.R., W.S. Ayres, D.L. Carlson, R.S. Davis, R. Dewar, M.R. González Morales, F.A. Hassan, B. Hayden, J.J. Lischka, P.D. Sheets, A. Osborn, D.L. Pokotylo, T. Rogers, E. Spanier, B.L. Turner II and E.E. Wreschner 1980 Maritime hunter-gatherers: ecology and prehistory [and comments and reply]. *Current Anthropology* 21(6):727–750.

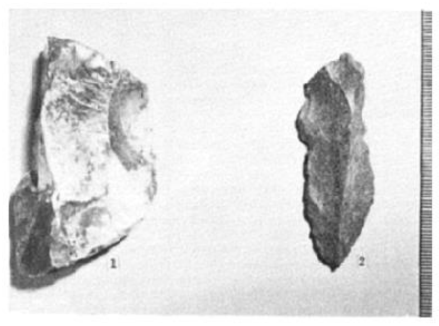
Zang, W., W.M. Cowley and M. Fairclough (J.F. Drexel ed.) 2006 *1:250,000 Geological Series—Explanatory Notes. Maitland Special, South Australia. Sheet SI53-12 International Index.* Adelaide: Primary Industries and Resources, SA Geological Survey Branch.

Zeder, M.A. 2012 The broad spectrum revolution at 40: resource diversity, intensification, and an alternative to optimal foraging explanations. *Journal of Anthropological Archaeology* 31:241–264.

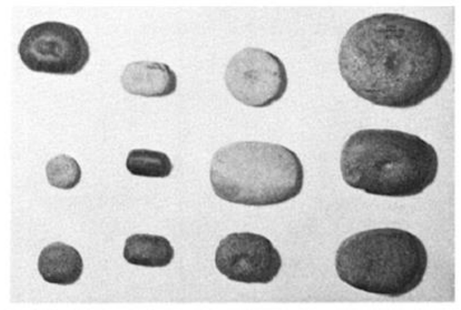
Zimmerman, L.J. 1997 Remythologizing the relationship between Indians and archaeologists. In N. Swidler, K.E. Dongoske, R. Anyon and A.S. Downer (eds), *Native Americans and Archaeologists. Stepping Stones to Common Ground*, pp.44–56. Walnut Creek: Altamira Press.

10. APPENDIX 1: YORKE PENINSULA/GUURANDA STONE TOOL TYPES AND DISTRIBUTION

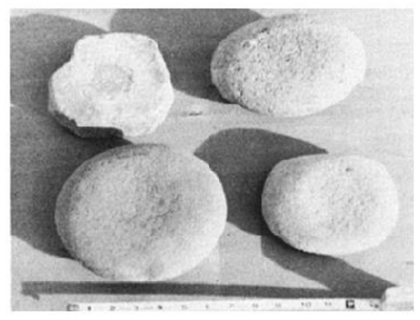
Knives and Scrapers

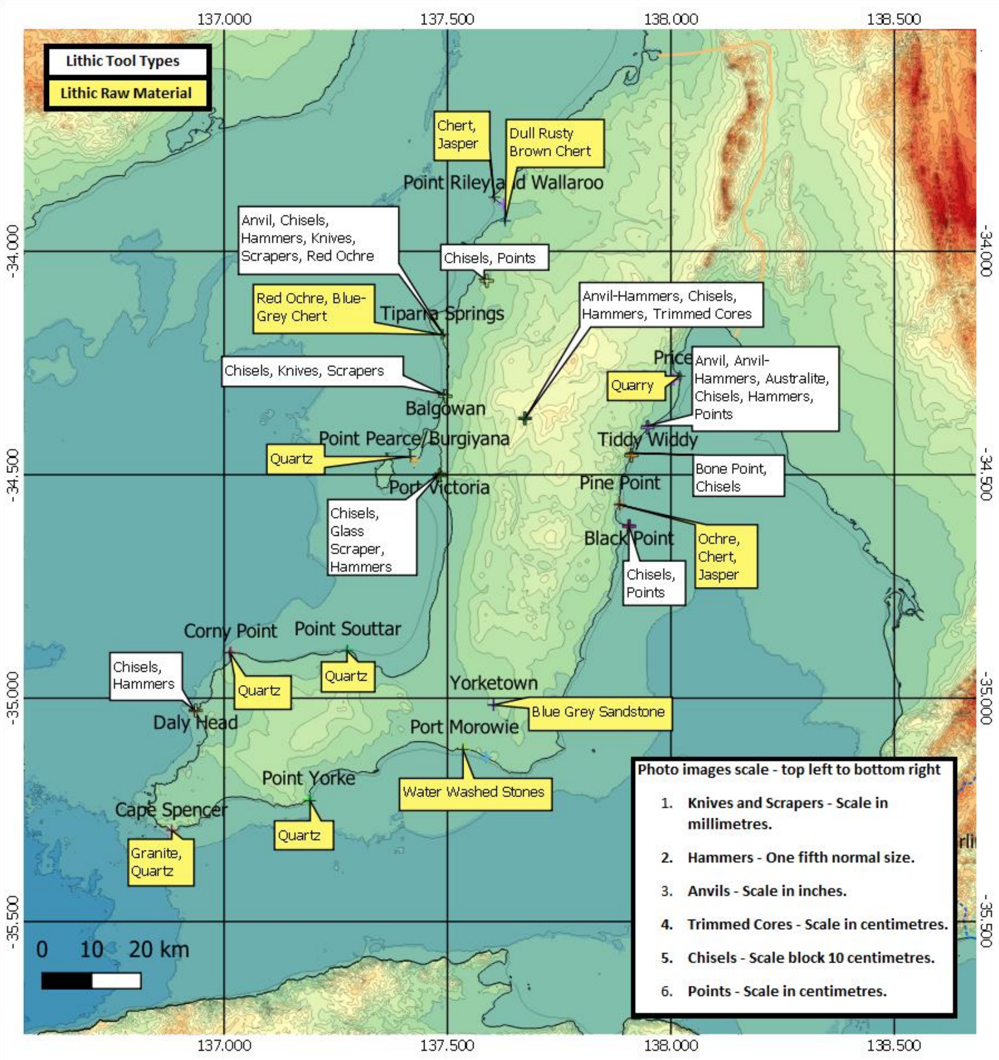


Hammers



Anvil

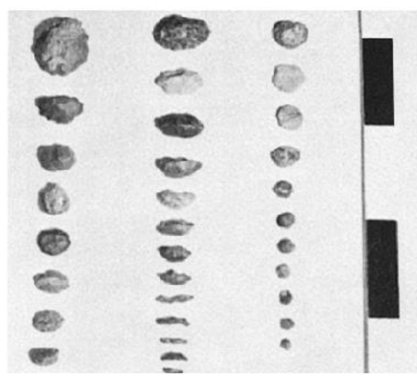




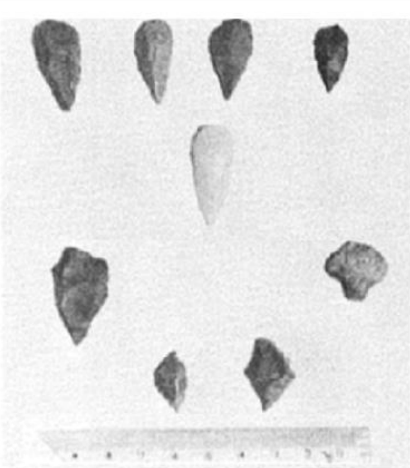
Balgowan	Black Point	Daly Head	Maitland	Moonta	Parara	Port Victoria	Tiddy Widdy	Tiparra Springs
Chisels	Chisels	Chisels	Anvil-Hammers	Chisels	Bone point	Chisels	Anvil	Anvil
Knives and Scrapers	Points	Hammers	Chisels	Points	Chisels	Glass scraper	Anvil-Hammers	Chisels
			Hammers			Hammers	Australite	Hammers
			Trimmed Cores				Chisels	Knives and Scrapers
							Hammers	Red ochre
							Points	

Trimmed Cores

Chisels



Points

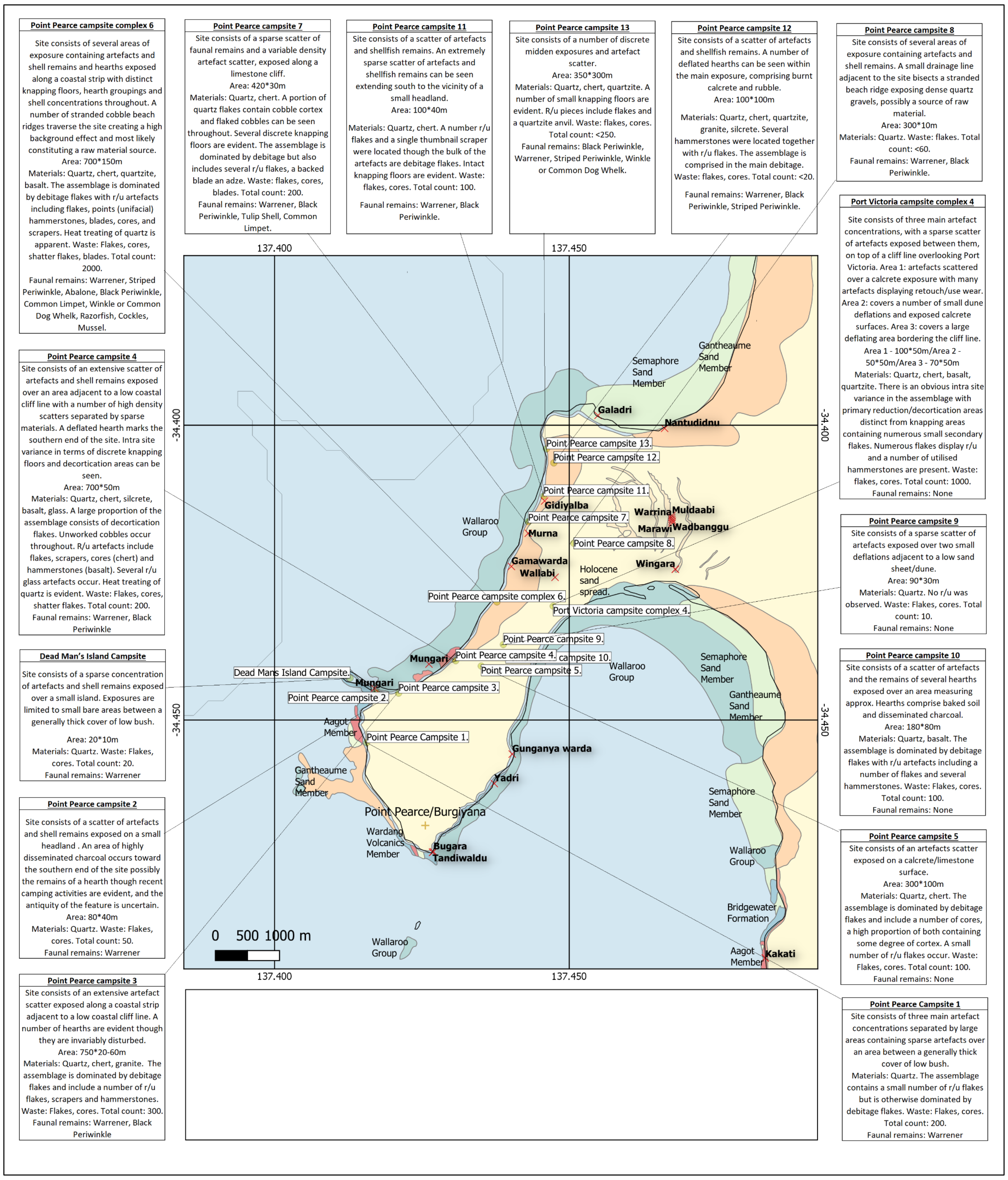


Appendix 1: Yorke Peninsula/Guuranda stone tool types and distributions and locally available raw material (source Hill and Hill [1975]).

11. APPENDIX 2: POINT PEARCE/BURGIYANA WOOD AND WESTELL (1998) SURVEY EXTRACTS

Table 20: Point Pearce/Burgiyana Wood and Westell (1998) site descriptions.

Site Name	Description	Area	Artefact Details	Quantity	Faunal Remains
Point Pearce campsite 13.	Site consists of a number of discrete midden exposures and artefact scatter.	350*300m	Materials: Quartz, chert, quartzite. A number of small knapping floors are evident. R/u pieces include flakes and a quartzite anvil. Waste: flakes, cores.	Density: 40-1/15. Total: <250.	Black Periwinkle, Turbo or Warrener, Striped Periwinkle, Winkle or Common Dog Whelk.
Point Pearce campsite 12.	Site consists of a scatter of artefacts and shellfish remains. A number of deflated hearths can be seen within the main exposure, comprising burnt calcrete and rubble.	100*100m	Materials: Quartz, chert, quartzite, granite, silcrete. Several hammerstones were located together with r/u flakes. The assemblage is comprised in the main debitage. Waste: flakes, cores.	Density: 5-1/20. Total: <20.	Turbo or Warrener, Black Periwinkle, Striped Periwinkle.
Point Pearce campsite 11.	Site consists of a scatter of artefacts and shellfish remains. An extremely sparse scatter of artefacts and shellfish remains can be seen extending south to the vicinity of a small headland.	100*40m	Materials: Quartz, chert. A number r/u flakes and a single thumbnail scraper were located though the bulk of the artefacts are debitage flakes. Intact knapping floors are evident. Waste: flakes, cores.	Density: 6-1/10. Total: 100.	Turbo or Warrener, Black Periwinkle.
Point Pearce campsite 7.	Site consists of a sparse scatter of faunal remains and a variable density artefact scatter, exposed along a limestone cliff.	420*30m	Materials: Quartz, chert. A portion of quartz flakes contain cobble cortex and flaked cobbles can be seen throughout. Several discrete knapping floors are evident. The assemblage is dominated by debitage but also includes several r/u flakes, a backed blade an adze. Waste: flakes, cores, blades.	Density: 15-1/10. Total: >200.	Turbo or Warrener, Black Periwinkle, Tulip Shell, Common Limpet.
Point Pearce campsite 8.	Site consists of several areas of exposure containing artefacts and shell remains. A small drainage line adjacent to the site bisects a stranded beach ridge exposing dense quartz gravels, possibly a source of raw material.	300*10m	Materials: Quartz. Waste: flakes.	Density: 4-1/5. Total: <60.	Turbo or Warrener, Black Periwinkle
Point Pearce campsite complex 6.	Site consists of several areas of exposure containing artefacts and shell remains and hearths exposed along a coastal strip with distinct knapping floors, hearth groupings and shell concentrations throughout. A number of stranded cobble beach ridges traverse the site creating a high background effect and most likely constituting a raw material source.	700*150m	Materials: Quartz, chert, quartzite, basalt. The assemblage is dominated by debitage flakes with r/u artefacts including flakes, points (unifacial) hammerstones, blades, cores, and scrapers. Heat treating of quartz is apparent. Waste: Flakes, cores, shatter flakes, blades.	Density: 100-1/10. Total: >2000.	Turbo or Warrener, Striped Periwinkle, Abalone, Black Periwinkle, Common Limpet, Winkle or Common Dog Whelk, Razorfish, Cockles, Mussel
Port Victoria campsite complex 4.	Site consists of three main artefact concentrations, with a sparse scatter of artefacts exposed between them, on top of a cliff line overlooking Port Victoria. Area 1: artefacts scattered over a calcrete exposure with many artefacts displaying retouch/usewear. Area 2: covers a number of small dune deflations and exposed calcrete surfaces. Area 3: covers a large deflating area bordering the cliff line.	Area 1 - 100*50m Area 2 - 50*50m Area 3 - 70*50m	Materials: Quartz, chert, basalt, quartzite. There is an obvious intrasite variance in the assemblage with primary reduction/decortication areas distinct from knapping areas containing numerous small secondary flakes. Numerous flakes display r/u and a number of utilised hammerstones are present. Waste: flakes, cores.	Density: 10-1/20. Total: >1000.	None
Point Pearce campsite 9.	Site consists of a sparse scatter of artefacts exposed over two small deflations adjacent to a low sand sheet/dune.	90*30m	Materials: Quartz. No r/u was observed. Waste: Flakes, cores.	Density: 2-1/20. Total: 10.	None
Point Pearce campsite 10.	Site consists of a scatter of artefacts and the remains of several hearths exposed over an area measuring approx. Hearths comprise baked soil and disseminated charcoal.	180*80m	Materials: Quartz, basalt. The assemblage is dominated by debitage flakes with r/u artefacts including a number of flakes and several hammerstones. Waste: Flakes, cores.	Density: 15-1/5. Total 100.	None
Point Pearce campsite 5.	Site consists of an artefacts scatter exposed on a calcrete/limestone surface.	300*100m	Materials: Quartz, chert. The assemblage is dominated by debitage flakes and include a number of cores, a high proportion of both containing some degree of cortex. A small number of r/u flakes occur. Waste: Flakes, cores.	Density: 6-1/20. Total 100.	None
Point Pearce campsite 4.	Site consists of an extensive scatter of artefacts and shell remains exposed over an area adjacent to a low coastal cliff line with a number of high density scatters separated by sparse materials. A deflated hearth marks the southern end of the site. Intrasite variance in terms of discrete knapping floors and decortication areas can be seen.	700*50m	Materials: Quartz, chert, silcrete, basalt, glass. A large proportion of the assemblage consists of decortication flakes. Unworked cobbles occur throughout. R/U artefacts include flakes, scrapers, cores (chert) and hammerstones (basalt). Several r/u glass artefacts occur. Heat treating of quartz is evident. Waste: Flakes, cores, shatter flakes.	Density: 20-1/5. Total >200.	Turbo or Warrener, Black Periwinkle
Point Pearce campsite 3.	Site consists of an extensive artefact scatter exposed along a coastal strip adjacent to a low coastal cliff line. A number of hearths are evident though they are invariably disturbed.	750*20-60m	Materials: Quartz, chert, granite. The assemblage is dominated by debitage flakes and include a number of r/u flakes, scrapers and hammerstones. Waste: Flakes, cores.	Density: 15-1/5. Total 300.	Turbo or Warrener, Black Periwinkle
Point Pearce campsite 2.	Site consists of a scatter of artefacts and shell remains exposed on a small headland . An area of highly disseminated charcoal occurs toward the southern end of the site possibly the remains of a hearth though recent camping activities are evident, and the antiquity of the feature is uncertain.	80*40 m	Materials: Quartz. Waste: Flakes, cores.	Density: 15-1/5. Total 50.	Turbo or Warrener
Deadman's Island Campsite.	Site consists of a sparse concentration of artefacts and shell remains exposed over a small island. Exposures are limited to small bare areas between a generally thick cover of low bush.	20*10m	Materials: Quartz. Waste: Flakes, cores.	Density: 2-1/20. Total 20.	Turbo or Warrener
Point Pearce Campsite 1.	Site consists of three main artefact concentrations separated by large areas containing sparse artefacts over an area between a generally thick cover of low bush.		Materials: Quartz. The assemblage contains a small number of r/u flakes but is otherwise dominated by debitage flakes. Waste: Flakes, cores.	Density: 10-1/10. Total >200.	Turbo or Warrener



Point Pearce/Burgiyana Wood and Westell (1998) general site locations and site survey extracts.

12. APPENDIX 3: WARDANG ISLAND/WARALDI WOOD ET AL. (2003) SURVEY EXTRACTS

Table 21: Wardang Island/Waraldi Wood et al. (2003) site descriptions.

Site Name	**Description**	**Area**	**Artefact Details**	**Quantity (artefacts per metre 2).**	**Faunal Remains**
Wardang Site 1	Site comprises a generally sparse deposit of stone artefacts and shell remains over an exposed limestone surface (overlying dune has been quarried) and continuing in moderate densities to a lower clay terrace immediately behind the narrow fore dunes. Several isolated artefacts were noted along the edge of a prominent headland to the north of the site.	140*80m		Density: 5-1/100. Total: 50.	Abalone, Warrener, Periwinkle, Limpet, Dog Whelk, Penguin.
Wardang Site 2	The site comprises a scatter of artefacts and shell exposed in variable densities across a large dune deflation area. It appears as though the area has been quarried for sand with the area striped to a fins silt/clay base. The bulk of cultural materials are exposed within remnant dune slopes surrounding the quarried area. A generally low density of material links several small concentrations with higher densities recorded in the southern parts of the site. A significant amount of mechanically fractured stone was also noted.	140*60m	Quartz: flakes, flaked pieces; Quartzite: flake, manuports.	Density: 6-1/400. Total: 250.	Periwinkle, Dog Whelk, Warrener, Penguin.
Wardang Site 3	The site comprises a limited deposit of artefacts and faunal remains in two exposures within low dunes behind a prominent headland. The first exposure (A) covers an area of approximately 50 x 20rn and contains a small number (less than 20) of quartz flakes and flaked pieces together with some shell (a natural shell deposit also covers the area). The second exposure (B) is located to the south of exposure A and within a small deflation area. Material includes penguin bone, shell, and several cobble manuports.	50*20m	Quartz: flakes, flaked pieces. Quartzite: manuports.	Density: 2-1/400 Total: 30.	Periwinkle, Dog Whelk, Warrener, Penguin.
Wardang Site 4	The site comprises a complex exposure of shell and artefacts over an extensive area of land 400-500m inland of the west coast of Wardang Island. The edges of the site have not been fully evaluated with variable vegetation cover making survey difficult. Survey along a vehicle track to the east of the site, however, failed to locate any cultural materials. The site comprises two main elements linked through, and surrounded by, a sparse scatter of isolated artefacts; Area A: Generally diffuse scatter of artefacts over an area measuring 60 x 50m; Area B: Several dense scatters of shell (Periwinkle) and artefacts over an area measuring approximately 120 x 80m. The assemblage includes a high proportion of large, flaked pieces and cores with cobble cortex with intact knapping floors evident. Shell occurs in mono-specific midden and lower density scatter throughout.	AreaA:60*50m, AreaB:120*80m	Quartz: flakes, flaked pieces, cores, blades.	Density: 6-1/100. Total: 250.	Periwinkle, Warrener.
Wardang Island 5	The site comprises a generally low density, diffuse scatter of stone artefacts and shell remains scattered along a considerable length of coastal cliff line and continuing in the west to a series of low sand dunes. Ground surface visibility is generally restrictive beyond a narrow erosional belt following the cliff line and it may be that additional materials occur beneath thick grass cover. A scatter of isolated artefacts continues in and around the dunes in the west. The eastern edge of the site was not fully established. Material occurs in both localised concentrations and an intervening background scatter. A natural shell deposit occurs throughout the area though it is suggested that a component of shell located is in fact part of the cultural deposit. Lithic materials are dominated by quartz flakes and flaked pieces with cobble cortex identified on a high proportion of artefacts. Quartz cobbles lie throughout the immediate area.	530*160m	Quartz: flakes, flaked pieces, core. Quartzite: flakes, manuports.	Density: 3-1/400. Total: 150.	Periwinkle, Warrener, Abalone, Dog Whelk.
Wardang Island 6	The site comprises a complex exposure of lithic and faunal materials throughout an area of quarried dunes fringing a low coastal cliff line. The complex covers an area measuring approximately 160 x 130m though visibility conditions are reduced markedly beyond the quarried areas and it may be that additional remains are present. Much of the material observed are likely to be in disturbed context. The area is littered with a natural deposit of shell and small quartz cobbles with much of the flaked material contains cobble cortex. A component of the shell is likely to be cultural. The site contains four main areas: A) Deflation area measuring 40 x 15m containing scattered shell, a large amount of penguin (some burnt) and a small number of artefacts. B) Flat area fringing cliff and containing a light scattering of shell. C/D: Large deflation/quarry measuring 80 x 60m and containing shell, artefacts, and other faunal remains (penguin, bettong). E: Quarried area 60 x 40m containing sparse scatter of artefacts and shell.	160*130m	Quartz: flakes, flaked pieces, cores. Quartzite: flakes, flaked pieces.	Density: 3-1/100. Total: 150.	Periwinkle, Warrener, Abalone, Dog Whelk, Penguin, Bettong.
Wardang Island 7	The site comprises a generally low density scatter of artefacts and shell throughout a long, narrow deflation/quarry area. Several small clusters of material were noted within an otherwise diffuse scatter. Much of the material is likely to be in a disturbed context given the extent of quarrying in the area. Large numbers of unmodified quartz and quartzite cobbles litter the deflation floor.	160*60m	Quartz: flakes, flaked pieces, cores. Quartzite: flakes, flaked pieces.	Density: 3-1/100. Total: 50.	Warrener
Wardang Island 8	The site comprises a high density knapping floor and associated shell located in a broad deflation/quarried area of dune. The knapping floor measures approximately 6 x 6m with lower density deposit extending into the immediate area. A natural deposit of quartz cobbles throughout the dune complex is a likely source of the raw material given the high incidence of cobble cortex on the artefacts.	90*50m	Quartz: flakes, flaked pieces, cores, blades.	Density: 30+ -1/4. Total: 200.	Warrener
Wardang Island 9	The site comprises a generally low density scatter of shell and possible artefactual materials throughout an extensive dune deflation/quarry. Most of the material is in a disturbed context but some shell is located high on dune slopes above quarried level and is likely to be partly in situ. Faunal assemblage also includes some penguin bone. The lithic assemblage includes a number of unmodified cobbles together with a smaller component of amorphous flaked pieces, some of which are obviously out of context.		Quartz: manuports, flakes.		Warrener, Periwinkle, Penguin.
Wardang Island 10	Small cluster of quartz flakes over an area measuring 8 x 3m within extensive area of quarried dune measuring 180 x 55m. A natural deposit or quartz cobbles and shell extends throughout the area with a component of the shell (large individual warrener and dog whelk) possibly part of the cultural deposit. The 'site' appears as a small-localised cluster within a broader background scatter of isolated artefacts and culturally derived shell continuing throughout the dune area.	180*55m	Quartz: flakes.	Density: 3 -1/4. Total: 15.	Warrener, Dog Whelk.
Wardang Island 11	Small scatter of quartz flakes and flaked pieces along a section of cliff line. A natural shell deposit covers the immediate area, and it may be that a component is in fact part of the cultural deposit. The 'site' appears as a small-localised cluster within a broader background scatter of isolated artefacts and culturally derived shell continuing throughout the immediate area.	6*2m	Quartz: flakes, flaked pieces.	Density: 2-1/4. Total: 20.	
Wardang Island 12	Small scatter of less than 10 quartz flakes and flaked pieces. The 'site' appears as a small-localised cluster within a broader background scatter of isolated artefacts and culturally derived shell continuing throughout the immediate area.	5*5m	Quartz: flakes, flaked pieces.	Density: 2-1. Total: 10.	
Wardang Island 13	Low density scatter of artefacts and shell remains exposed within narrow erosional area fringing high limestone cliff. Visibility beyond the erosional surface is limited and it may be that additional materials occur beneath a typically thick grass cover. The site exposure is sporadic and continues for approximately 180m of cliff extending at maximum to 10 - 15m inland of the cliff edge.	180*15m	Quartz: flakes, flaked pieces.	Density: 2-1/100. Total: 30.	Warrener, Dog Whelk, Tulip Shell.
Wardang Island 14	The site comprises a generally row to moderate density scatter of shell, together with a small component of other faunal and lithic materials, exposed throughout and extensive dune deflation quarry measuring approximately 360 * 140m. Most of the material is in a disturbed context exposed on a basal limestone floor. A smaller amount of material is preserved higher up the dune surfaces. A natural shell and cobble unit occurs throughout the area. Anthropogenic shell was distinguished generally on the size of individual specimens relative to the natural coquina. A small 10 * 4m moderate- high density scatter of bone and shell was located in the northern section of the site and appears to be eroding from an in situ lens high on the deflation wall. There is a general absence of flaked stone with a number of manuports (quartz, quartzite, granite) located out of context on dune slopes.	360*140m	Quartz: manuports, flakes, flaked cobbles. Quartzite: manuports. Granite: manuports.	Density: 10-1. Total: 150.	Warrener, Dog Whelk, Tulip Shell, Abalone, Penguin, Fish.
Wardang Island 15	The site comprises a series of exposures along the edge of a low coastal cliff line over approximately 80 x 15m and containing artefacts and faunal material in variable densities. The faunal assemblage is dominated by penguin bone but also includes a variety of shell species and mammal remains. The lithic assemblage is characterised by small flakes manufactured from quartz with artefact densities approaching g-l0/m2 in parts. In situ lenses are exposed in several areas and it is likely that additional sub-surface materials will be present inland of the exposures but are obscured by otherwise thick vegetation cover.	80*15m	Quartz: flakes, flaked cobbles, blades, r/u flakes, flaked pieces.	Density: l0-Total. 150.	Periwinkle, Penguin, Bandicoot, Fish.
Wardang Island 16	Small, bowl shaped deflation area measuring 60 x 50m with a low density scatter of stone artefacts and faunal material covering the deflation floor. The bulk of material is contained in a small cluster on the eastern slope of a low pedestal in the centre of the deflation. Beyond this cluster, the deposit is generally low density.	60*50m	Quartz: flakes.	Density: 2-1/100. Total: 20.	Warrener, Penguin.

Wardang Site 3

The site comprises a limited deposit of artefacts and faunal remains in two exposures within low dunes behind a prominent headland. The first exposure (A) covers an area of approximately 50 x 20m and contains a small number (less than 20) of quartz flakes and flaked pieces together with some shell (a natural shell deposit also covers the area). The second exposure (B) is located to the south of exposure A and within a small deflation area.
Area: 50*20m.
Materials: Quartz: flakes, flaked pieces. Quartzite: manuports. Density: 2-1/400. Total: 30.
Faunal remains: Periwinkle, Dog Whelk, Warrener, Penguin.

Wardang Site 1

Site comprises a generally sparse deposit of stone artefacts and shell remains over an exposed limestone surface (overlying dune has been quarried) and continuing in moderate densities to a lower clay terrace immediately behind the narrow fore dunes. Several isolated artefacts were noted along the edge of a prominent headland to the north of the site.
Area: 140*80m.
Materials: Density: 5-1/100. Total: 50.
Faunal remains: Abalone, Warrener, Periwinkle, Limpet, Dog Whelk, Penguin.

Wardang Site 4

The inland site comprises two main elements; Area A: Generally diffuse scatter of artefacts; Area B: Several dense scatters of shell (Periwinkle) and artefacts. The assemblage includes a high proportion of large, flaked pieces and cores with cobble cortex with intact knapping floors evident. Shell occurs in mono-specific midden and lower density scatter throughout.
Area 1 - 60*50m/Area 2 - 120*80m.
Materials: Quartz: flakes, flaked pieces, cores, blades. Density: 6-1/100. Total: 250.
Faunal remains: Periwinkle, Warrener.

Wardang Island 16

Small, bowl shaped deflation area measuring 60 x 50m with a low density scatter of stone artefacts and faunal material covering the deflation floor. The bulk of material is contained in a small cluster on the eastern slope of a low pedestal in the centre of the deflation. Beyond this cluster, the deposit is generally low density.
Area: 60*50m.
Materials: Quartz: flakes. Density: 2-1/100. Total: 20.
Faunal remains: Warrener, Penguin.

Wardang Island 9

The site comprises a generally low density scatter of shell and possible artefactual materials. Most of the material is in a disturbed context but some shell is located high on dune slopes above quarried level and is likely to be partly in situ. The lithic assemblage includes a number of unmodified cobbles together with a smaller component of amorphous flaked pieces, some of which are obviously out of context.
Materials: Quartz: manuports, flakes.
Faunal remains: Warrener, Periwinkle, Penguin.

Wardang Island 10

Small cluster of quartz flakes over an area measuring 8 x 3m within extensive area of quarried dune measuring 180 x 55m. A natural deposit or quartz cobbles and shell extends throughout the area with a component of the shell (large individual warrener and dog whelk) possibly part of the cultural deposit.
Area: 180*55m.
Materials: Quartz: flakes. Density: 3 - 1/4. Total: 15.
Faunal remains: Warrener, Dog Whelk.

Wardang Site 2

The site comprises a scatter of artefacts and shell exposed in variable densities across a large dune deflation area. It appears as though the area has been quarried for sand with the area striped to a fins silt/clay base. The bulk of cultural materials are exposed within remnant dune slopes surrounding the quarried area. A generally low density of material links several small concentrations with higher densities recorded in the southern parts of the site.
Area: 140*60m.
Materials: Quartz: flakes, flaked pieces; Quartzite: flake, manuports. Density: 6-1/400. Total: 250.
Faunal remains: Periwinkle, Dog Whelk, Warrener, Penguin.

Wardang Island 15

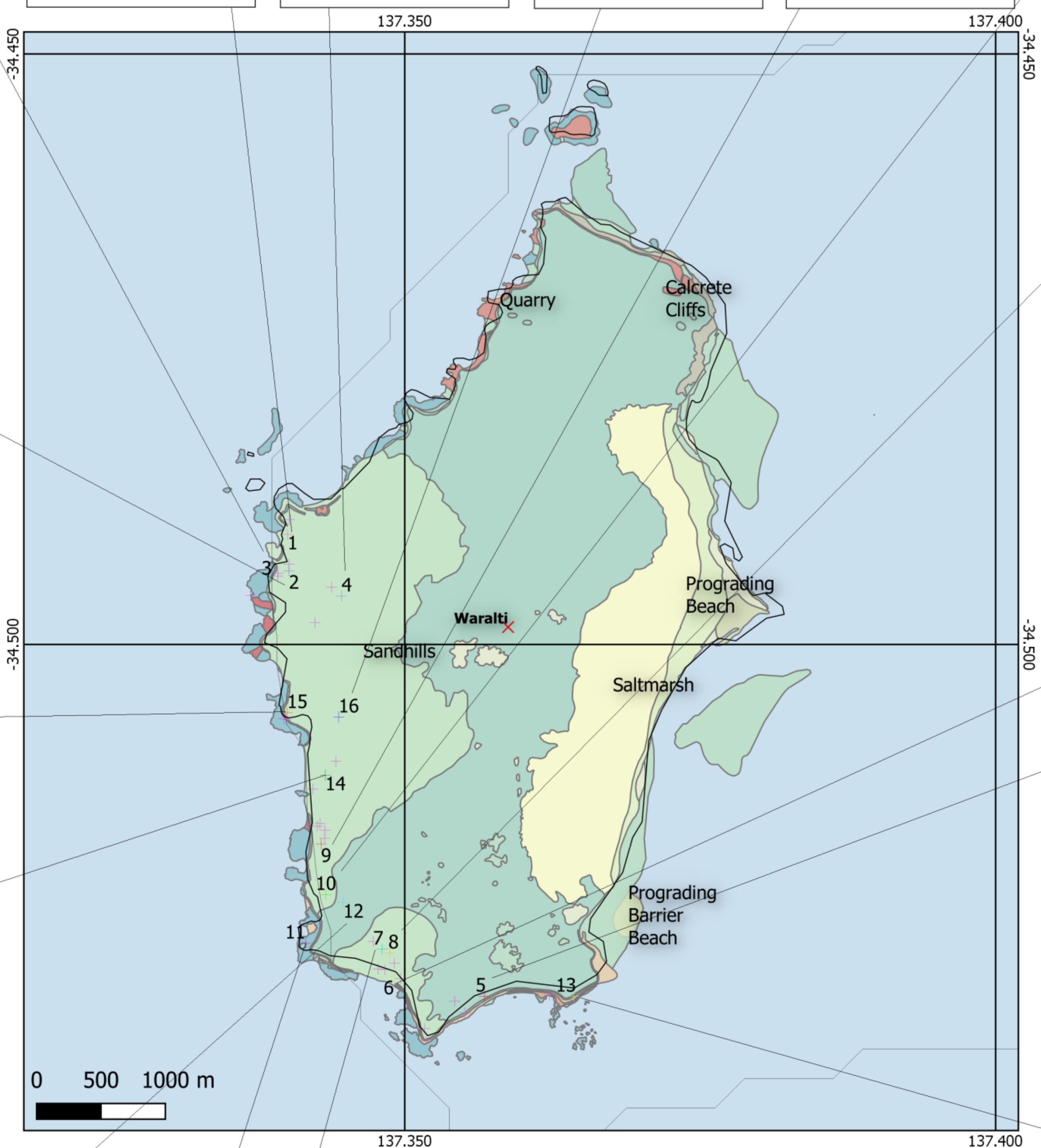
The site comprises a series of exposures along the edge of a low coastal cliff line over approximately 80 x 15m and containing artefacts and faunal material in variable densities. The faunal assemblage is dominated by penguin bone but also includes a variety of shell species and mammal remains. The lithic assemblage is characterised by small flakes manufactured from quartz with artefact densities approaching g-l0/m2 in parts. In situ lenses are exposed in
Area: 80*15m.
Materials: Quartz: flakes, flaked cobbles, blades, r/u flakes, flaked pieces. Density: 10-Total. 150.
Faunal remains: Periwinkle, Penguin, Bandicoot, Fish.

Wardang Island 14

The site comprises a generally row to moderate density scatter of shell, together with a small component of other faunal and lithic materials, exposed throughout and extensive dune deflation quarry measuring approximately 360 * 140m. Most of the material is in a disturbed context exposed on a basal limestone floor. A smaller amount of material is preserved higher up the dune surfaces. A natural shell and cobble unit occurs throughout the area.
Area: 360*140m.
Materials: Quartz: manuports, flakes, flaked cobbles. Quartzite: manuports. Granite: manuports. Density: 10-1. Total: 150.
Faunal remains: Warrener, Dog Whelk, Tulip Shell, Abalone, Penguin, Fish.

Wardang Island 12

Small scatter of less than 10 quartz flakes and flaked pieces. The 'site' appears as a small-localised cluster within a broader background scatter of isolated artefacts and culturally derived shell continuing throughout the immediate area.
Area: 5*5m.
Materials: Quartz: flakes, flaked pieces. Density: 2-1. Total: 10.



Wardang Island 8

The site comprises a high density knapping floor and associated shell located in a broad deflation/quarried area of dune. The knapping floor measures approximately 6 x 6m with lower density deposit extending into the immediate area. A natural deposit of quartz cobbles throughout the dune complex is a likely source of the raw material given the high incidence of cobble cortex on the artefacts.
Area: 90*50m.
Materials: Quartz: flakes, flaked pieces, cores, blades. Density: 30+ - 1/4. Total: 200.
Faunal remains: Warrener.

Wardang Island 6

The site comprises a complex exposure of lithic and faunal materials throughout an area of quarried dunes fringing a low coastal cliff line. The complex covers an area measuring approximately 160 x 130m though visibility conditions are reduced markedly beyond the quarried areas and it may be that additional remains are present. Much of the material observed are likely to be in disturbed context. The area is littered with a natural deposit of shell and small
Area: 160*130m.
Materials: Quartz: flakes, flaked pieces, cores. Quartzite: flakes, flaked pieces. Density: 3-1/100. Total: 150.
Faunal remains: Periwinkle, Warrener, Abalone, Dog Whelk, Penguin, Bettong.

Wardang Island 5

The site comprises a generally low density, diffuse scatter of stone artefacts and shell remains scattered along a considerable length of coastal cliff line and continuing in the west to a series of low sand dunes. Material occurs in both localised concentrations and an intervening background scatter. Lithic materials are dominated by quartz flakes and flaked pieces with cobble cortex identified on a high proportion of artefacts. Quartz cobbles lie
Area: 530*160m.
Materials: Quartz: flakes, flaked pieces, core. Quartzite: flakes, manuports. Density: 3-1/400. Total: 150.
Faunal remains: Periwinkle, Warrener, Abalone, Dog Whelk.

Wardang Island 11

Small scatter of quartz flakes and flaked pieces along a section of cliff line. A natural shell deposit covers the immediate area, and it may be that a component is in fact part of the cultural deposit. The 'site' appears as a small-localised cluster within a broader background scatter of isolated artefacts and culturally derived shell continuing throughout the immediate area.
Area: 6*2m.
Materials: Quartz: flakes, flaked pieces. Density: 2-1/4. Total: 20.

Wardang Island 7

The site comprises a generally low density scatter of artefacts and shell throughout a long, narrow deflation/quarry area. Several small clusters of material were noted within an otherwise diffuse scatter. Large numbers of unmodified quartz and quartzite cobbles litter the deflation floor.
Area: 160*60m.
Materials: Quartz: flakes, flaked pieces, cores. Quartzite: flakes, flaked pieces. Density: 3-1/100. Total: 50.
Faunal remains: Warrener.

Wardang Island 13

Low density scatter of artefacts and shell remains exposed within narrow erosional area fringing high limestone cliff. Visibility beyond the erosional surface is limited and it may be that additional materials occur beneath a typically thick grass cover. The site exposure is sporadic and continues for approximately 180m of cliff extending at maximum to 10 - 15m inland of the cliff edge.
Area: 180*15m.
Materials: Quartz: flakes, flaked pieces. Density: 2-1/100. Total: 30.
Faunal remains: Warrener, Dog Whelk, Tulip Shell.

Wardang Island/Waraldi Wood et al. (2003) general site locations and site survey extracts.

13. APPENDIX 4: WOOD AND WESTELL 1998 SURVEY EDITED SITE DESCRIPTIONS

13.1.1 Northwest Coast

13.1.1.1 18 Point Pearce campsite 13.

Point Pearce campsite 13 consists of a number of discrete midden exposures, small knapping floors and artefact scatter within an area covering 0.1 km^2. Lithic material (<250) comprised quartz, chert and quartzite included flakes and a quartzite anvil as well as waste flakes and cores. Faunal remains included Black Periwinkle, Turbo or Warrener, Striped Periwinkle and Winkle or Common Dog Whelk.

13.1.1.2 19 Point Pearce campsite 12.

Point Pearce campsite 12 consists of a scatter of artefacts shellfish remains and deflated hearths comprising burnt calcrete and rubble within an area covering 0.01 km^2. Lithic material (<20) comprised quartz, chert, quartzite, granite, silcrete and included several hammerstones located together with retouch/use wear flakes as well as waste flakes and cores. Faunal remains included Turbo or Warrener, Black Periwinkle and Striped Periwinkle.

13.1.1.3 20 Point Pearce campsite 11.

Point Pearce campsite 11 consists of a scatter of artefacts, intact knapping floors and shellfish remains within an area covering 0.004 km^2. An extremely sparse scatter of artefacts and shellfish remains can be seen extending south to the vicinity of a small headland. Lithic material (100) included quartz, chert with a number of retouch/use wear flakes and a single thumbnail scraper though the bulk of the artefacts are debitage flakes, waste flakes and cores. Faunal remains included Turbo or Warrener, and Black Periwinkle.

13.1.1.4 21 Point Pearce campsite 7.

Point Pearce campsite 7 consists of a sparse scatter of faunal remains and a variable density artefact scatter, exposed along a limestone cliff covering an area 0.0126 km^2. Lithic materials (>200) included quartz, chert. A portion of quartz flakes contain cobble cortex and flaked cobbles can be seen throughout. Several discrete knapping floors are evident. The assemblage is dominated by debitage but also includes several retouch/use wear flakes, a backed blade an adze with waste flakes, cores and blades. Faunal remains included Turbo or Warrener, Black Periwinkle, Tulip Shell and Common Limpet.

13.1.2 Inland

13.1.2.1 22 Point Pearce campsite 8.

Point Pearce campsite 8 consists of several areas of exposure containing artefacts and shell remains covering an area of 0.003 km^2. A small drainage line adjacent to the site bisects a stranded beach ridge exposing dense quartz gravels, possibly a source of raw material. Lithic material (<60) included quartz waste flakes. Faunal remains included Turbo or Warrener and Black Periwinkle.

13.1.2.2 24 Port Victoria campsite complex 4.

Port Victoria campsite complex 4 consists of three main artefact concentrations covering an area of 0.011 km^2 on top of a cliff line overlooking Port Victoria. Area 1: artefacts scattered over a calcrete exposure with many artefacts displaying retouch/use wear. Area 2: covers a number of small dune deflations and exposed calcrete surfaces. Area 3: covers a large deflating area bordering the cliff line. Sparse scatter of artefacts are exposed between the areas. Lithic material (>1000) included quartz, chert, basalt and quartzite. The assemblage included primary reduction/decortication areas distinct from knapping areas containing numerous small secondary flakes. Numerous flakes display retouch/use wear. Utilised hammerstones are present with waste flakes and cores. There were no faunal remains.

13.1.2.3 25 Point Pearce campsite 9.

Point Pearce campsite 9 consists of a sparse scatter of artefacts exposed over two small deflations adjacent to a low sand sheet/dune covering an area .0027 km^2.Lithic material (10) was quartz. No retouch/use wear was observed. Waste included flakes cores. There were no faunal remains.

13.1.2.4 26 Point Pearce campsite 10.

Point Pearce campsite 10 consists of a scatter of artefacts and the remains of several hearths covering an area 0.0144 km^2. Hearths comprise baked soil and disseminated charcoal. Lithic material (100) included quartz and basalt. The assemblage is dominated by debitage flakes with retouch/use wear artefacts including a number of flakes and several hammerstones as well as waste flakes and cores. There were no faunal remains.

13.1.2.5 27 Point Pearce campsite 5.

Point Pearce campsite 5 consists of an artefacts scatter exposed on a calcrete/limestone surface covering an area 0.03 km^2. Lithic material (100) included quartz, chert. The assemblage is dominated by debitage flakes and include a number of cores, a high proportion of both containing some degree of cortex. A small number of retouch/use wear flakes occur as well as waste flakes and cores. There were no faunal remains.

13.1.3 Shack

13.1.3.1 23 Point Pearce campsite complex 6.

Point Pearce campsite complex 6 consists of several areas of exposure containing artefacts and shell remains and hearths exposed along a coastal strip covering an area 0.105 km^2 with distinct knapping floors, hearth groupings and shell concentrations throughout. A number of stranded cobble beach ridges traverse the site creating a high background effect and most likely constituting a raw material source. Lithic material (<2000) included quartz, chert, quartzite, basalt. The assemblage is dominated by debitage flakes with retouch/use wear artefacts including flakes, points (unifacial) hammerstones, blades, cores, and scrapers. Heat treating of quartz is apparent. Waste included flakes, cores, shatter flakes and blades. Faunal remains included Turbo or Warrener, Striped Periwinkle, Abalone, Black Periwinkle, Common Limpet, Winkle or Common Dog Whelk, Razorfish, Cockles and Mussel.

13.1.4 Hearths

13.1.4.1 28 Point Pearce campsite 4.

Point Pearce campsite 4 consists of an extensive scatter of artefacts and shell remains exposed over an area adjacent to a low coastal cliff line with a number of high-density scatters separated by sparse materials. A deflated hearth marks the southern end of the site. Intrasite variance in terms of discrete knapping floors and decortication areas can be seen. Lithic material (>200) included quartz, chert, silcrete, basalt, glass. A large proportion of the assemblage consists of decortication flakes. Unworked cobbles occur throughout. Retouch/use wear artefacts include flakes, scrapers, cores (chert) and hammerstones (basalt). Several retouch/use wear glass artefacts occur. Heat treating of quartz is evident. Waste include flakes, cores and shatter flakes. Faunal remains include Turbo or Warrener and Black Periwinkle.

13.1.5 Mounds and Fish Trap

13.1.5.1 29 Point Pearce campsite 3.

Point Pearce campsite 3 consists of an extensive artefact scatter exposed along a coastal strip adjacent to a low coastal cliff line covering an area 0.03 km^2. A number of hearths are evident though they are invariably disturbed. Lithic material (300) included quartz, chert, granite. The assemblage is dominated by debitage flakes and include a number of retouch/use wear flakes, scrapers and hammerstones. Waste included flakes and cores. Faunal remains include Turbo or Warrener and Black Periwinkle.

13.1.5.2 30 Point Pearce campsite 2.

Point Pearce campsite 2 consists of a scatter of artefacts and shell remains exposed on a small headland covering an area 0.0032 km^2. An area of highly disseminated charcoal occurs toward the southern end of the site possibly the remains of a hearth though recent camping activities are evident, and the antiquity of the feature is uncertain. Lithic material (50) included quartz with waste flakes and cores. Faunal remains were Turbo or Warrener.

13.1.5.3 32 Point Pearce Campsite 1.

Point Pearce Campsite 1 consists of three main artefact concentrations separated by large areas containing sparse artefacts over an area between a generally thick cover of low bush. Lithic material (200) was exclusively quartz. The assemblage contains a small number of retouch/use wear flakes but is otherwise dominated by debitage flakes with waste flakes and cores. Faunal remains were Turbo or Warrener.

13.1.6Island

13.1.6.1 31 Deadman's Island Campsite.

Deadman's Island Campsite consists of a sparse concentration of artefacts and shell remains exposed over a small island covering an area 20 metres * 10 m. Exposures are limited to small bare areas between a generally thick cover of low bush. Lithic material (20) was exclusively quartz and included waste flakes and cores. Faunal remains include Turbo or Warrener.

14. APPENDIX 5: WOOD ET AL. 2003 SURVEY EDITED SITE DESCRIPTIONS

14.1.1 Wardang Site 1

Wardang Site 1 within an area covering 0.012 Km^2 comprises a generally sparse deposit of stone artefacts (50) and shell remains over an exposed limestone surface (overlying dune has been quarried) and continuing in moderate densities to a lower clay terrace immediately behind the narrow fore dunes. Several isolated artefacts were noted along the edge of a prominent headland to the north of the site. Faunal remains included Abalone, Warrener, Periwinkle, Limpet, Dog Whelk and Penguin bone. Dimensions: 140*80m. Density: 5-1/100.

14.1.2 Wardang Site 2

Wardang Site 2 within an area covering 0.009 Km^2 comprises a scatter of artefacts and shell exposed in variable densities across a large dune deflation area. It appears as though the area has been quarried for sand with the area striped to a fine silt/clay base. The bulk of cultural materials are exposed within remnant dune slopes surrounding the quarried area. A generally low density of material links several small concentrations with higher densities recorded in the southern parts of the site. A significant amount of mechanically fractured stone was also noted. Lithic material (250) included quartz flakes and flaked pieces; and quartzite flakes and manuports. Faunal remains included Periwinkle, Dog Whelk, Warrener and Penguin bone. Dimensions:140*60m. Density: 6-1/400.

14.1.3 Wardang Site 3

Wardang Site 3 within an area covering 0.001 Km^2 comprises a limited deposit of artefacts and faunal remains in two exposures within low dunes behind a prominent headland. The first exposure (A) covers an area of approximately 50 x 20rn and contains a small number (less than 20) of quartz flakes and flaked pieces together with some shell (a natural shell deposit also covers the area). The second exposure (B) is located to the south of exposure A and within a small deflation area. Material includes penguin bone, shell, and several cobble manuports. Lithic material (30) included quartz flakes and flaked pieces; and quartzite manuports. Faunal remains included Periwinkle, Dog Whelk, Warrener and Penguin bone. Dimensions: 50*20m. Density: 2-1/400.

14.1.4 Wardang Site 4

Wardang Site 4 within an area covering 0.013 Km^2 comprises a complex exposure of shell and artefacts over an extensive area of land 400-500m inland of the west coast of Wardang Island. The edges of the site have not been fully evaluated with variable vegetation cover making survey difficult. Survey along a vehicle track to the east of the site, however, failed to locate any cultural materials. The site comprises two main elements linked through, and surrounded by, a sparse scatter of isolated artefacts; Area A: Generally diffuse scatter of artefacts over an area measuring 60 x 50m; Area B: Several dense scatters of shell (Periwinkle) and artefacts over an area measuring approximately 120 x 80m. The assemblage includes a high proportion of large, flaked pieces and cores with cobble cortex with intact knapping floors evident. Shell occurs in mono-specific midden and lower density scatter throughout. Lithic material (250) included quartz: flakes, flaked pieces, cores and blades. Faunal remains included Periwinkle and Warrener. Dimensions: Area A: 60*50m, Area B: 120*80m. Density: 6-1/100.

14.1.5 Wardang Site 5

Wardang Island 5 within an area covering 0.085 Km^2 comprises a generally low density, diffuse scatter of stone artefacts and shell remains scattered along a considerable length of coastal cliff line and continuing in the west to a series of low sand dunes. Ground surface visibility is generally restrictive beyond a narrow erosional belt following the cliff line and it may be that additional materials occur beneath thick grass cover. A scatter of isolated artefacts continues in and around the dunes in the west. The eastern edge of the site was not fully established. Material occurs in both localised concentrations and an intervening background scatter. A natural shell deposit occurs throughout the area though it is suggested that a component of shell located is in fact part of the cultural deposit. Lithic materials are dominated by quartz flakes and flaked pieces with cobble cortex identified on a high proportion of artefacts. Quartz cobbles lie throughout the immediate area. Lithic material (150) included quartz: flakes, flaked pieces and core; and quartzite: flakes and manuports. Faunal remains included Periwinkle, Warrener, Abalone and Dog Whelk. Dimensions: 530*160m. Density: 3-1/400.

14.1.6 Wardang Site 6

Wardang Island 6 within an area covering 0.021 Km^2 comprises a complex exposure of lithic and faunal materials throughout an area of quarried dunes fringing a low coastal cliff line. The complex covers an area measuring approximately 160 x 130m though visibility conditions are reduced markedly beyond the quarried areas and it may be that additional remains are present. Much of the material observed are likely to be in disturbed context. The area is littered with a natural deposit of shell and small quartz cobbles with much of the flaked material contains cobble cortex. A component of the shell is likely to be cultural. The site contains four main areas: A) Deflation area measuring 40 x 15m containing scattered shell, a large amount of penguin (some burnt) and a small number of artefacts. B) Flat area fringing cliff and containing a light scattering of shell. C/D: Large deflation/quarry measuring 80 x 60m and containing shell, artefacts, and other faunal remains (penguin, bettong). E: Quarried area 60 x 40m containing sparse scatter of artefacts and shell. Lithic material (150) included quartz: flakes, flaked pieces and cores; and quartzite: flakes and flaked pieces. Faunal remains included Periwinkle, Warrener, Abalone, Dog Whelk, Penguin and Bettong. Dimensions: 160*130m. Density: 3-1/100.

14.1.7 Wardang Site 7

Wardang Island 7 within an area covering 0.01 Km^2 comprises a generally low density scatter of artefacts and shell throughout a long, narrow deflation/quarry area. Several small clusters of material were noted within an otherwise diffuse scatter. Much of the material is likely to be in a disturbed context given the extent of quarrying in the area. Large numbers of unmodified quartz and quartzite cobbles litter the deflation floor. Lithic material (50) included quartz: flakes, flaked pieces and cores; and quartzite: flakes and flaked pieces. Faunal remains included Warrener. Dimensions: 160*60m Density: 3-1/100.

14.1.8 Wardang Site 8

Wardang Island 8 within an area covering 0.005 Km^2 comprises a high density knapping floor and associated shell located in a broad deflation/quarried area of dune. The knapping floor measures approximately 6 x 6m with lower density deposit extending into the immediate area. A natural deposit of quartz cobbles throughout the dune complex is a likely source of the raw material given the high incidence of cobble cortex on the artefacts. Lithic material (200) included quartz flakes, flaked pieces, cores and blades. Faunal remains included Warrener. Dimensions: 90*50m. Density: 30+ -1/4.

14.1.9 Wardang Site 9

Wardang Island 9 comprises a generally low-density scatter of shell and possible artefactual materials throughout an extensive dune deflation/quarry. Most of the material is in a disturbed context but some shell is located high on dune slopes above quarried level and is likely to be partly in situ. Faunal assemblage also includes some penguin bone. The lithic assemblage includes several unmodified cobbles together with a smaller component of amorphous flaked pieces, some of which are obviously out of context. Lithic material included quartz manuports and flakes. Faunal remains included Warrener, Periwinkle, and Penguin bone.

14.1.10 Wardang Site 10

Wardang Island 10 within an area covering 0.01 Km^2 comprises a small cluster of quartz flakes over an area measuring 8 x 3m within extensive area of quarried dune measuring 180 x 55m. A natural deposit or quartz cobbles and shell extends throughout the area with a component of the shell (large individual warrener and dog whelk) possibly part of the cultural deposit. The 'site' appears as a small-localised cluster within a broader background scatter of isolated artefacts and culturally derived shell continuing throughout the dune area. Lithic (15) material included quartz flakes. Faunal remains included Warrener and Dog Whelk. Dimensions: 180*55m. Density: 3 -1/4.

14.1.11 Wardang Site 11

Wardang Island 11 within an area covering 0.001 Km^2 consists of a small scatter of quartz flakes and flaked pieces along a section of cliff line. A natural shell deposit covers the immediate area, and it may be that a component is in fact part of the cultural deposit. The 'site' appears as a small-localised cluster within a broader background scatter of isolated artefacts and culturally derived shell continuing throughout the immediate area. Lithic material (20) included quartz flakes and flaked pieces. Dimensions: 6*2m. Density: 2-1/4.

14.1.12 Wardang Site 12

Wardang Island 12 within an area covering 0.001 Km^2 comprises a small scatter of less than 10 quartz flakes and flaked pieces. The 'site' appears as a small-localised cluster within a broader background scatter of isolated artefacts and culturally derived shell continuing throughout the immediate area. Lithic material (10) included quartz flakes and flaked pieces. Dimensions: 5*5m. Density: 2-1.

14.1.13 Wardang Site 13

Wardang Island 13 within an area covering 0.003 Km^2 comprises a low density scatter of artefacts and shell remains exposed within narrow erosional area fringing high limestone cliff. Visibility beyond the erosional surface is limited and it may be that additional materials occur beneath a typically thick grass cover. The site exposure is sporadic and continues for approximately 180m of cliff extending at maximum to 10 – 15m inland of the cliff edge. Lithic material (30) included quartz flakes and flaked pieces. Faunal remains included Warrener, Dog Whelk and Tulip Shell. Dimensions: 180*15m. Density: 2-1/100.

14.1.14 Wardang Site 14

Wardang Island 14 within an area covering 0.051 Km^2 comprises a generally low to moderate density scatter of shell, together with a small component of other faunal and lithic materials, exposed throughout and extensive dune deflation quarry. Most of the material is in a disturbed context exposed on a basal limestone floor. A smaller amount of material is preserved higher up the dune surfaces. A natural shell and cobble unit occurs throughout the area. Anthropogenic shell was distinguished generally on the size of individual specimens relative to the natural coquina. A small 10 * 4m moderate- high density scatter of bone and shell was located in the northern section of the site and appears to be eroding from an in-situ lens high on the deflation wall. There is a general absence of flaked stone with a number of manuports (quartz, quartzite, granite) located out of context on dune slopes. Lithic material (150) included quartz manuports, flakes and flaked cobbles; quartzite manuports; and granite manuports. Faunal remains included Warrener, Dog Whelk, Tulip Shell, Abalone and Penguin and Fish bone. Dimensions: 360*140m. Density: 10-1.

14.1.15 Wardang Site 15

Wardang Island 15 within an area covering 0.002 Km^2 comprises a series of exposures along the edge of a low coastal cliff line over approximately 80 x 15m and containing artefacts and faunal material in variable densities. The faunal assemblage is dominated by penguin bone but also includes a variety of shell species and mammal remains. The lithic assemblage is characterised by small flakes manufactured from quartz with artefact densities approaching g-l0/m2 in parts. In situ lenses are exposed in several areas and it is likely that additional sub-surface materials will be present inland of the exposures but are obscured by otherwise thick vegetation cover. Lithic material (150) included quartz flakes, flaked cobbles, blades, r/u flakes and flaked pieces. Faunal remains included Periwinkle, Penguin, Bandicoot and fish bone. Dimensions: 80*15m. Density: 10.

14.1.16 Wardang Site 16

Wardang Island 16 within an area covering 0.003 Km^2 comprises a small, bowl-shaped deflation area measuring 60 x 50m with a low-density scatter of stone artefacts (20) and faunal material covering the deflation floor. The bulk of material is contained in a small cluster on the eastern slope of a low pedestal in the centre of the deflation. Beyond this cluster, the deposit is generally low density. Faunal remains included Warrener and Penguin bone. Dimensions: 60 x 50m. Density: 2-1/100. Total: 20.

15. APPENDIX 6: GEOLOGICAL DESCRIPTIONS (FROM [GSSA 2019])

Name	Era	Description	Code
Cape Jervis Formation	Sakmarian	Glacio-marine and fluvioglacial sediments and residual erratics.	CP-j –
Winulta Formation	Atdabanian	Sandstone, quartzose; conglomerate.	Eoi –
Kulpara Formation	Atdabanian	Dolomite and limestone, stromatolitic and fenestral, micritic; ooid grainstone.	Eok -
Pegmatite, ganite and aplite dykes	Mesoproterozoic	Pegmatite, ganite and aplite dykes, at least three generations, inferred ages from ~1850 to 1500Ma.	LM17 -
Wallaroo Group	Palaeoproterozoic	Schist, quartz-feldspar-mica; argillite; rhyolite, porphyritic, fine grained, A-type; limestone; siltstone; felsic volcanics; sandstone, medium to coarse grained, poorly sorted; amphibolite; dolerite; basalt. 1772-1735 Ma.	Lx –
Moonta Porphyry Member	Palaeoproterozoic	Rhyolite, fine-grained, foliated, pale grey to reddish pink porphyritic rhyolite. Extensively recrystallised.	Lxem –
Wardang Volcanics Member	Palaeoproterozoic	Acid volcanics. Phenocrysts of calcic-plagioclase, usually sericitised with carbonate, scapolite and chlorite inclusions. Matrix of K-feldspar, quartz, plagioclase, biotite. Inferred age ~1734 Ma.	Lxew –
Matta Formation	Palaeoproterozoic	Mafic volcanics.	Lxt –
Renowden Metabasalt Member	Palaeoproterozoic	Metabasalt.	Lxtr –
Aagot Member	Palaeoproterozoic	Layered metasandstone, sandy or tuffaceous argillite, minor calcsilicate and albitic rocks. Lower to middle amphibolite facies metamorphism.	Lxwa –
Arthurton Granite	Mesoproterozoic	Granite; adamellite.	Mhr –
Quaternary alluvial/fluvial sediments	Quaternary	Quaternary alluvial/fluvial sediments.	Qa –
Quaternary aeolian sediments	Quaternary	Quaternary aeolian sediments.	Qe –
Holocene alluvial/fluvial sediments	Holocene	Holocene alluvial/fluvial sediments.	Qha –
Saint Kilda Formation	Holocene	Coastal marine sediment: calcareous, fossiliferous sand and mud of iintertidal sand flats, beaches and tidal marshes; organic, gypseous clay of supratidal flats.	Qhck –

Gantheaume Sand Member	Holocene	Unconsolidated aeolian cliff top dunes and sand spreads from reworking of Bridgewater Formation.	Qhckg –
Le Hunte Member	Holocene	Gypsiferous lacustrine sediment of coastal saline lakes.	Qhckh –
Semaphore Sand Member	Holocene	Unconsolidated white bioclastic quartz-carbonate sand of modern beaches and transgressive dune fields.	Qhcks –
Holocene sand spread	Holocene	Holocene sand spread.	Qhe3 –
Holocene lacustrine sediment	Holocene	Holocene lacustrine sediment.	Qhl4 –
Pleistocene calcrete	Pleistocene	Pleistocene calcrete	Qp\ca –
Undifferentiated Pleistocene calcrete	Pleistocene	Pleistocene calcrete.	Qp\ca –
Hindmarsh Clay	Pleistocene	Consolidated mottled clay and sandy clay with sand and gravel lenses, aeolian sand, gypseous and pelletal clay dunes and calcareous palaeosols. Alluvial and colluvial red-brown sandy clay with sand and gravel beds.	Qpah –
Bridgewater Formation	Pleistocene	Coastal barrier and shallow sub-tidal sediments: bioclastic and aeolian cross-bedded calcarenite, palaeosol horizons, often capped by calcrete.	Qpcb –
Glanville Formation	Pleistocene, Late	Clay, mottled, shelly; calcarenite, skeletal, coquina. Geochron age 132 000+/-6 000 years Bp on TL.	Qpcg –
Hallett Cove Sandstone	Pliocene	Sandstone, calcareous; limestone, sandy, fossiliferous. Transgressive, shallow marginal marine.	Tph –