

Looking at the Sky, Listening to the Sea

Customary Environmental Knowledge, Climate Change in the Pacific and Connections of Atmosphere, Oceans, Species and People

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Statement of Authentication

The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in full or in part, for a degree at this or any other institution.

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Chels Alby Marshall

21 October 2019

Dedication

I dedicate this thesis to my family: past, present and future.

I also dedicate this thesis to the many kids I have spoken to about the environment, human-induced climate change and Indigenous ways of knowing and thinking. Their plight is ensuring a future and world full of trees, clean air, animals, clean beaches and prosperity with Indigenous ideology.

Dreaming for future generations to inherit.

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Abstract

The investigation of regional correlations between knowledge of seasonal patterns and indicators, along with closer examination of the monitoring methods used in traditional management systems, can determine traditional knowledge's viability and role in monitoring shifting patterns of seasonal variation or atmospheric trends. Furthermore, investigation into what the key elements of traditional knowledge are and how these are related to plant and animal life cycles and overall ecological seasonal cycles provides detailed information for foundational frameworks. These frameworks will assist in providing some detail to an unspecified map for future adaptation and vigilance through generational knowledge exchange and how these elements are intergraded into regional frameworks for policy direction in the face of climate change in the Pacific.

One of the primary issues when dealing with traditional knowledge systems is acknowledging the holistic nature of information and the value that this perspective or way of knowing holds in current day natural resource management and decision-making strategies. Comparing Indigenous Australian and Pacific Islander environmental management for practical environmental and cultural resilience returns/benefits provides information on the significance of traditional knowledge and the correlations of climate and seasonal change in the Pacific. It also highlights the associated understanding of living bodies of knowledge and the fundamentals of how we think about nature, species and associated landscape resources (Borrini-Feyerabend et al. 2004, Walker et al. 2004, Bennett and Zurek 2006, Berkes et al. 2006). This also includes the context and integration of local Indigenous peoples', communities' and Indigenous institutions' interpretations of these returns and benefits and the cultural knowledge base, knowledge adaptation and resilience as we transition into anthropogenic climate change. The cultural dimensions around the longevity of oral tradition provide empirical substantiation of environmental transformation. This research also highlights the importance of platforms to provide Indigenous perspectives in the interpretation and reconditioning of past European contextualisation and the partiality of Indigenous anecdotes and cultural dimensions.

The investigations also attempted to look at the locational range of ecological knowledge and potential similarities in cultural knowledge practices, the examination of the monitoring methods used in environmental observation, the detailing of sustainability and the utilisation and application of cultural environmental knowledge as it pertains to knowledge transfer. Seasonal change has a significant role in cultural existence and the means of how people relate and utilise their environment. It is a variable that shows forms of adaptation and resilience that are distinct from western forms of

land/sea use and appreciation. The issue of climatic change and seasonal patterns or variations raises questions about Indigenous knowledge and adaptation and gives a voice to the problems and concerns of Pacific people, especially in relation to climate change and global population issues.

The language and information contained in this paper includes traditional knowledge, traditional cultural expression and references to biological resources (plants and animals) of the Gumbaynggirr people. The information is published with the consent of Gumbaynggirr traditional custodians, for the purposes of general education and language maintenance purposes.

This information should not be used commercially in any way including in tourism or food technology, including bush tucker applications, medicines, pharmaceutical products, health and beauty products, storytelling or as trademarks, patents and designs without observing the Aboriginal cultural protocols of prior informed consent, attribution to traditional Indigenous communities, cultural integrity and the sharing of benefits.

Table of Contents

List of Figures and Maps.....	15
List of Tables.....	18
Abbreviations and Acronyms.....	19
Cultural Statement: My Essence, My Core, My Place, My Cultural Totem, Is Being Abused.....	20
Chapter 1: Introduction to My Cultural Origin.....	22
1.1 Introduction.....	22
1.2 Key research question or hypothesis.....	24
Chapter 2: Climate Dictates Our Lives.....	28
2.1 Introduction and scope.....	28
2.2 Climate dictates our lives.....	30
2.3 Climate change or changing — a brief look at the changes so far.....	33
2.4 Heinrich and Dansgaard-Oeschger events.....	34
2.5 The Younger Dryas.....	36
2.6 Climate changes during the late Pleistocene.....	36
2.7 Changes in sea level.....	37
2.8 The changing shoreline.....	42
2.9 Localised variations.....	43
Chapter 3: Impacts of Variability in Climate and How These Affected Human Activities.....	45
3.1 Seeking refuge in past adaptation principles.....	45
3.2 Consequences of and issues with current adaptation.....	46
3.3 Ecological connective evolution.....	50
3.4 Aboriginal peoples, biodiversity management and species adaptation.....	51
Chapter 4: Utilisation and Application of Cultural Environmental Knowledge.....	56
4.1 Introduction.....	56
4.2 Exploring the underlying nexus of principles.....	57
4.3 Examination of the monitoring methods used in environmental observation.....	58
4.4 Origin of western scientific theory and environmental observation and monitoring.....	59
4.5 The monitoring methods and principles used in environmental observation.....	60
4.6 Environmental knowledge and Indigenous knowledge systems.....	61
4.7 A comparison with western scientific theory and method.....	64
4.8 Inherent limitations in the classical scientific way of analysing nature and ecological systems/biodiversity monitoring.....	66

4.9	What is Indigenous science?	68
Chapter 5: The Elements of the Visual and Intangible in Cultural Expression and Knowledge.....		71
5.1	Introduction.....	71
5.2	Cultural artistic methodologies in change production.....	73
5.3	Calendars, time and seasonality.....	75
5.4	Astronomical bases of calendars.....	76
5.5	The Gregorian calendar.....	76
5.6	Traditional knowledge, space and time.....	77
5.7	Case study 1: Gumbaynggirr Seasonal Calendar.....	79
5.7.1	Background.....	79
5.7.2	Climate.....	81
5.7.3	The people: Gumbaynggirr area/clans spatial distribution.....	82
5.7.4	Constructing an interactive cultural calendar.....	85
5.7.5	Garrigarrang: Sea Country exhibition at the Australian Museum.....	87
5.7.5.1	The Gumbaynggirr Seasonal Calendar touchscreen.....	87
5.7.5.2	Design concept — technical specifications.....	88
5.7.5.3	Design concept.....	89
5.7.5.4	Converting and inserting cultural environmental data.....	91
5.7.5.5	The seasonal calendar, species and technical specifications.....	95
5.7.5.6	The process of animation and movement.....	96
5.8	Case study 2: Gumbaynggirr Women’s Spirit animation.....	101
5.8.1	Introduction.....	101
5.8.2	The making of <i>gagaal</i> (the sea) — totem of the Gumbaynggirr people.....	102
5.8.3	Ancestors and spirituality — the creation stories, spirituality and belief systems...103	
5.8.4	Spirituality and connection.....	105
5.8.5	Gumbaynggirr Women’s creation story — animation storyboard.....	105
5.8.5.1	Phase 1.....	106
5.8.5.2	8 May 2018.....	113
5.8.5.3	9 August 2018.....	114
5.8.5.4	28 November 2018.....	114
5.8.5.5	25 January 2019.....	114
5.9	Case study 3: <i>Gangaagundi guunuwaygan</i> (future life).....	114
5.9.1	Introduction.....	114
5.9.2	Animism.....	116

5.9.3	Totems.....	116
5.9.4	Marine biotechnology and Indigenous ideology.....	118
Chapter 6: The Examination of Monitoring Methods Used by Indigenous People in Environmental Observation, Astronomy, Seasons and Sailing.....		128
6.1	Introduction: Aotearoa — landforms and ecology.....	128
6.2	Unearthing Aotearoa.....	129
6.3	Case study 4: Three hundred and sixty degrees — star maps, waves, sky, ocean and traditional sailing in the Pacific.....	131
6.3.1	We sailed here — ecological knowledge and components of sailing (the stars, the swells, the winds, the birds)	133
6.3.2	Star maps and ocean knowledge.....	134
6.3.3	<i>Te kāpehu whetū</i> (Māori star compass).....	137
6.3.4	Woman and the sea — the female womb is like the ocean.....	138
6.3.5	Intergenerational knowledge transfer — sailing into hope for future adaptation...139	
6.4	Case study 5: Moon living — cultural astrology (Photo essay: New Zealand and Gumbaynggirr).....	142
6.4.1	Historical introduction.....	142
6.4.2	Maramataka — the lunar cycle.....	143
6.4.3	Resource harvesting and lunar cyclic events.....	145
6.4.4	Fishing — Kaimoana.....	146
6.4.5	Traditional and contemporary understanding and use of the Maramataka.....	150
6.4.6	The process and store houses.....	151
6.5	Conclusions — the revitalisation of traditional knowledge.....	151
Chapter 7: Sustaining the Integrity of Indigenous Women’s Roles in Generational Knowledge Transfer.....		154
7.1	Decolonising methodologies.....	154
7.2	Oceanic women — sailing sisters.....	154
7.3	Biological diversity, cultural diversity and Indigenous peoples.....	156
7.4	Moon Island, or the <i>Giidan Mirral</i>	156
7.5	Gumbaynggirr women and the sea.....	158
7.6	Fishing methods used in Gumbaynggirr.....	166
7.6.1	Traps.....	166
7.6.2	Helpers, dolphins.....	166
7.6.3	Nets.....	167

7.6.4	Hook and line.....	167
7.6.5	Poisons.....	168
7.6.6	Knowledge of species and their life cycles — eel migration.....	168
7.7	The significance of fishing to Pacific people.....	170
7.8	Conclusion.....	171
Chapter 8: Understanding the Implications of Climate Change for Indigenous Peoples of the Pacific		
.....		175
8.1	Introduction: Climate change, species movement and cultural adaptation.....	175
8.2	How seasonal change has a significant role in cultural existence and the means by which people relate to, utilise and adapt to their environment.....	178
8.3	Case Study 6: Climate Change: Adapting Language to Landscape and Species Movement .	179
8.3.1	Microclimatic patterns and regional scale — Gumbaynggirr case study.....	179
8.3.2	Being aware, attuned and influencing.....	181
8.3.3	Case study 6: Latin to lingo: Sustaining and renewing Gumbaynggirr language.....	179
8.3.4	Knowledge of resources.....	182
8.3.5	Cultural marine species of the Gumbaynggirr.....	183
8.3.6	Species movement impacts on cultural components.....	185
8.3.7	With the transitions of landscapes and species come the transition of language...	185
8.4	Looking after <i>gaagal</i> (ocean): Biodiversity and debris surveys in Gumma Indigenous Protected Area Stages 1, 2 & 3.....	187
Chapter 9: Indigenous Paradigms in Marine Protected Area Planning		191
9.1	Introduction.....	191
9.2	Functions, establishment and construction processes.....	193
9.3	Aboriginal rights, interests and obligations in the marine environment.....	195
9.4	Where do the obstructions lie?.....	196
9.5	Aboriginal cultural marine mapping: Recognising governance complexity and diversity.....	199
9.6	The most effective strategies for realising the benefits of Indigenous approaches to sustainable resource use in the era of climate change.....	200
Chapter 10: Designing a Future Based on Past Ideology: The Detailing of Sustainability and Utilisation and Application of Cultural Environmental Knowledge		206
10.1	Introduction.....	206
10.2	Sustainability.....	207
10.3	Ecological sustainability.....	208
10.4	Traditional knowledge systems.....	211

10.5	The role of Indigenous paradigms and traditional knowledge systems in modern humanity's sustainability quest.....	212
10.6	Environmental kinship and totemic relations.....	213
10.7	Moving into new territory.....	216
10.8	A New System.....	219
10.9	Conclusion.....	221
Chapter 11: A Future through Indigenous Principles for Design.....		223
11.1	Introduction.....	223
Chapter 12: Cultural Summary and Conclusions.....		231
12.1	<i>Giingan.gundi maangun bindaala: Juungamala ngiyambaygu</i>	240
References.....		242
Appendix 1.....		258
Appendix 2.....		259

List of Figures and Maps

Map 1: Southern Gumbaynggirr coastline and place names.....	27
Figure 1: Changes in surface air temperature globally over 150 years.....	32
Figure 2: Time series anomalies in sea surface temperature and temperature over land in the Australian region.....	32
Figure 3: Measurements of air extracted from Antarctic ice extend the record of measured atmospheric carbon dioxide concentrations to 800,000 years ago.....	34
Figure 4: Trends in the length of the sea-ice season each year (in days per year) around Antarctica, 1979–2017.....	38
Figure 5: High-quality global sea level measurements showing annual sea level change from 1880 in tide gauge data (1880–2014, blue line, light blue shading indicates confidence range) and annual sea level change in satellite altimetry (1993–2017, red line).....	39
Figure 6: Projections of atmospheric temperature increase to 2020 showing approximate 5°C.....	40
Figure 7: Sea surface temperatures from 1910–2010 showing gradual warming of 0.5–0.7°C.....	41
Figure 8: Temperature data showing rapid warming in the past few decades, the latest data going up to 2018.....	41
Figure 9: New displacements in 2018 broken down by conflict, violence and disasters.....	48
Figure 10: Disaster figures showing weather-related hazards, particularly storms.....	48
Figure 11: As in previous years, the East Asia and Pacific region accounted for most of the internal displacement associated with disasters recorded worldwide in 2018.....	49
Figure 12: Period of human–megafauna overlap and climate variation in Sahul.....	53
Figure 13: The five spheres of the earth system.....	59
Figure 14: The process of scientific evaluation and outcomes.....	61
Figure 15: The six faces of traditional ecological knowledge: challenges and opportunities for Canadian co-management arrangements.....	64
Figure 16: Science 101, 2012–16.....	66
Figure 17: The Traditional Owners of Urunga and the Bellinger Valley.....	83
Figure 18: First draft of the Gumbaynggirr calendar and mind mapping of species and text (left). Second draft of two-dimensional static display (right).....	85
Figure 19: Third draft and the organisation of connectors and sequences of flow in drafting knowledge visually.....	87

Figure 20: The relationships of graphics and interconnections of species.....	90
Figure 21: Second draft of calendar with species and indicators organised.....	91
Figure 22: The final version of calendar one in a two-dimensional layout. The initial design comprised of six-millimetre plywood with decals.....	94
Figure 23: The installation of the two-dimensional calendar at the Australian Museum in 2015.....	95
Figure 24: The human influences on ecological cycles 3D models.....	97
Figure 25: Vegetation indicator species 3D models.....	96
Figure 26: Fish species as a primary resource and indicator species 3D models.....	98
Figure 27: The making of indicator species and secondary species 3D models.....	99
Figure 28: The interactions of people with landscape and seasonal activity 3D modelling.....	99
Figure 29: The final version of calendar 2 in digital format with all species and human influences..	100
Figure 30: Australian Museum Aboriginal guide tests the Gumbaynggirr Seasonal Calendar digital installation at the Australian Museum in 2017.....	100
Figure 31: The twenty spheres of Aboriginal connections to Earth systems.....	106
Figure 32: Motion capture in the UTS Data Arena.....	113
Figure 33: The opening of the <i>Gangaagundi Guunuwaygan</i> (Future Life) exhibition at the University of New South Wales.....	127
Figure 34: Photographic interpretation of The Irakewa Rock with star constellation by Pauline Harris	130
Figure 35: The traditional sails of the <i>waka</i>	132
Figure 36: Photographic interpretation of the roles and functions on the <i>waka</i> involving knowledge of all workings on the vessel Haunui.....	133
Figure 37: Map showing some recorded voyages of the Polynesians.....	134
Figure 38: Māori war canoe approaching Taranaki, 1879, by Nicholas Chevalier.....	136
Figure 39: Bonni. Luafutu Tamati. Photographic interpretation of the sailing thoughts of a woman.....	137
Figure 40: Photographic interpretation of star knowledge and transfer in contemporary mediums with Dr Pauline Harris in the star dome.....	140
Figure 41: Georgia Bell on the Haunui talks about the spiritual components of sailing the Mauri rocks have place and meaning on the vessel.....	141
Figure 42: Photographic interpretation. This extract of charms comes from the Torres Strait.....	142

Figure 43: A Maramataka from <i>Fishing Methods and Devices of the Māori</i>	144
Figure 44: Photographic interpretation of historic climate change from a newspaper clip from 1920 highlighting the knowledge and consequences of coal and carbon dioxide in the atmosphere.....	148
Figure 45: Photographic interpretation of white bait and climate change.....	148
Figure 46: This is my interpretation of the moon and the fish and how each is connected.....	149
Figure 47: The whitebait lay eggs on vegetation upstream, the unknown factors associated to climate change could push this species that has sustained Māori fishing and sustenance for generations into further decline. This is my interpretation, a message from the fish.....	149
Figure 48: Māori oven, 12 March 1933.....	151
Figure 49: One of the youngest of the crew Pera Wakka contemplates the waves, learnings through intergenerational knowledge transfer. The image also shows the star constellations and female component of the vessel.....	153
Figure 50: Tidal sequence and Gumbaynggirr interpretation.....	157
Figure 51: A self-portrait used for promotion at the Australian Museum for the Gumbaynggirr seasonal calendar.....	158
Figure 52: Two Gumbaynggirr women and children from staged photography. The two women show Malgun, 1873–74.....	161
Figure 53: The components of spirituality in culture and ecological knowledge pertaining to management of resources.....	164
Figure 54: Hook made from turbo shell, reproduction, Aboriginal artefact.....	168
Figure 55: The knowledge of eel biology and migration in Gumbaynggirr country.....	169
Figure 56: Crankey Tom and Dilberree, 1818.....	180
Figure 57: Australia’s network of marine protected areas.....	198
Figure 58: Habitual living ideology as expressed by the Regenesis group shows the trajectory of regenerative design concepts that have ecological consciousness and outcomes as the main thinking.....	209
Figure 59: The comparison of modern planning paradigm and regenerative planning paradigm.....	210
Figure 60: The Indigenous knowledge design and development stratums.....	212
Figure 61: A small example section from my Gumbaynggirr/Ngambaa-Baga Baga kinship paradigm with elements, animals, plants and habitats.....	214
Figure 62: Levels of ecological strategies for sustainability.....	220
Figure 63: Reinstating cultural planning paradigms in modern context.....	221
Figure 64: Earth overshoot day 1969–2018.....	227
Figure 65: Country overshoot days 2018.....	227

Figure 66: Principles in Indigenous knowledge systems and governance.....	237
---	-----

List of Tables

Table 1: IUCN Red List summary country totals (animals) for Ocean.....	55
Table 2: Comparison of Indigenous and western observational knowledge.....	67
Table 3: The variables in environmental monitoring and holistic cultural attributes.....	68
Table 4: A comparison of Indigenous and western methods and practices in calendars.....	77
Table 5: First draft of organising seasonal climate oral knowledge into an Excel spreadsheet.....	93
Table 6: Second draft of organising species and climatic oral knowledge into a spreadsheet.....	93
Table 7: Evaluation of associations and applied attributes of environmental landscapes.....	102
Table 8: Totemism in Gumbaynggirr culture.....	118
Table 9: The Māori Maramataka (moon cycle calendar) from the Ngati Kahungunu tribe.....	144
Table 10: Fish commonly eaten by Gumbaynggirr people.....	166
Table 11: Commonly eaten marine species in Gumbaynggirr.....	184
Table 12: New species names for Gumbaynggirr marine environments.....	188
Table 13: Guidelines for applying the IUCN protected area management categories to marine protected areas 2012.....	192

Abbreviations and Acronyms

TEK	Traditional Ecological Knowledge
IK	Indigenous Knowledge
IEK	Indigenous Ecological Knowledge
IKS	Indigenous Knowledge Systems
TKS	Traditional Knowledge Systems
IPA	Indigenous Protected Areas
IUCN	International Union for Conservation of Nature and Natural Resources
NZ	New Zealand
DCCEE	Department of Climate Change and Energy Efficiency
GIPA	Gumma Indigenous Protected Area
TEEB	The Economics of Ecosystem and Biodiversity
ITEO	Indigenous Theory and Environmental Observation
CSIRO	Commonwealth Scientific and Industrial Research Organisation
IPCC	Intergovernmental Panel on Climate Change
SPCZ	South Pacific Convergence Zone
ITCZ	Inter-Tropical Convergence Zone
WPM	West Pacific Monsoon
SLR	Sea Level Rise
NOAA	National Oceanic and Atmospheric Administration

Cultural Statement

My Essence, My Core, My Place, My Cultural Totem, Is Being Abused

The ocean, the sea, the salty water that brings rejuvenation and life on this planet. It is dynamic, living and extreme, it is my mother's lungs. Its echelons are the womb that contain unique and interesting creatures, some so bazaar that it's hard to believe such unique physiology is possible. The creatures evolved to live in extremes, the creator's paradise, others form symbiotic relations, helping each other to exist.

It is sometimes angry, overwhelming, scary, intense, it is most times inviting, sometimes calm and glassy, but always a pleasure to gaze deeply into the dynamic changes and its pulsing movement.

It is a bit like me, influenced by the moon and warmed by the sun, with lots of interesting things inside. My teaching place, the centre of my kinships and world understanding. It is said that humans emerged from the ocean, I look at the webbing between my fingers and toes and imagine my marine ancestors.

We, like so many other creatures, are dependent on its ability to function and be healthy. However, somewhere along the line, we forgot to nurture what nurtures us. A somewhat selfish mentality and existence has emerged and pervaded. The ocean has been abused for hundreds of years to serve our selfish needs, by every culture on every continent. The accumulation of abuse over time has made it quite evident that the ocean is not as resilient or as large as was once thought, so that we are now seeing the effects of such neglect of nurturing, an ocean in need of palliative care.

As I write, I know that millions of tonnes of sewage are still being discharged into the sea, appropriated as a normal action, millions of animals dying. That unexploded bombs, highly toxic chemicals, vitamins and minerals of nutrient supplements, antibiotics and medications of every sort, plastic and other human rubbish are dumped daily, the list is multiple and varied. Carnage is rampant on an hourly basis as refuse, toxic residues, chemicals and crap are literally pumped into my beautiful sanctuary every second. You would not let this happen to the water in your home pool, or your home water tank, so why are you letting it happen to this body of water?

Shipping accidents, megaships, factories, dirty energy, plastic addictions, multi-nationals, science experimentation, economic activity, wealth, exploding rigs, oil spills, war games, fishing industry. Billions drive this now status quo of abuse, fuelled by a mentality of 'what's in it for me?'

It's a playground for human greed, our paradigms of debauched human addiction to the capitalist economy.

Who let this happen? They did...we did...you did...I did.

My favourite place is suffering, my cultural totem of sustenance is being abused, seconds, minutes, hours, days, weeks, months, years, decades, centuries.

Chels Marshall: Yuggirr/Nyan: Baga Baga:Ngambaa:Gumbaynggirr 2015

Chapter 1: Introduction to My Cultural Origin

1.1 Introduction

In Indigenous cultural realms, it is cultural protocol to introduce one's self, of whom I derive, where my family come from and my place within this *jagun* (country) and my homeland origin (*bari*).

This thesis investigates and documents the history and knowledges of my people and my family who descended from two northern New South Wales clans, the Gumbaynggirr and the Ngambaa. My great great grandmother (Maggie Buchanan-Dargan, meaning brown tamarind tree) was one of the last direct descendants from the Ngambaa clan, who were taken unawares and massacred whilst out on country. My *baluuny ba* (grandmother) stayed home with the Irish family (Buchanans) for whom she worked to do their laundry. The majority of area of the Ngambaa was also inundated by the ocean during the last sea level rise and the majority of Ngambaa jagun is covered by water 20–30 kilometres out to sea. My Gumbaynggirr totem is the Ocean. My family totem is the red bass. My female totem is the *niyin* (treecreeper) and mine is Yuggirr (Dolphin).

My great grandfather is known to originate from New Zealand, a Māori by the name of (John Marshall) known as Juunga Mattua. His name Juunga is a Gumbaynggirr name meaning 'person one may marry', 'right sort (with right section)' or 'the right man to marry'. Due to incoherent, missing or undocumented historic records of this time, the challenge to find my great grandfather's origin continues.

I spent all my childhood growing up on country and not only listening to but living and experiencing the knowledges of culture and environment. The gradual understanding and comprehension of 'dreamtime and stories' has shifted my whole perspective on the environment and life. From a young age, understandings of the interactions between people and earth were very important. As I grew older, especially when I started university studying natural resource management and wildlife ecology, I began to understand their significance and to realise that I should record these stories, experiences and knowledges as a historical record for the future generations of my family, and to help the wider community understand the experiences and perspectives of my people.

My grandmother (Violet Buchanan), her brother, Uncle Harry 'Tiger' Buchanan (Maruwanba Maruungga), Aunty Bine (Eileen Buchanan), Grandmother Nan Marshall (Eileen Marshall) and Uncle Pompy (Stanley Marshall) were instigators of not only documenting our culture but ensuring

generational knowledge transfer took place on country in practice. Uncle Harry documented Southern Gumbaynggirr stories and linguistics with Anthropologists, sociolinguistics and Ethnolinguistics, T. Crowley, Diana Eades and B. Fillary. Eades produced the first accurate and professional grammatical analysis of the Gumbaynggirr language in 1979 (Morelli 2015). As more and more Elders of my family were passing on, I discussed with my mum (Frances Edwards) and dad (Okey Marshall) the need to record and preserve our stories, in particular our Traditional Ecological Knowledge (TEK), before they were lost forever. My dad replied, 'Why do you need to write them down? Why can't you just take your kids out on the river or beach and let them experience the life of the fish and the life of the plants for themselves?'. His words resonate with me today, The importance of indigenous knowledge transfer, maintenance of cultural practice, access to country and the relationship between well-being and ecosystem health is extremely important for Indigenous people.

To understand the context in which the Gumbaynggirr people utilised the landscape, one must recognise Gumbaynggirr as distinct cultural group (own stories, language, songs, etc.). The complexity of the language developed over thousands of years for how Gumbaynggirr people lived and interacted with the natural environment. Ultimately, it is essential to value how language and land are connected and understand the context of how places are created and given perspective and meaning.

This is my homeland, this is *jagun* and *bari*. This is where I come from. This is my landscape, my part that touches this vast and magnificent Pacific Ocean. This is my association to that part of country. My part of country extends from the Clarence River to the Nambucca River and Yarrabiny Mountains in the south. Map 1 explains all the components of that landscape from an Indigenous perspective. Everywhere in every town on this coastline has cultural meaning, and the meaning extends from what it was prior to European invasion. Understanding the names and meanings of places in Gumbaynggirr country and our connection to landscape creation knowledge provides insight into the balanced existence and significance of culture and spirituality in the sustainability of healthy, functioning marine and terrestrial ecosystems.

I struggled with how to articulate worldviews and metaphysical phenomena along with explanation of cultural systems to suit the western institute of learning and validation. How does oral knowledge be organised and what principles should it operate, how do I explain the spiritual, the magic and dreaming dimension of culture and knowledge transmission without sounding like a mental health candidate. Anxiety also emulates in that I haven't remained true to my cultural teachings. How do I reference the things I learn from "*mimmi wajarr*" (mother earth) direct, what's the organising framework for cultural cosmological context and why does this all have to fit into an education system

where Aboriginal perspectives and methodologies are still non-existent or does not fit. The two worlds of knowledge becoming one. For all the scientific references in my writing style and terminology, I did not want to undertake a thesis that would sit on a shelf and not be understood or easily read by my family. I feel that while it is to be assessed as an academic document, the cultural, artistic components can be used, seen, touched and understood by not only my family, but all.

I have come through a period of schooling in Australia where history began in 1788. When Captain Cook found Australia and the British colonisation founded a nation. The reference to First Nations people not only here in Australia but the whole Pacific was a negative description, perceived as 'noble savages' or 'a backward race'. Through my family's experiences, I received the other side of this skewed history. I understand the sinister evil of the strategies in colonisation, I comprehend how Indigenous peoples' fate was at the hand of a cunning plan, set in place well before the arrival of European vessels laden with smallpox hitting our eastern coastlines. The plan was to eradicate and eliminate, an intention that would see our people eventually die out from colonisation (Miller 1985; Nakata 2007; Tatz 1999). 'We Have Survived' — a distinct song in 1984 by the band No Fixed Address — was played in my cousins' houses constantly whilst growing up. My memories of kindergarten still ring through like yesterday, the only Aboriginal kid, belittled in front of my class by my teacher when, in show and tell, I told them of the giant kangaroo (Nunguu Miirlarl) that hopped over the Gumbaynggirr landscape and rests as a mountain. My teacher quickly dismissing this, saying 'there were no giant animals in Australia'. How wrong she was.

Rewriting history from Indigenous perspectives is a part of the paradigm shift. Indigenous perspectives provide balance to historic and contemporary research, writings and design. It gives insight to different lenses and perspectives of various issues, coming from different worldviews in culturally appropriate ways.

1.2 Key research question or hypothesis

This doctorate seeks to advance our understanding of a key issue in resource management in multi-cultural context — what are the most effective strategies for realizing the benefits of Indigenous approaches to sustainable resource use in the era of climate change? To fully understand this issue, I set out to examine the relationships of diverse forms of Indigenous knowledge to each other, and to global western scientific approaches, either in partnered co-management or distinctively, comparing Indigenous Australian and Pacific Islander environmental knowledge and management for practical environmental and cultural resilience returns/benefits.

This integrated study aims to highlight the extent of ecological knowledge and potential similarities in cultural knowledge practices, examining the monitoring methods used in environmental observation and detailing the sustainability, utilisation and application of cultural environmental knowledge and intergenerational transfer. It is important to explore seasonal change and how it has a significant role in cultural existence and the means of how people relate to and utilise their environment. It is a variable that shows forms of adaptation and resilience that are distinct from western forms of land/sea use and appreciation. The issue of climatic change and seasonal patterns or variations raises questions about Indigenous knowledge and adaptation and gives a voice to the problems and concerns of Pacific people, especially in relation to climate change and global population issues.

This thesis also aimed to decolonise the academic expectation when writing and researching Indigenous topics from Indigenous researchers. The research was undertaken with creative elements to enhance the understanding of the intangible components of culture and relationships that really have no justice applied when writing about them with western methodology and English language. This was attempted through investigating and documenting the Indigenous knowledge systems of Pacific peoples' relationships with the ocean, atmosphere and marine resources through:

- Consultation of key Indigenous people in the Pacific region and creating digital oral perspectives through images and animation.
 - Utilising Indigenous methodologies to sensitively record these perspectives through oral transmission and the author's interpretation through creative images.
- Investigating the issues associated with climate change from an Indigenous perspective and allowing creative fusion of this process into images and song.

This was achieved through photography/mixed digital media by visually exploring the connections between cultural environmental knowledge, marine habitats and species as they relate to seasonal variation and individuals. It includes the exploration of cultural elements in connection and how these elements are integral to the sustenance of livelihood, local resources, cultural traditions and associated responsibilities in a physical and metaphysical way.

The photographic documentation and synthesis of Indigenous people, environment and species forms the holistic approach to the research by giving the subject a place and a creative visual dimension. It

provides a scientific, cultural and artistic medium for Indigenous people to have a voice on climate change and how it affects culture.

This knowledge contributes to climate science by offering observations and interpretations at a much finer spatial scale with considerable temporal depth and by highlighting elements that may not be considered by climate scientists. It also humanises climate-related issues such as sea level rise, food security and cultural sustainability.



Map 1: Southern Gumbaynggirr coastline and place names. Source: Marshall 2012.

Chapter 2: Climate Dictates Our Lives

2.1 Introduction and scope

The Pacific Ocean is the largest single geographic feature on our planet (Newell and Arengo 2013). It represents half of the world's oceanic area, occupies one-third of the earth's surface and helps support hundreds of millions of people (ibid.). Gumbaynggirr country is part of this great ocean realm on the east coast edge of the landmass called Australia.

The Pacific Ocean supports an array of ocean-based economies and global food resources (FAO 2018). It is essentially the driving force of the earth's climate and the storeroom of complex ecosystems and marine biodiversity. It is the lungs of the planet, a diverse space that has acted as a sentinel to the many species that have evolved in relative isolation (Postaire et al 2017: Boero 1984: Keppel et al 2009). The world's oceans are considered the only long-term sink for carbon dioxide emissions from human activities (Feely et al 2018). Climate change impacts are anticipated to be both soon and severe in the Pacific due to its geographic location in vulnerable environments (i.e. coastlines, islands) (Commonwealth of Australia 2015: Ryan.P and Ryan 2006)

Climate change also poses a direct threat to many Indigenous societies within these island environments due to their continuing reliance upon resource-based livelihoods (Nakashima et al. 2012). Already the impacts have begun with storm surges inundating some atolls and increasingly frequent and severe typhoons hitting the many islands (Mortruex and Barnett (2017): Commonwealth of Australia 2015).

Mortruex and Barnett (2017) summarise and highlight the vulnerabilities and challenges facing small islands. They note that the predicted increase in greenhouse gases will lead to an increase in mean and extreme air and ocean temperatures, rising sea levels and changes in precipitation patterns with the intensity of extreme events. Due to the geographic location of vulnerable low-lying island and atoll environments, these impacts are expected to affect not only Pacific peoples' livelihoods, but also their culture (Nakashima et al. 2012:90). Climate change also poses a direct threat to many Indigenous societies within these environments due to their continuing reliance upon local resource-based livelihoods that are dependent on tropical, subtropical and temperate island sustenance (UN 2012). The expected effects of transformations and fluctuations in factors such as fish movement due to changing sea temperatures beyond their range of tolerance, increasing coral bleaching, crop water

stress through saline contamination of fresh water, increasing risk of diseases such as dengue fever, cholera, diarrheal outbreak and malaria (Galloway McLean 2010; Nakashima et al. 2012) and the inundation of low coastal areas and atolls by rising sea levels are no longer impending, but rather current realities for many (Commonwealth of Australia 2015: UN 2012: Nakashima et al. 2012). The persistent expectation and pressure of global western ideology through economic competition also poses threats to economic attributes, including economic resources like tourism. Along with this is the dominance of western-based paradigm solutions to endemic environments and associated Indigenous issues and problems (UN 2012: UNESCO 2018).

As indicated by Byg and Salick (2009:157), 'until recently, local knowledge of climate change and its impacts has largely been ignored by most climate change studies'. Over the last decade, a number of studies have emerged to illustrate the potential of Indigenous knowledge to complement or add value to scientific climate data (UNESCO 2018, Ford et al 2016; Lefale 2010). Indigenous knowledge also provides culturally and locally appropriate solutions to community-based climate change adaptation strategies and planning (Berkes et al. 2000; McNamara and Westoby 2011) and is fundamental to monitoring local climatic and seasonal patterns (McNamara and McNamara 2011; Riedlinger and Berkes 2001). Indigenous observations and interpretations of meteorological phenomena have guided seasonal and inter-annual activities of local communities for millennia. This knowledge contributes to climate science by offering observations and interpretations at a much finer spatial scale with considerable temporal depth, as well as by highlighting elements that may not be considered by climate scientists (Nakashima et al. 2012).

Attentiveness to environmental variability, shifts and trends is an integral part of our ways of life. Community-based and local knowledge may offer valuable insights into environmental change due to climate change and complement broader-scale scientific research with local precision and nuance (Nakashima et al. 2012). This application of holistic management contrasts with models built on western science, which focuses on reductionist explanations and is accompanied by a worldview that isolates and separates humans from and above the natural world (Aikenhead and Ogawa 2007; Gadgil et al. 1993). Folke et al. (2003) and Gadgil et al. (ibid.) see reductionism as an aid in manipulating and understanding simpler systems, but it is less effective for managing complex social-ecological systems.

Concepts of sustainable living and social-ecological resilience are emerging in natural resource management (Folke et al. 2003; IUCN 2005). Most contain some attempt at holistic attributes, though these models are still in early development and application.

2.2 Climate dictates our lives

Climate may be defined as ‘the average weather’. It is measured by observing patterns in temperature, precipitation, wind, the days of sunlight and other variables (Colls.K: Whitaker.R, 1993). The climate is a highly complex system consisting of five interacting components: the atmosphere (air), the hydrosphere (water), the cryosphere (frozen), the land surface and the biosphere (earth) (Pittock.A 2005: Burroughs.W .2005)

Weather describes current atmospheric conditions such as rainfall, temperate and wind speed at particular places at particular times. Climate is the average pattern of weather for a particular place over several decades and is reliant on long-term records (Colls.K;Whitaker.R 1993: (CSIRO and SPREP 2017). In the Pacific, the climate is influenced by three primary large-scale features: the South Pacific Convergence Zone (SPCZ), the Intertropical Convergence Zone (ITCZ) and the West Pacific Monsoon (WPM). The two fluctuation drivers, El Niño (a warm phase) and La Niña (a cold phase) are the terms given to the opposite phases of the El Niño Southern Oscillation (ENSO) cycle (CSIRO and SPREP 2017:). They describe the fluctuations in temperatures between ocean and atmosphere. These are the descriptions given to the deviations from normal temperatures. They have large-scale impacts on ocean processes and global weather and climate. Each phase can last between nine and 12 months, although their frequencies are irregular. The effects of El Niño and La Niña events are the most important driver of the year-to-year variability of the Pacific regional climate (CSIRO and SPREP 2017).

The fundamentals of global climate comprise major factors that determine the patterns of climate on Earth, including:

- the strength of the incident radiation from the sun, which determines the overall planetary temperature of the earth
- the spherical shape of the earth and the orientation of its axis
- the greenhouse effect of water vapour and other radiatively active trace gases
- the various physical, chemical and biological processes that take place within the atmosphere-geosphere-biosphere climate system
- the rotation of the earth, which substantially modifies the large-scale thermally driven circulation patterns of the atmosphere and oceans and
- the distribution of continents and oceans (Smith 2006).

The earth's climate has changed and altered over centuries and millennia from a number of primary dynamics, including natural changes in the earth's orbit, natural influences from the sun and amounts of incoming solar radiation, large scale volcanic eruptions with ash reflecting sunlight back toward the atmosphere resulting in mean surface temperature decline and changes in atmospheric chemistry. Both natural phenomena and human activities (i.e. greenhouse gasses and burning fossil fuels) have altered the atmosphere (CSIRO and SPREP 2017).

Reconstructions of temperature data over the last 1000 years indicate that global temperature changes in the last hundred years are very unlikely to be exclusively natural in origin. The Intergovernmental Panel on Climate Change (IPCC), recognised as the global authority on climate change, concluded that most of the observed warming over the last 50 years is likely due to the increase in greenhouse gas concentrations (IPCC 2014, 2018, 2019) from induced human behaviour and actions on earth. The IPCC projects that global mean temperature will increase by 1.4 to 5.8 °C over the period 1990 to 2100. This projection has led many scientists to predict that if society pursues a 'business as usual' approach to greenhouse emissions, the collapse of society due to climate change is inevitable (Smith 2006). This statement was written in 2006 as part of an NSW parliamentary briefing on the science of climate change. It also included two sections that explain climate change and a critique of climate change science. As noted in a later article, business as usual approach employed "manipulative behaviors [which] tend to disregard the integrity of social-ecological systems and focus on external change or manipulating the broader system with the aim of making self-regulation unnecessary" (Thomsen et al 2012, abstract).

As I write, human-induced climate change is altering the fundamental biotic and abiotic environments in which biological species exist (Steffen et al. 2009). This has previously happened to the planet naturally over long periods of time as part of natural global processes. The changes from human-driven alterations show the long-term patterns of variability, with the warming of the climate over the past century unequivocal (Steffen et al. 2009). Figure 1 shows changes in mean surface temperatures over the past 150 years where global average temperatures have increased 0.74°C. Studies published in scientific journals reveal that more than 97 per cent of actively published scientists agree that climate warming trends over the last century are without question due to human-induced activities (NASA 2019).

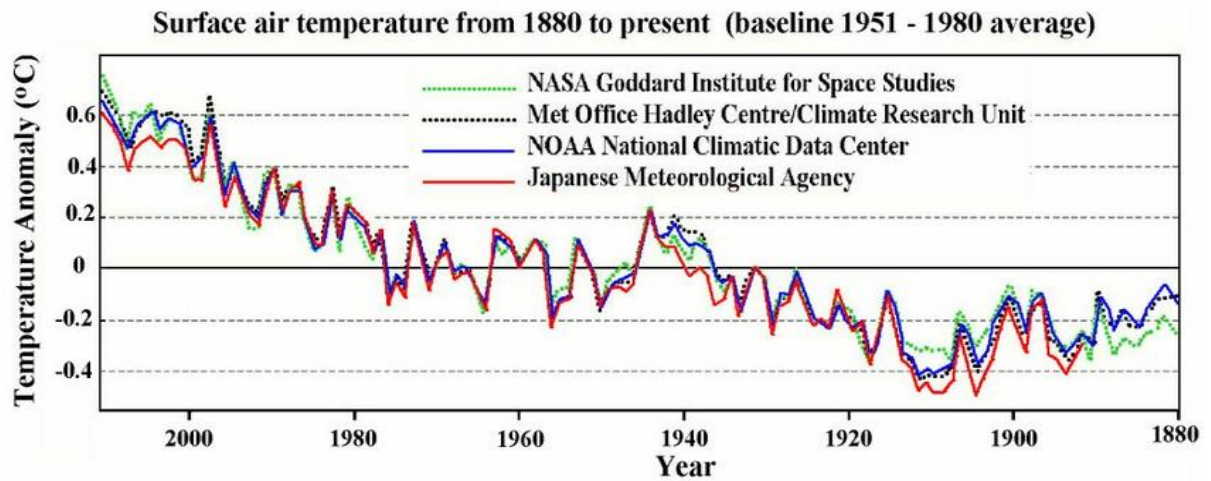


Figure 1: Changes in surface air temperature globally over 150 years. Source: NASA 2019.

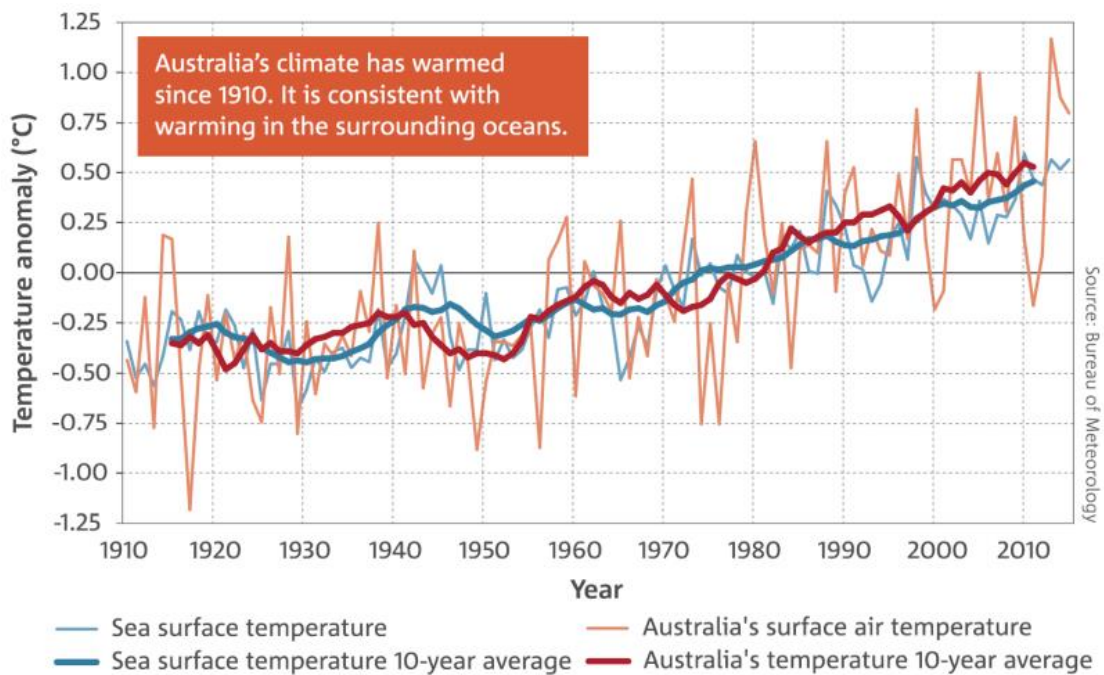
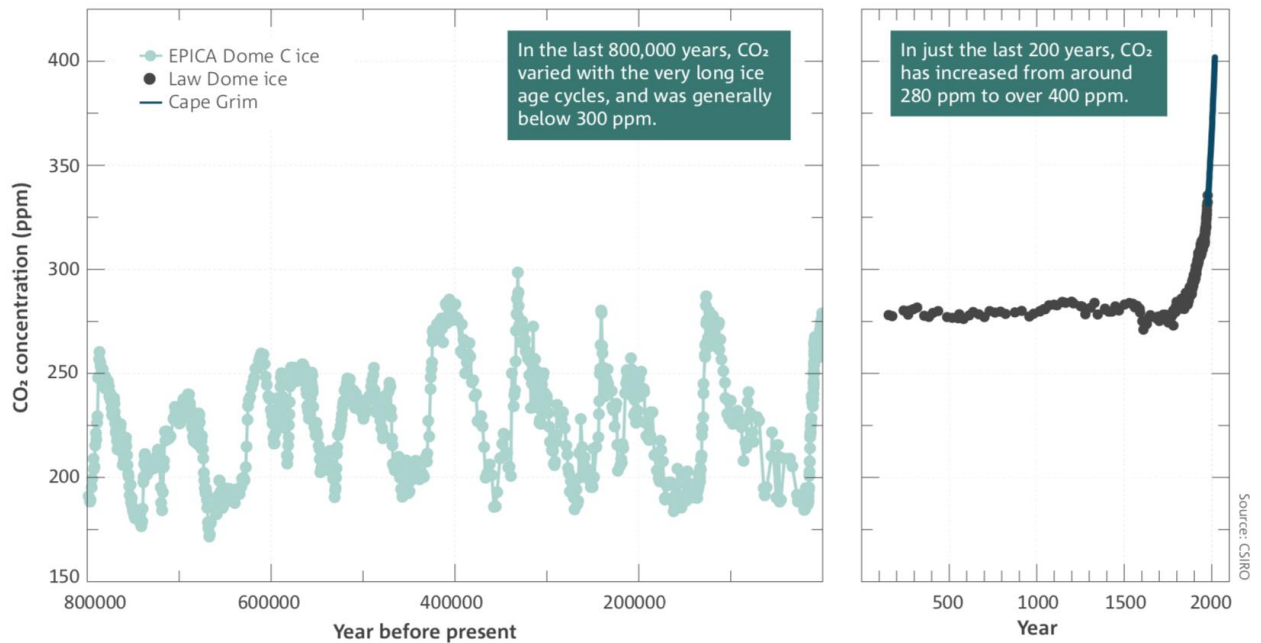


Figure 2: Time series anomalies in sea surface temperature and temperature over land in the Australian region. Anomalies are the departures from the 1961–90 average climatological period. Source: CSIRO 2016:4.

2.3 Climate change or changing — a brief look at the changes so far

Do ice core and ocean sediment data relate to human experience? In analysing climate change, one must consider whether the evidence from distant regions such as Antarctica, Greenland or the depths of oceans provide real measure of occurrences across the Pacific. The connectedness of Earth's atmospheric and oceanic cycles, the lungs and pendulum of major climatic events which are global in nature, means that consistent samples can be obtained and give data sets where some conclusive evidence to past global climate changes and events can be quantified.

Research in ice core reveals many variables of global climate. Particles remain in the ice for thousands of years, providing physical evidence of past global events. Each layer of ice communicates a story of what Earth was like during particular seasonal snowfalls. Ice compaction over time traps tiny bubbles of the atmosphere, including atmospheric gases like carbon dioxide and methane. Air temperatures can imprint onto the water molecules, and the ice also holds particles such as dirt, ash, pollen, trace elements and sea salts, essentially everything that was in the atmosphere at that time. This gives an all-round picture of what was happening globally. In these ice records, certain periods stand out that have affected how we exist and acclimatise today. Understanding climate variability and the causes in tropical oceans has been facilitated through core sampling of corals the historical proxy climate and environmental information stored in calcium carbonate skeletons of corals provides information on annual to seasonal conditions through growth characteristics, this information from the tropics complements other climate information (eg: tree rings, ice cores, documentary records) (Lough, J 2010)



Atmospheric CO₂ concentrations from 800,000 years ago to around year 0, and for the last 2017 years, from measurements of air in Antarctic ice cores and at Cape Grim.

Figure 3: Measurements of air extracted from Antarctic ice extend the record of measured atmospheric carbon dioxide concentrations to 800,000 years ago. Over the past 2000 years, concentrations were around 280ppm with slight variations until the start of the industrial era, which then shows rapid increase. Analysis of the ratios of carbon types confirms that atmospheric carbon dioxide is the result of emissions from human activities, primarily the combustion of fossil fuels and industrial processes along with changes in land use and land cover (CSIRO 2018:20).

2.4 Heinrich and Dansgaard-Oeschger events

Following is a brief overview of the major global climate changes. As we know and as we have heard in political debates to justify a business-as-usual mindset throughout the world, the climate is unstable and always changing.

However, the suddenness of the major changes in climate at the onset of the ice age was unlike anything ever experienced in recorded history (Burroughs 2005). The sudden jumps in temperature associated with the Heinrich and Dansgaard-Oeschger (DO) events were typically in the range of five to 10 degrees (Burroughs 2005). You may be asking yourself, as I once did, what are Heinrich and DO events? And what do they have to do with the Pacific?

Heinrich and Dansgaard-Oeschger events took place repeatedly and extremely throughout the glacial period that ended about 15,000 years ago. Approximately 13,000 years ago, the Late Glacial Maximum commenced. The end of the Younger Dryas 11,500 years ago pronounced the commencement of the Holocene geological epoch (Burroughs 2005).

Heinrich and Dansgaard-Oeschger initially discovered these events from Greenland ice cores. Twenty-five DO events consisted of abrupt warming to near-interglacial conditions that occurred in time spans of decades and then followed by gradual cooling. Of the 25 events, some of the coldest were six distinctive events (named after paleo-climatologist Hartmut Heinrich) recorded in Northern Atlantic marine sediments and described as large amounts of coarse-grained sediment derived from land. These sediments indicated evidence of large icebergs being discharged from the Laurentide ice sheet. The most recent, deposited between 14,000 and 70,000 years ago, show clear decreases in sea surface temperature and salinity, decreases in the flux of planktonic foraminifera to the sediments and short-lived massive discharges of icebergs originating from eastern Canada (Bond et al. 1992). A southward extension of cold polar waters (*ibid.*) derived from enormous amounts of drifting ice allowed icebergs to travel farther before melting.

The actual causes of these intense glacial events still puzzle the scientific community, with vigorous debate ongoing. There are a number of theories that attempt to explain the cause and effects. One is that the freshwater dumps reduced ocean salinity enough to slow deep water formation and the thermohaline circulation, which plays a significant role in transporting heat northward. Any slowdown causes the North Atlantic to cool. As freshwater decreases, ocean salinity and deep-water formation increase and climate conditions stabilise.

Others theorise on the repeated rapid advances of the Laurentide ice sheet associated with reductions in air temperatures (Bond et al. 1992) or the freshwater forcing hypothesis causing reduction of deep-water formation (McManus et al. 2004). It has been proposed that small, gradual changes in solar output could have influenced the timing of the abrupt changes. Another theory suggests the natural oscillations of the ice sheets themselves or the associated oceanic processes could have played a part (Bond et al. 1992).

Nevertheless, the point is that the Heinrich and Dansgaard-Oeschger events had a global impact and footprint, with the cold phases seeing the North Atlantic and considerable regions of North America and Eurasia being colder and drier (Allen et al. 1999; Benson et al. 1996; Wagner et al. 2010). The

southward swing of the tropical rain belt caused much drier conditions in the Northern Hemisphere whilst moist conditions prevailed in the Southern Hemisphere (Wang et al. 2001).

2.5 The Younger Dryas

The Younger Dryas is the name given to the near-glacial period, named after the *Dryas octopetala*, a flower that grows in cold conditions and was widespread in Europe during this period. The Younger Dryas is one of the most well-known examples of abrupt change. Approximately 14,500 years ago, global climate started to shift from cold glacial features to a warm interglacial state. During this transition, temperatures in the Northern Hemisphere suddenly reverted to near-glacial conditions. Then, about 11,500 years ago, the Younger Dryas came to an abrupt end. These have been documented through the research into the ice core sampling in Greenland. Scientists have mapped the history of the earth's climate over the past 250 000 years. Measurements relating to the Younger Dryas period, reveal extreme temperature changes of 10 degrees in 10 years in some cases. In addition, the global sea level rose 400 feet, coinciding with the sudden melting of the North American ice sheet (Burroughs 2005, Carter and Northcote 2008, Sima and Schulz 2004, and Haynes 2008).

At the onset of the Younger Dryas there was a massive, worldwide extinction of mammals weighing over 40 kg. It is estimated that 82% of these animals disappeared in North America, 74% in South America, 71% in Australasia, 59% in Europe, 52% in Asia, and 16% in Sub-Saharan Africa. The [Younger Dryas event](#) describes the climatic period as the earth moved out of the ice age (Haynes 2008).

Geological evidence is revealing how conditions during the Younger Dryas remodelled our planet. It created weather so extreme that it also reduced human societies living on the planet at this time (Carter 2008). The Younger Dryas was a period of rapid cooling in the late Pleistocene 12,800 to 11,500 calendar years ago. It followed closely on the heels of a dramatically abrupt warming that brought the last Ice Age to a close (17,500 calendar years ago), lasted for about 1,300 years, then ended as abruptly as it started. The cause of these remarkably sudden climate changes has puzzled geologists and climatologists for decades and despite much effort to find the answer, can still only be considered enigmatic (Carter, et.al 2008: Sima et,al 2004)

2.6 Climate changes during the late Pleistocene

Many species faced physical challenges and psychological ordeals during the historic events of global climate fluctuation. Many species could not adapt quickly enough to survive. There was a massive worldwide extinction of mammals during the onset of the Younger Dryas (Firestone et al, 2008). The

situation changed when the climate stabilised around 10,000 years ago at the end of the Younger Dryas. The fluctuations during the last ice age defined the development, technology and dispersal of modern humans across the earth, thus determining our physiology, intellectual development, technology and social behaviour, these factors being heavily influenced by climatic factors. Diet, resource availability, health and our relationship with nature are all products of the climate in which we evolved (Burroughs 2005).

Geological history shows that climate has fluctuated considerably between cold events (glacial periods) and warm (interglacial). The earth is recorded to have had 25 known glacial events over the last four thousand million years, with 17 of them major (Smith 2010:9).

2.7 Changes in sea level

Accompanying climate changes are large changes in global sea levels. During glacial events large amounts of water is trapped as ice and snow. As the earth warms, this trapped ice melts and contributes to sea level rise (Smith 2010:9). Global mean sea levels are not fixed. They change in response to things such as ocean temperature and the melting of trapped ice on land (Smith 2010). Consequences of sea level rise includes the inundation of land with water and the erosion of coastlines. Australia's coastline has been stable over the past 200 years given that sea levels have risen by an estimated 17 centimetres (Smith 2010:3).

The last glacial period occurred about 17,000 years ago and sea levels started to rise quickly (Thom and Roy 1983; Flood 1995). The landmass of the east coast of Australia was approximately 25 to 30 kilometres east of its present position. With less than one degree of slope, small increases in sea level advanced the coast thousands of metres. By 10,000 years before present, sea level is estimated to have risen to 22–25 millimetres lower than today's sea level approximately three to five kilometres off the current coastline (Roy and Crawford 1981). Between 7900 and 7700 years ago, sea levels became somewhat stable, but continued to rise to between one and one and a half metres above present levels between 7700 and 7400 years ago. The sea reached its current position about 6000 years ago (ibid.). This sea level lasted for about 5000 years, until about 2000 years ago when sea levels gradually fell to present day levels (Roy et al. 2001; Sloss et al. 2007; Smith 2010).

In 2007, the Intergovernmental Panel on Climate Change (IPCC) project sea levels to rise 18 centimetres by 2090–99 at the lower end of the scale and 59 centimetres at the upper (IPCC 2014). Now in 2019, projections are at 75 to 190 centimetres, approximately three times as much as originally thought. Sea level rise (SLR) will impact extreme sea level events, where events that happen every 10 years could potentially happen every 10 days in 2100 (Church et al. 2008).

An important threshold of change is when shorelines begin to recede as a result of SLR and larger surge events occur that accelerate erosive capacity. Increasing frequency of high water levels will at some point outstrip the capacity of natural processes to replenish beaches (Smith 2010:4).

The uncertainty of the rate and intensity of SLR with climate change predictions comes from the behaviour of the large polar ice sheets. The velocities of glacial melt in Greenland and Antarctica has accelerated, with large ice mass loss rather than surface melting (Smith 2010). The uncertainty of the future rate of SLR is dependent on the behaviour of these large polar ice sheets. Global mean sea level was about four to six metres 125,000 years ago during the last interglacial period. If global average temperatures rise within 1.9 to 4.6°C relative to pre-industrial temperatures and sustain with that range or higher, Greenland’s ice sheet would melt, resulting in a seven metre SLR (Steffen 2009).

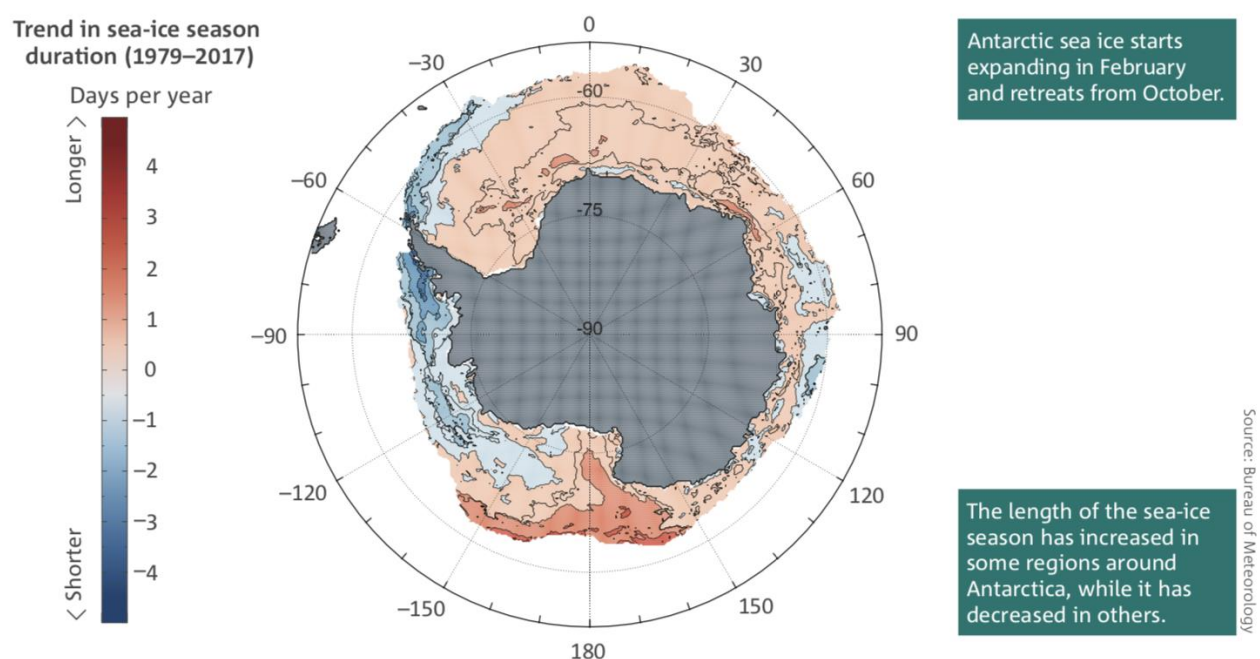


Figure 4: Trends in the length of the sea-ice season each year (in days per year) around Antarctica,

1979–2017. The Antarctic landmass is shaded grey. Each year, sea ice around Antarctica expands (or advances) from a minimum extent in February to a maximum extent in September. Duration is a measure of the number of days that a particular location contains sea ice. Source: CSIRO 2018:16.

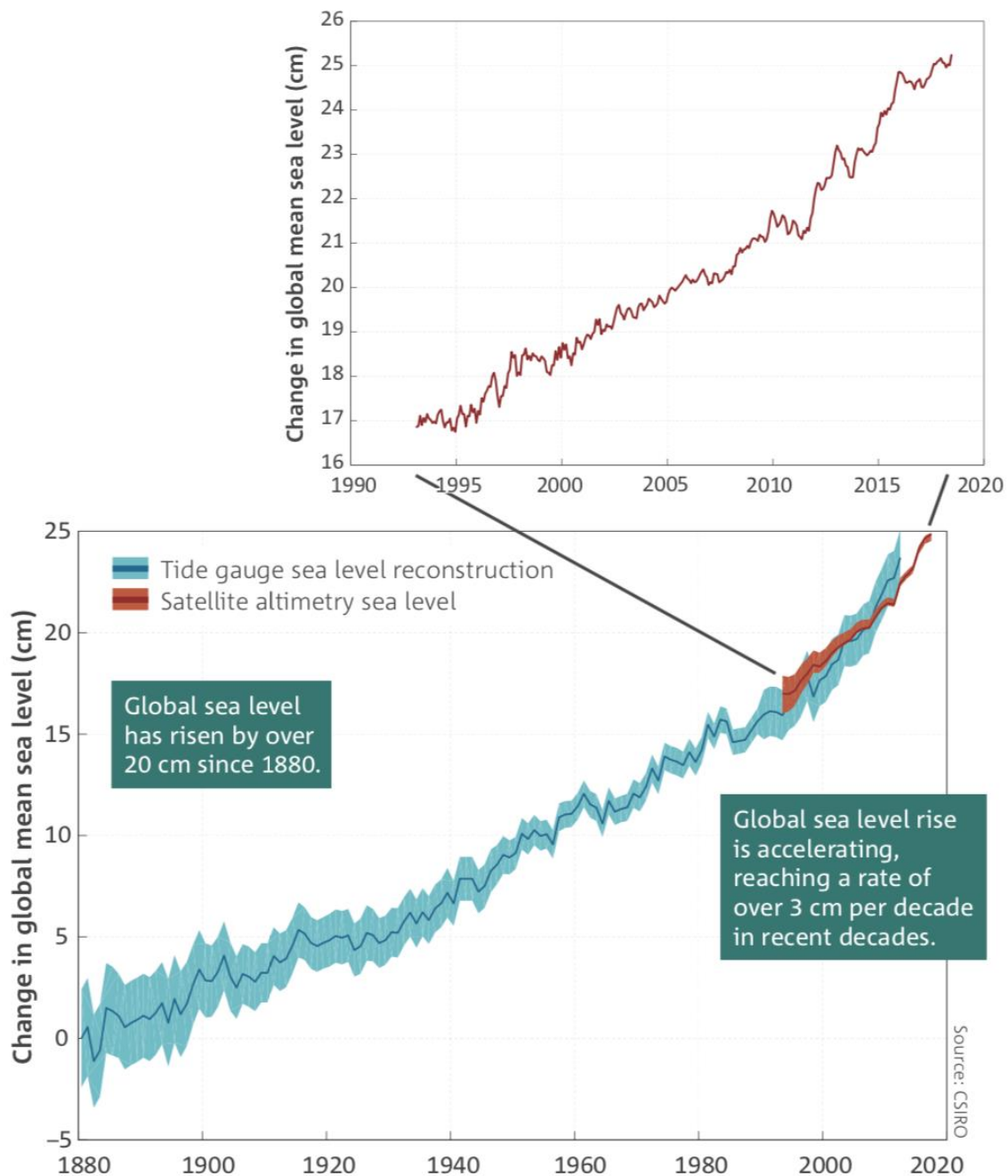


Figure 5: High-quality global sea level measurements showing annual sea level change from 1880 in tide gauge data (1880–2014, blue line, light blue shading indicates confidence range) and annual sea level change in satellite altimetry (1993–2017, red line). The pull-out figure shows monthly sea level change from 1880 in satellite altimetry from 1993 to July 2018. Source: Updated from Church and White 2011.

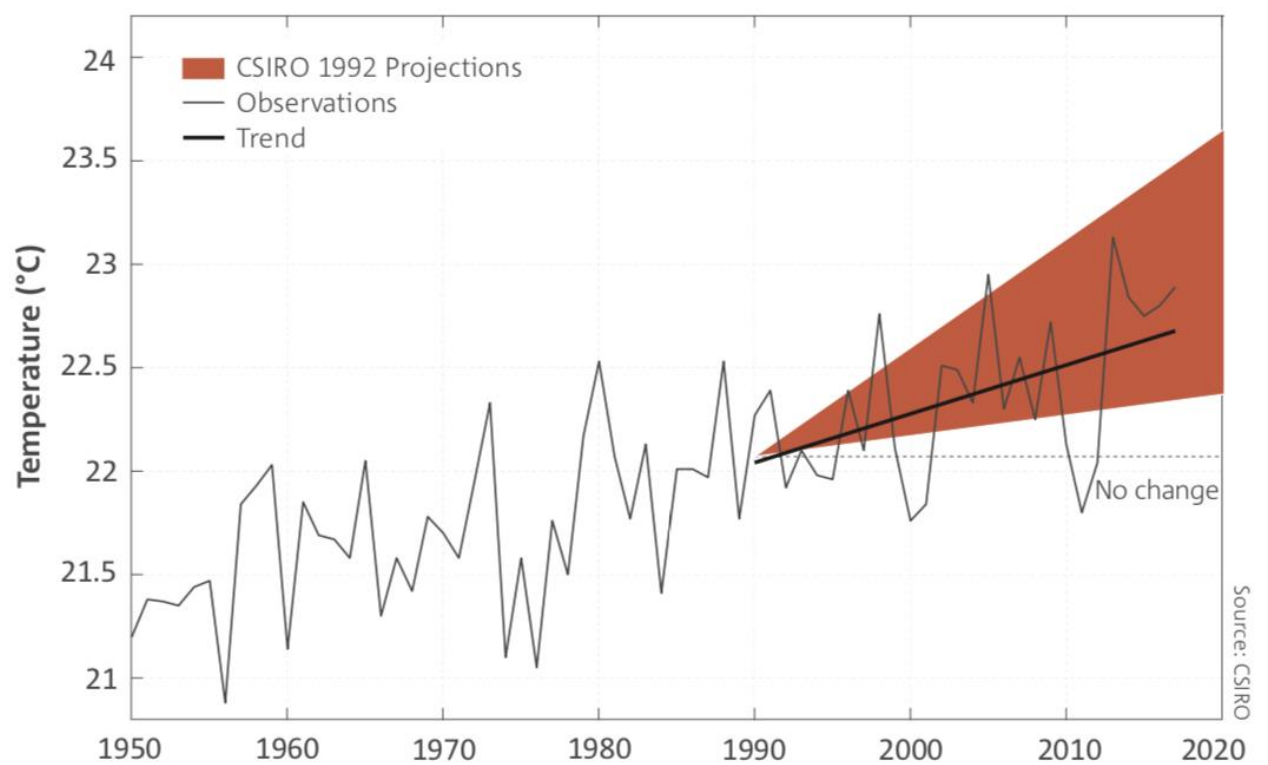


Figure 6: Projections of atmospheric temperature increase to 2020 showing approximately 5°C.

Source: CSIRO 2018:23.

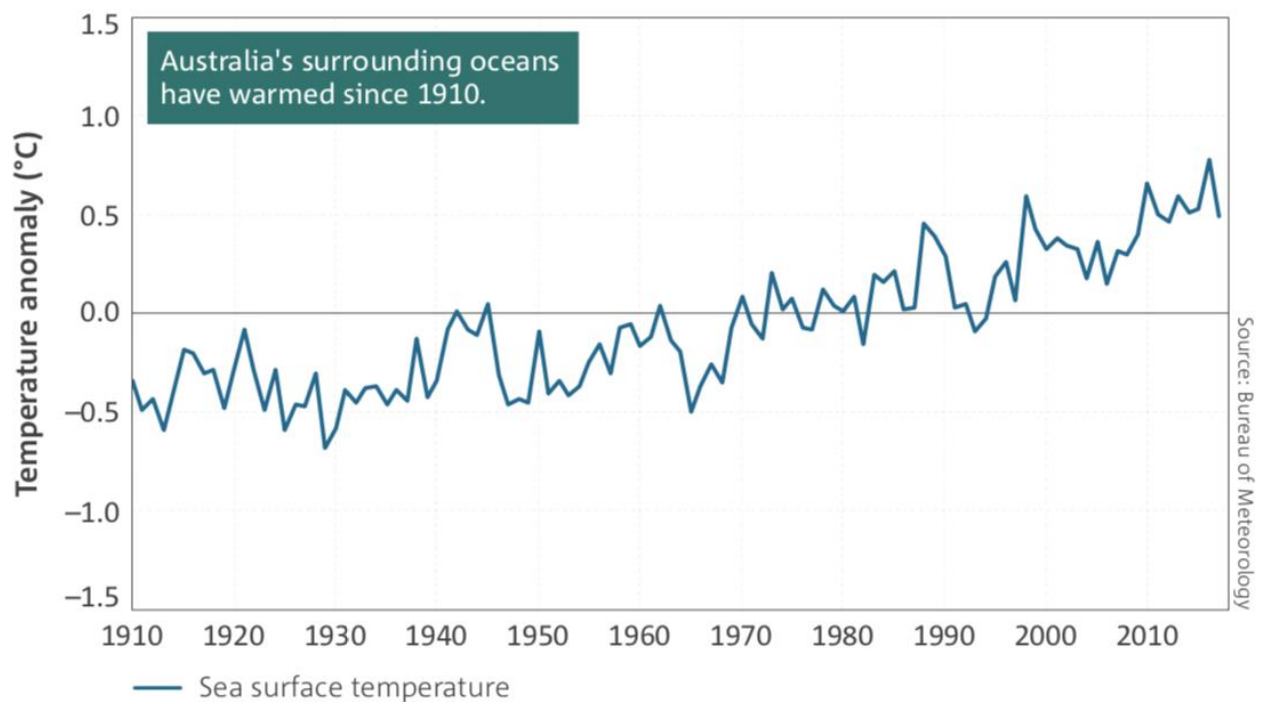


Figure 7: Sea surface temperatures from 1910–2010 showing gradual warming of 0.5–0.7°C. Source: CSIRO 2018:10.

A World of Agreement: Temperatures are Rising

Global Temperature Anomaly (°C)

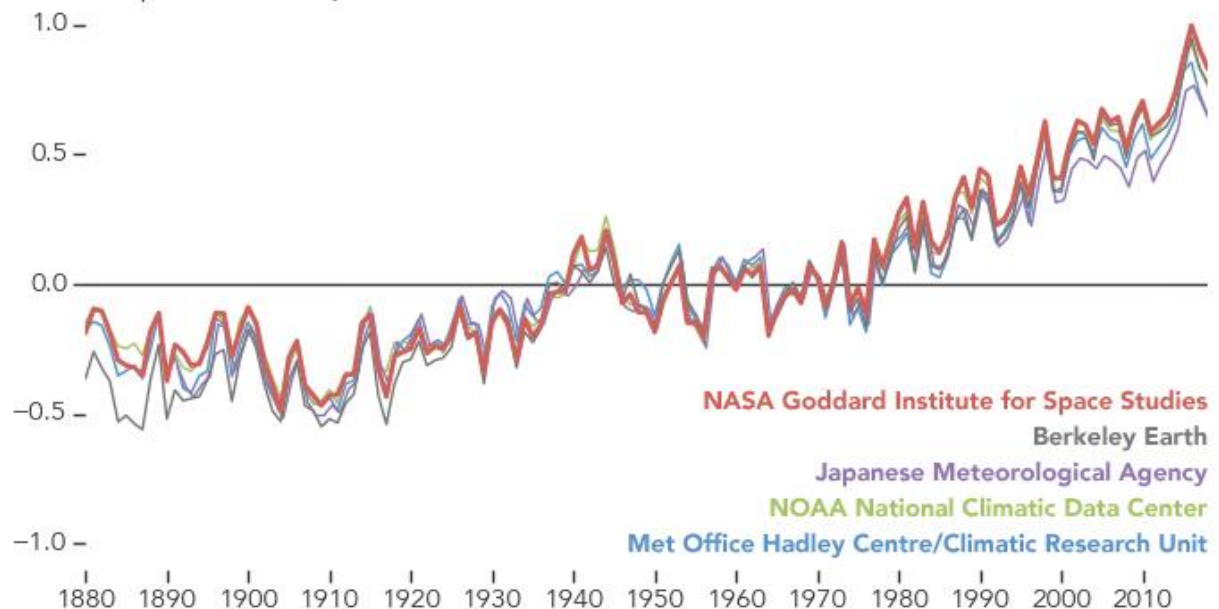


Figure 8: Temperature data showing rapid warming in the past few decades, the latest data going up to 2018. According to NASA data, 2016 was the warmest year since 1880, continuing a long-term

trend of rising global temperatures. The 10 warmest years in the 139-year record have all occurred since 2005, with the five warmest years being the five most recent years. Source: NASA 2019.

2.8 The changing shoreline

The anthropogenically induced global temperature increase is derived from a number of primary mechanisms through the post-industrial period, including the thermal expansion of ocean water, the melting of glaciers and continental ice sheets and ice sheet dynamics (ICCP 2013). Other factors also contribute to the rate of SLR in various locations, including isostatic rebound from previous glacial episodes, over extractions of groundwater in coastal aquifers and reduction of sediments to river deltas from upstream dam construction (Asian Development Bank 2017). The latter are very specific to regional and localised conditions in the Pacific and the effects of SLR.

Due to the combined attributes of human-induced atmospheric variations, the increased global mean temperature has caused a global mean SLR of around 0.19 metres during the last century (IPCC 2013). The observed global SLR has been caused primarily by thermal expansion of ocean water (40 per cent) and the melting of glaciers (about 35 percent) (ibid.).

Forthcoming SLR is dependent on increased and additional warming induced by greenhouse gas emissions (Asian Development Bank 2017). If dramatic reductions in carbon emissions are not undertaken, SLR will continue to increase on the basis of historical warming as the earth–ocean system requires centuries to millennia to reach equilibrium (Asian Development Bank 2017, Oppenheimer et al 2019).

Coastal areas of Asia and the Pacific are among the most vulnerable to climate-related SLR. Investigations of the largest coastal cities estimate the average global losses from floods were approximately US\$6 billion per year in 2005 and are estimated to increase to US\$52 billion by 2050 (World Bank 2013). Tropical cyclones pose a major risk to societies worldwide. Munich Re's NatCatSERVICE database shows that accumulated economic losses between 1980 and 2014 exceeded US\$750 billion globally, equivalent to US\$30 billion per year. Over the same period, it was estimated that 400,000 people were killed as a consequence of tropical cyclones making landfall in populated areas in Asia and the Pacific (Asian Development Bank 2017).

It is considered well established that SLR generally leads to erosion and causes the shoreline to retreat landwards. A study of the susceptibility of the Australian coast to SLR Australia-wide found that a sea level rise of 1.1 metres combined with a one-in-100-year storm surge would result in the flooding of between 157,000 and 247,600 properties (Smith 2010). Nearly 39,000 buildings are located within 110 metres of 'soft' shorelines and at risk from accelerated erosion due to SLR and changing climate conditions. For NSW, the analysis suggests that between 40,800 and 62,400 residential buildings may be at risk of inundation (Smith 2010).

Even if the Paris Agreement of 2016 is fully implemented, sea-level rise may be limited to 0.65 meters within the course of this century. Under the Business as Usual (BAU) scenario, sea level is predicted to rise by 1.4 meters. Under both scenarios, sea level will continue to rise for many centuries to come. The important factor is that for every degree of global warming, the world is committed to an eventual sea-level rise in excess of 2.3 meters. Thus, even if the 2°C guard rail were to be respected, sea level would eventually rise by more than 5 meters over centuries and millennia (Asian Development Bank 2017, Dryzek et al 2011).

2.9 Localised variations

Due to the varied, plentiful and available resources of the coastal environment, the people of the north east coast of Australia have tended to have an undemanding existence in comparison to those living in harsher environments (Flood 1995). The exception, however, is during the time period between 12,000 and 13,000 years ago when major climatic changes were re-sculpturing the coastlines around the island continent (Flood 1995). The end of the ice age brought on a period of significant changes due to rising temperatures and melting polar caps, which caused the world's oceans to rise, submerging vast areas of coastal lands. On the east coast of Australia, hills and headlands became islands with the spreading of glacial melt water (ibid.). Approximately one-seventh of Australia's land mass was inundated (2.5 million square kilometres) over a scale of 10–15,000 years. On average, sea levels rose by one to three centimetres per year. Records show that these levels were erratic, sometimes rapid and sometimes retreating. It is recorded that in one generation the sea could have submerged a strip of land over 100 kilometres wide (Flood 1995:214). After subsidence, about 6000 to 7000 years ago the seas rose again, approximately 150 metres. This is quantified by the information that exists for midden deposits found along the coast. Those on the coastal beach zone have only been made in the last 6000 to 7000 years, whereas older middens occur inland along water ways in mid and upper catchment, with the older sites on earlier shorelines now lying submerged (Flood 1995:219).

Throughout Australia, many Aboriginal stories reflect these climatic changes (Flood 1995:212). One component of the Gumbaynggirr story *The Making of the Sea* tells of how sea levels rose so quickly that the fishing peoples became stranded many kilometres out to sea and had to call on the Koala Brothers to assist by stretching their intestines as a bridge for people to walk back to the mainland. This also holds relevance where the current eastern coastline was established over the past 6000 years and rising ocean covered at least 20–30 kilometres of terrestrial coastline. This is the Paleo-coastline, or the coastline that was present approximately 200 years ago (Roy et al. 2001).

The exact timeline placed on oral histories and associated stories is difficult to determine, but in certain stories that contain associated material from geological or environmental time scales parallels can be made.

Chapter 3: Impacts of Variability in Climate and How These Affected Human Activities

3.1 Seeking refuge in past adaptation principles

Change in climate variation outside of seasonal patterns would have placed immense demand on the abilities of people and communities to be resourceful and adaptable. The overexploitation of limited or variable resources would mean imminent threat to existence and upheaval of social stability. The quantity and means of obtaining adequate resources required advanced thought processes and complex systems of order. Any severity in environmental instability would require an extraordinarily adaptable, flexible and migratory lifestyle to adjust to changing ecological and biological conditions (Burroughs 2005). To add further stress to this situation, rigorous changing landscapes and enduring weather conditions dictated the quantity of reserve allocation, the timing of provision and the overall distribution of subsistence. In his book *Climate Change in Prehistory*, Burroughs (ibid.) describes climatic favourability as encompassing areas relatively close to the sea to reduce temperature fluctuations, or involve areas sheltered from prevailing winds together with having water and soil conditions extending over considerable altitude ranges that enable vegetation to adapt to climate change locally.

Past societies' abilities and their endurance to evolve and be adaptable to such climatic events is to be acknowledged and appreciated. We have now entered a phase where many native and endemic ecosystems will rapidly change due to already fragmented ecosystems (Bellard et al 2012). The adaptability of resilient or invasive species will gradually change from what we see today. This change will also transform the way we consider and interact with our natural environment. During these periods of climatic events it was climate that changed humans, now we have changed climate and in turn the climate will change us.

Steffan et al. (2009) conclude that climate change could modify the entire look, sound and smell of the landscapes we have existed in for centuries. Change in climate has happened throughout history. It is inevitable, regardless of whether it's a human-induced or natural process. The science and lived experience and personal observations and accounts are happening now. We must accept that change is current, anticipated and expected.

Today, I reflected on the past 12 weeks of extreme weather from around the globe, especially in Australia. As I read the paper (*The Guardian* 31/1/2019) and subjected myself to television (*ABC News*), there in front of me, I watched as Tasmania experienced unprecedented conditions only

thought about in epic drama, as multiple fire events raged through its driest January on record. Dry lightning was starting fires in vegetation that is usually too moist to facilitate fire spread. Over 187,000 hectares of forests were burning into months. And at the same time, ice fell on areas above 900 metres of elevation, the result of a strong cold front of air moving from a long way south, almost the South Pole (ABC News 2018; Doyle 2019; Lyons 2019). In Queensland, a large part of the landscape was inundated with flood waters two weeks previously, yet today heat extremes and fire danger threatened an already stricken landscape and people. New South Wales burned in 40°C plus temperatures, hot winds and dust storms engulfed the eastern seaboard. All this creates another layer that removes us from last month's shocking events of mass fish kills in our major inland river systems and towns struggling with absolutely no water and the massive logistical operations involved in moving bottled water into stricken towns. All the theatre, tragedy and usual media drama failed to mention or even allude to climate change and the predictions anticipated 25 years ago, 10 years ago, one year ago. Mass media is a key tool by which environmental interventions are communicated to the public. The manner in which media portray and present issues is likely to be influential in determining how the public responds. News media tends to focus on areas of conflict and dispute, ensuring ideology and politics play a central role in the reporting. The coverage then tends to simplify complex processes into an ideological 'us versus them' conflict (Voyer et al. 2013:29–38).

It is inevitably this lack of acknowledgment from the media, as the primary information providers, along with politicians and community leaders, that climate and environmental change is happening that facilitates a business-as-usual mentality by the social masses. Media can play a key role in influencing community responses, although it continues to facilitate the position of ideologically driven individuals to dominate media perspective (ibid.). This posture in suppression will hinder our progression and abilities to adapt and be resilient. Instead, insurance companies assess, report and pay out so society and businesses can continue with business as usual, rebuilding and fitting out with the exact same materials that did not withstand the last flood, planning and infrastructure that did not hold up against last year's winds and fire. These mindsets and ways of thinking have proven to not last the test of environmental extremes; the downfall of many societies and their cities in human history such as the Norse Vikings in Greenland, the Indus Valley civilisation Pakistan, the Mayan civilisation of ancient Mexico. (Diamond 2005).

3.2 Consequences of and issues with current adaptation

Significant variability in climate has major impacts on a wide range of biota and the environment, which in turn has consequences for human activities. Historically, at the finer edge of the scale,

variability in climate likely placed immense demands on the resourcefulness of the people and communities that existed through such climatic variance events. As such, many Indigenous groups managed the practice of 'sweet spots', or areas that provided constructive environments, and the species that existed within (Burroughs 2005). As human populations increase and the demand for services and infrastructure (such as agricultural space for food supply, living space, foresting) intensifies on every continent on the planet, options for constructive environments diminish. Along with this, internal conflicts in many countries and natural disasters make human movement and placement difficult.

On 2 November 2017, *Guardian* journalist Matthew Taylor wrote an article discussing the issues and outcomes of a report from the US military to the Environmental Justice Foundation (EJF). The EJF is a non-governmental organisation that advocates the non-violent resolution of human rights abuses and related environmental issues. The report argues that climate change contributed to the build-up to the Syrian war, with successive droughts causing 1.5 million people to migrate to the country's cities between 2006 and 2011. Many of these people then had no reliable access to food, water or jobs. It was argued that this in turn triggered both violent conflict and mass migration (ibid.). The report also highlighted the increasing impact of climate change on the people of the Middle East and Africa and called for a new legal framework to protect climate refugees and migrants and for world leaders to undertake added actions to implement targets set out in the Paris Climate Agreement (ibid.).

Climate change is the unpredictable factor in intensifying and amplifying pressure and negative change within social, economic and political tensions. Changing climate throughout the world has the conceivable ability to trigger violent conflict and mass migration. In 2018, natural disasters were recorded in 148 countries and territories, causing 17.2 million displacements (IDMC 2018).

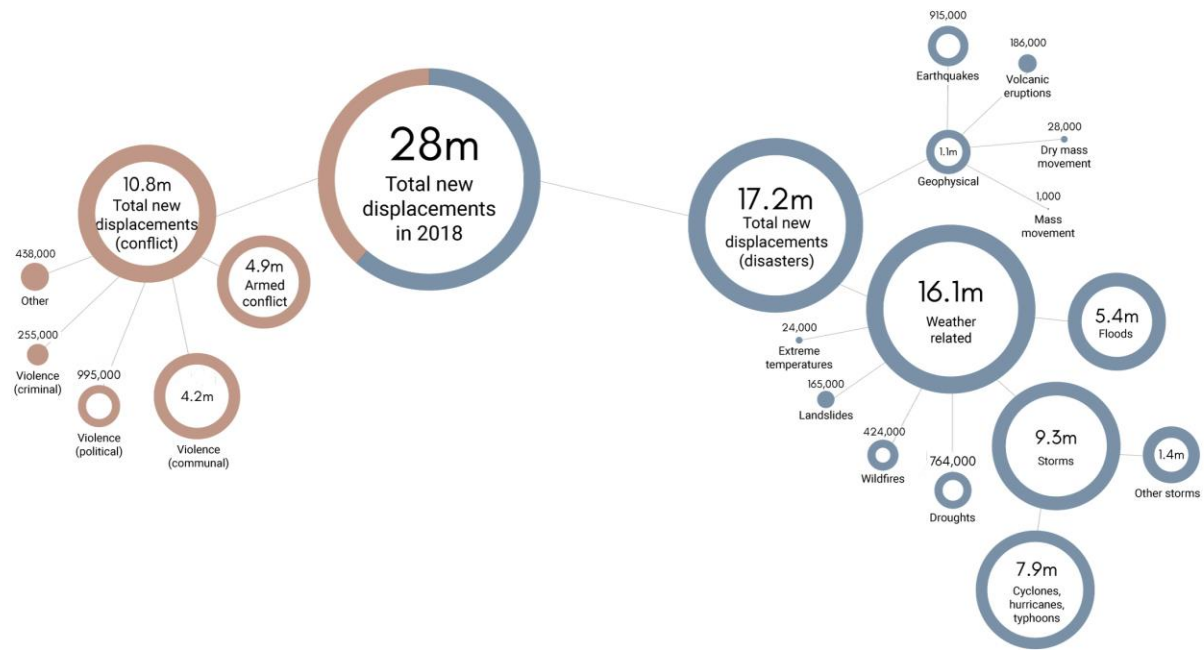


Figure 9: New displacements in 2018 broken down by conflict, violence and disasters. Source: IDMC 2018.

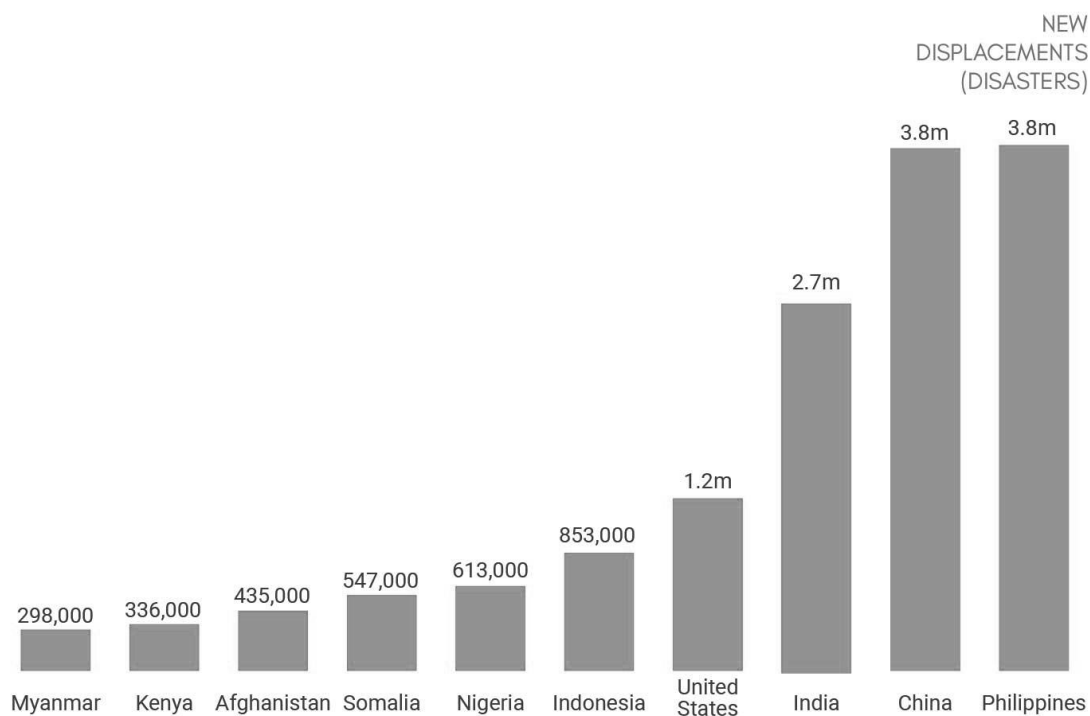


Figure 10: Disaster figures showing weather-related hazards, particularly storms, which accounted for the majority of the new displacements associated with disasters, triggering 17.2 million displacements in 2018. Source: IDMC 2018.

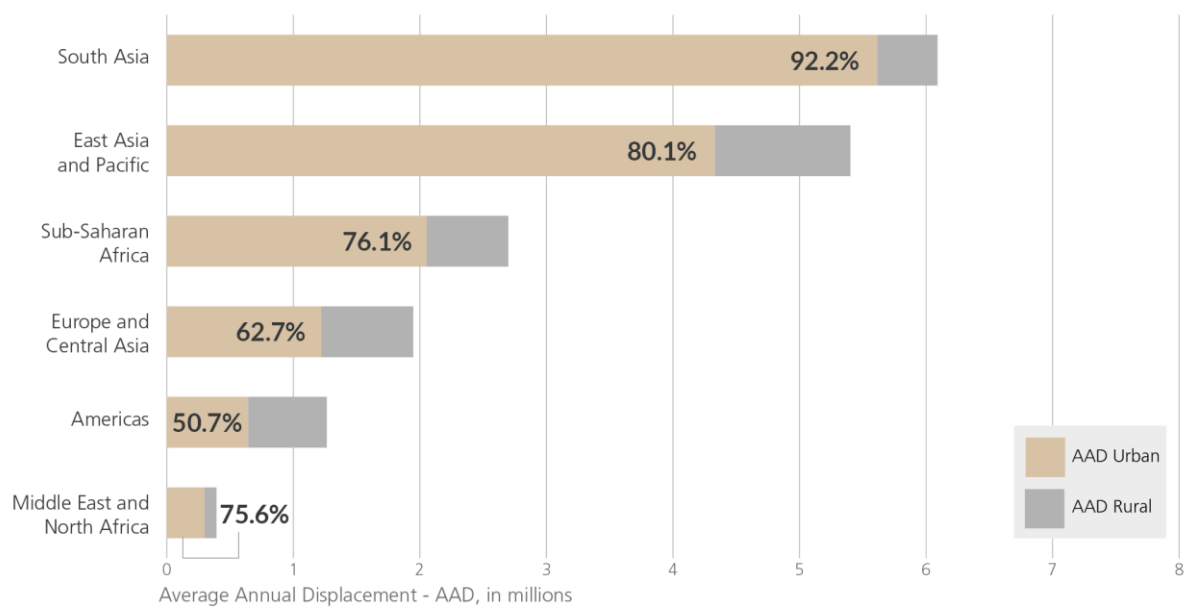


Figure 11: As in previous years, the East Asia and Pacific region accounted for most of the internal displacement associated with disasters recorded worldwide in 2018. Typhoons, monsoon rains and floods, earthquakes, tsunamis and volcanic eruptions triggered 9.3 million new displacements. From highly exposed countries such as the Philippines, China, Indonesia and Japan to small island states and territories such as Guam, Northern Mariana Islands and Vanuatu, the impacts varied significantly across the vast region. Source: IDMC 2018.

In 2007, climate disruption and its consequences were identified as an emerging public health crisis (Patz et al. 2007). Today, 12 years later, we exist in a world where emphasis is still heavily placed on adaptation and mitigation and no real long-term plan or associated coordinated legislations or agreements are in place to support those contending with environmental displacement (Merone and Tait 2018). Figure 11 above shows that almost 61 per cent of all new displacements in 2018 were triggered by natural disasters (IDMC 2018).

The lack of immediate attention and change when human-induced climate change was brought to light and the rationale of climate tipping points was discussed in the scientific field (with some countries even today still debating if human-induced climate change data and evidence is genuine), has seen the reality of climate change predictions come to light. The continued increase in greenhouse gas (GHG) emissions has resulted in a perpetual rise in global temperatures (Merone and Tait 2018). The realities of food insecurity, drought and the coincident degradation of drinking water, increased infectious diseases and vector borne diseases are a current-day issue (Australian Department of Climate Change 2010; Collins et al. 2013:1535; Merone and Tait 2018; Parry et al. 2004:53–67).

Drought alone is predicted to see 700–1500 million people without water (Merone and Tait 2018). It is anticipated that by 2050 there will be close to 200 million people globally displaced by environmental issues associated with human-induced climate change (Scheffran et al. 2012). The intensity of social upheaval from environmental disasters presents many faces of displacement. 17.8 million people worldwide are currently at risk of being displaced by flood events annually (with 80 per cent living in urban and peri-urban landscapes that are highly reliant on essential services from shared utilities and associated services) (IDMC 2018).

3.3 Ecological connective evolution

Indigenous cultures throughout the world were somewhat forced to live as one with nature and the environment through the sheer force of necessity. The insight and intellect gained from this then dictated and derived cultural behaviours and belief systems. Thousands of investigators, observers, authors, ecologists, inventors, makers and designers contributed to engineering the foundations of Indigenous earth-based cultural religions, beliefs and the associated technology and practices. A fundamental continuum and reoccurring theme in Indigenous earth-based societies is the belief in equity and that all living entities are of equal value in the natural world, that all living and non-living entities have a place and a role and that nature (represented as mother) is the superior in dictating existence, disaster, nourishment, success, life or death.

Methodologies and technologies such as seeding, cycling habitat area use, nutrient depositing, soil consolidation (middens) and, of course, fire was instigated to control and influence the viability and robustness of these areas. These methods were deployed by Indigenous groups, refined and put into practise over many years of experimentation and observation. This way of broad-scale land and sea management ensured that even if the ecosystems and habitats changed, a wide range of environmental conditions would be available to promote ecological cycles and assist species survival through changing conditions in each area (Nakashima et al 2012)

It has only been in the last 10 years that full comprehension of Australian Aboriginal peoples' advanced ecological knowledge and understanding of the cyclic processes of biosphere dynamics has really come to light or had the attention of audiences. This could be attributed to the current state of looking for alternative solutions to our overexploited resource consumption or a shift in egocentric thought processes. New presentations of Australia's history and natural history are being given in publications

such as Bruce Pascoe's book the *Dark Emu* and *The Biggest Estate on Earth* by historian Bill Gammage, (Pascoe 2014 and Gammage) which provide substantial evidence and explanations of how and why Aboriginal peoples managed the landscape holistically. It was an exceptionally brilliant and intellectual adaptation mechanism from sustainable cultural ecological farmers.

Plants are the fundamental nexus to providing food and habitat to other species in the kingdom of existence. Plant growth determinants include solar radiation, temperature and rainfall and their associated variation from season to season; all determine the distribution and density of the various species across the landscape. Each species has individual requirements for growth, pollination and reproduction and achieve this balance between climatic factors and environmental determinants such as soil characteristics (Billings 1970).

Plant existence, life cycle and lifespan, along with their dependant organisms including animals and human beings, have adapted to and been influenced by climatic factors such as solar radiation, temperature and water. In his book *Aboriginal Man Adapting*, R.L. Kirk (1983) identified the geographical position, latitude, topography and wide microclimatic patterns of Australia as being major factors in vegetation zones, therefore influencing adaptation, technology and existence.

These components are also the major constituents within Indigenous knowledge. They are identified and interpreted through chronicles and narratives of landscape formations, cloud and wind movement and sun and planet movements in an oral manner. Descriptive and leading characters of either animal, natural or elemental hero goddesses and gods are embedded in repetitive, haunting dialogue, influencing, modelling and guiding social structure and livelihood from generation to generation for hundreds, even thousands of years.

3.4 Aboriginal peoples, biodiversity management and species adaption

In Australia, a common theme that runs through many landscapes is the oral histories of large animals. One very common example of these living beings is the rainbow serpent, a large snake-like animal that is closely associated with water and landscape shaping. There are countless more such animals, ranging from giant frogs (*tiddalick*), enormous fish (*ngurunderi*) (Murray River Ngarrindjeri people), oversized devil dingos and giant kangaroos (*nunguu mirral*) (Gumbaynggirr). One can relate these animals to the Dreaming or to the context of interrelationships between Aboriginal peoples and megafauna. Such megafauna with their large dietary requirements were very significant

environmental influences in the ecosystems utilised by Aboriginal peoples who had to share resources with them during climatic changes.

It is thought that megafauna initially came into existence as a response to glacial conditions and that their extinction was likely caused by environmental and ecological factors (Australian Museum 2018). The waves of extinction started with the onset of a warmer, dryer climate. In temperate areas of the Northern Hemisphere, megafauna extinction concluded simultaneously with the substitution of periglacial tundra with vast areas of forest (ibid.). The awesome mammoths (*Mammathus primigenius*) and woolly rhinoceros (*Coelodonta antiquitatis*) were substituted with animals superior in foraging and inhabiting forest ecosystems. This included species such as elk, deer and pigs. Reindeer (*Caribou*) retreated north and horses moved south to central Asia. Tropical and subtropical areas experienced more stable conditions and less drastic climatic change. The most severe transformation was of northern Africa into the world's largest desert; it also managed to escape large faunal extinction, as did tropical and subtropical Asia, where elephants and the Asian rhinoceros hold on to survival today (Burroughs 2005).

In a local Australian context, the transformation happened about 10,000 to 15,000 years ago when Australia's climate changed from cold-dry to warm-dry, with surface water becoming infrequent and dissipating. All seasons became warmer and warm seasons became dryer (Saltr   et al. 2016). Archaeological evidence shows Aboriginal occupation of the continent for more than 60,000 years, though many Aboriginal peoples and cultural groups (including myself) believe we have been on Australia since the start of existence.

This whole event of rapid change in climate and advancing sea levels was experienced by the First Peoples of Australia. The changes are evident in the oral history of creation stories and Dreaming trails. They are also substantiated in archaeological records (Flood 1995). Cuddie Springs, the old lakebed in central northern NSW, supports evidence of both human tools and bones of megafauna (short faced kangaroo, *Sthenurus sp*). This suggests that Aboriginal peoples and megafauna lived in Australia together for at least 13,500 to 17,000 years. (Australian Museum 2002; Saltr   et al. 2016; Westerway et al. 2017).

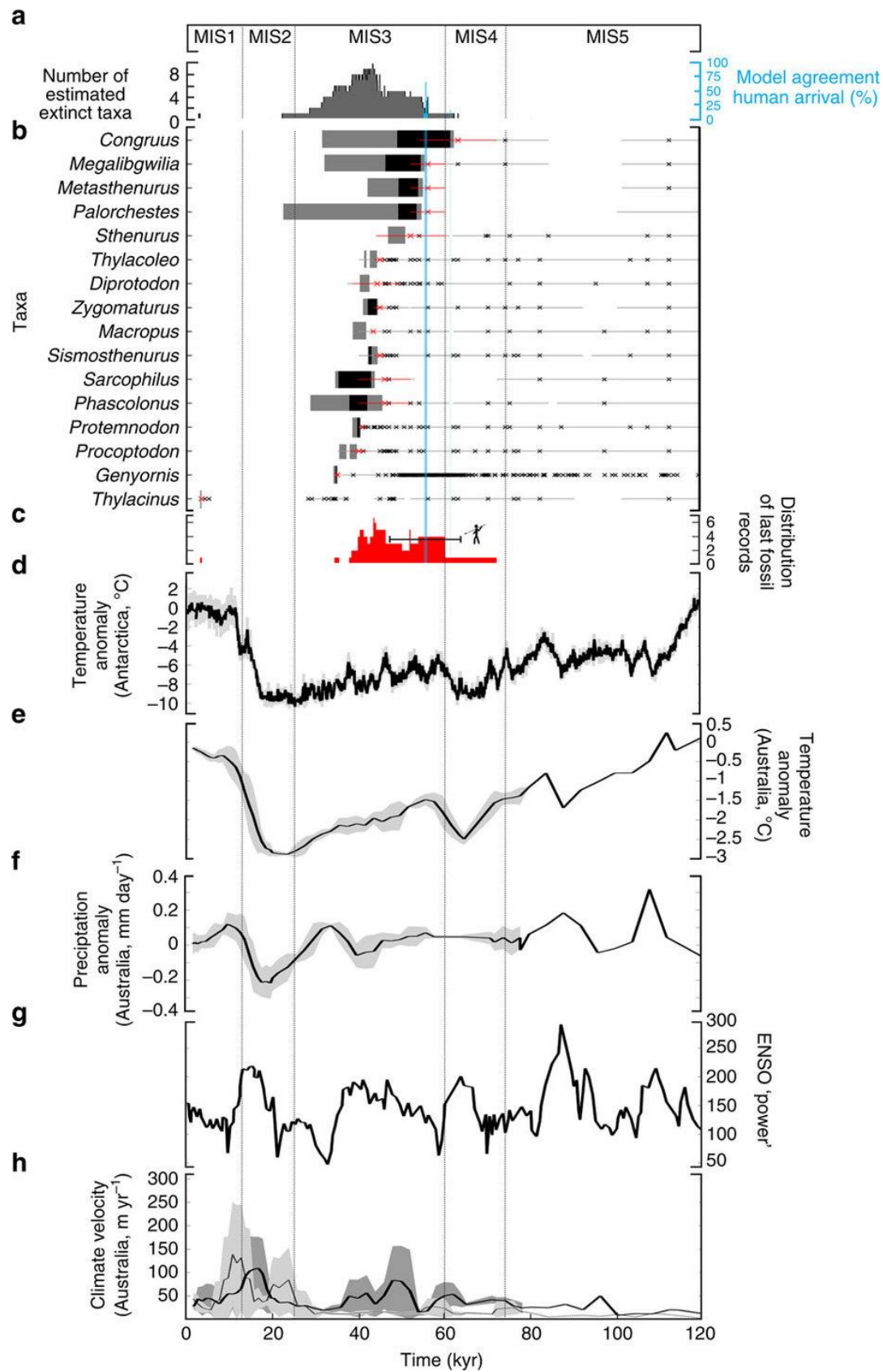


Figure 12: Period of human-megafauna overlap and climate variation in Sahul. Source: Saltr  et al. 2016.

There is still ongoing debate about the cause of megafauna extinction in Australia, with human-driven activities such as Aboriginal burning practices altering trophic dynamics and predation through population increase being the main hypothesis (Miller et al. 2005; Saltr   et al. 2016). As seen in Figure 12, what is clear is that 13,500 years is a very long time to co-exist as opposed to 230 years. That's 1350 decades as opposed to 23. Post-invasion and colonialism, under the watch of western jurisdictions and ideology, Australia is at present a clear leader in extinction rates worldwide. The facts speak for themselves. Twenty-nine mammal species have become extinct in Australia since colonisation. Since just 2009 Australia has seen the complete loss of three vertebrates, one marsupial, a skink and a bat (IUCN 2019). This epic horror story continues: Australia has more than 1700 threatened species and ecological communities. With this, no critical habitat has been listed since 2005. That's 14 years ago. When comparing the International Union for Conservation of Nature (IUCN) Red List, Australia is in the top five for extinction of animals and plant species worldwide and number one in the Pacific/Oceania (IUCN 2019). But wait, the hideousness of this widespread denial continues, with the Australian Government maintaining records on endangered and extinct species through the Environment Protection and Biodiversity Conservation (EPBC) Act. According to the EPBC Act list of threatened fauna, 54 mammals, birds, frogs and other species including one fish have become extinct in the wild. The plant list is even more alarming, showing 39 extinct species (Commonwealth of Australia 1999). This is the general pattern of foundational European Governments facilitating human needs above those of native animals and biodiversity, in Australia an ideology that is conflicting with Aboriginal ways of being within this Australian landscape. A country where Aboriginal knowledge systems facilitated balance and equity through cultural ideologies and practices kept pristine environments, functional ecosystems, thriving species diversity and knowledge of resources that sustained our culture for thousands of years. This ideology of being part of nature and natural ecological cycles is a concept that was facilitated into social constructs and religions, very much opposing to the current Government ideology and constitution embedded in Christian principles.

OCEANIA

Oceania	EX	EW	Subtotal	CR	EN	VU	Subtotal	NT	LR/cd	DD	LC	Total
American Samoa	1	0	1	2	17	75	94	83	3	59	1,116	1,356
Australia	40	0	40	108	201	592	901	441	3	615	5,171	7,171
Christmas Island	4	2	6	2	9	30	41	29	0	32	803	911
Cocos (Keeling) Islands	0	0	0	0	8	29	37	26	0	35	720	818
Cook Islands	15	0	15	0	12	52	64	51	1	51	883	1,065
Fiji	1	0	1	26	43	153	222	156	3	123	1,622	2,127
French Polynesia	59	11	70	38	24	67	129	63	2	100	1,141	1,505
Guam	5	2	7	6	21	71	98	89	2	110	1,072	1,378
Kiribati	1	0	1	0	13	92	105	118	3	62	1,116	1,405
Marshall Islands	0	0	0	0	10	91	101	119	3	65	1,196	1,484
Micronesia, Federated States of	2	0	2	4	23	136	163	146	3	127	1,463	1,904
Nauru	0	0	0	0	7	76	83	111	0	44	905	1,143
New Caledonia	5	0	5	36	48	159	243	154	3	180	1,944	2,529
New Zealand	23	0	23	35	52	108	195	62	0	208	861	1,349
Niue	0	0	0	0	10	43	53	53	0	38	769	913
Norfolk Island	8	0	8	2	9	33	44	28	0	24	484	588
Northern Mariana Islands	2	0	2	7	18	71	96	88	3	71	1,133	1,393
Palau	1	0	1	27	30	124	181	145	4	111	1,665	2,107
Papua New Guinea	1	0	1	19	51	274	344	256	3	465	3,391	4,460
Pitcairn	0	0	0	0	7	28	35	25	1	31	440	532
Samoa	0	0	0	3	17	73	93	86	3	79	1,212	1,473
Solomon Islands	2	0	2	10	29	187	226	194	3	144	1,969	2,538
Tokelau	0	0	0	0	7	44	51	57	2	39	784	933
Tonga	2	0	2	3	14	58	75	68	3	61	1,277	1,486
Tuvalu	0	0	0	0	11	87	98	114	3	49	964	1,228
United States Minor Outlying Islands	1	0	1	3	6	62	71	73	1	52	1,063	1,261
Vanuatu	1	0	1	1	20	109	130	137	3	97	1,587	1,955
Wallis and Futuna	0	0	0	2	9	77	88	94	0	51	1,061	1,294

Table 1: IUCN Red List summary country totals (animals) for Ocean. IUCN Red List categories include: EX - Extinct, EW - Extinct in the Wild, CR - Critically Endangered, EN - Endangered, VU - Vulnerable, LR/cd - Lower Risk/conservation dependent, NT - Near Threatened (includes LR/nt - Lower Risk/near threatened), DD - Data Deficient, LC - Least Concern (includes LR/lc - Lower Risk, least concern). Source: IUCN 2019.

Chapter 4: Utilisation and Application of Cultural Environmental Knowledge

There is grave concern that the ecological knowledge held by Indigenous people will be lost to the world's bank of scientific data.

David Harrison, Linguistics Professor, 2007

4.1 Introduction

Within academic literature, a broad range of disciplines incorporate discussions of traditional ecological knowledge (TEK) and provide different perspectives of Indigenous knowledge systems (IKS). Seasonal change has a significant role in cultural existence and the means by which people relate to, and utilise, their environment. Many Pacific cultures way of life necessitated the development of detailed knowledge between landscape and seasons (Jones 1985: Rose 1987: Simpson 1997: Stevenson 1985) and a relationship to seasons through environmental calendars.

Traditional calendars in the Pacific can be understood as the seasonal frames of reference by which different communities organise their relations to the surrounding land, sea and climate. The calendars tend to follow seasonal solar variations and are based on interconnections between people and observation of their environment (Nakashima et al. 2012). Well-documented ecological calendars can be viewed as integrated, albeit simplistic, representations of Indigenous natural resource management (NRM) that offer some steps toward elucidating advantages of Indigenous over western NRM models (Houde 2007; Usher 2000).

However, few scholars have undertaken research to understand how Pacific people make sense of their experiences in relation to species movement and seasonal variability, or explored ways in which constructions of seasonal calendars might influence access to marine food resources and the knowledge transfer in contemporary times. Research on traditional or Pacific cultural seasonal calendars draws attention to aspects of generational environmental knowledge in a broad range of seasonal patterns and associated species ecology. This knowledge may enhance our insights into climate change variables and variability (Nakashima et al. 2012).

It is particularly appropriate to conduct a comparative study between New Zealand and Australian Indigenous management of coastal and offshore environments. The comparative dimension of my project is therefore important for ecological management techniques, Indigenous co-management linkages with one of our closest neighbors, that have similar natural/cultural management and

Australian broader regional environmental, cultural and political commitments.

Exploring how environmental practices and knowledge of Pacific communities fit within other configurations across neighbouring islands can provide regional models through the amalgamation and clustering of traditional knowledge. This information can contribute to science and policy debate over climate change variables with the aim of presenting in a manner that best represents the interests and values of Indigenous people and our traditional knowledge. This can add to larger conversations on effective resilience and adaptation strategies worldwide.

4.2 Exploring the underlying nexus of principles

Indigenous people hold extensive ecological knowledge about land and seascapes (McNivan.I 2009: National Oceans Office 2000: Smyth 2011: Flinders University 2019: Muller et al 2019). This knowledge is held in language and culture. For too long, this valuable ecological knowledge has been ignored by westerners. This ignorance is the driving cause of the utilisation of natural resources and the human-centric direction and view of western systems that continues to dominate and dictate resource utilisation in Australia today. The perception that humans can control the environment to suit the needs of society and the economy has had its time, including the ongoing issues associated with such things as wide-scale land clearing, logging native forests, damming catchments, farming hooved animals, water extracting for unsustainable water-thirsty crops and unviable farm practices to name a few. All these practices have foundations in western ideology of 'one size fits all', bringing cultivation, agriculture, economic fundamentals and social structures from a continent of civilisations that had completely different climatic and environmental landscape paradigms.

The impact and influence of this has extremely negative consequences on the Australian landscape, its inherent endemic species and the atmospheric condition of ambience. It is a lack of knowledge about the processes and intricacies of the landscape itself and its place in the cyclic process of energy and the functions of ecosystem dynamics. Now, it may be thought that the loss of Indigenous knowledge is of little or no concern to the health and wellbeing of the 'modern' globalising world, but this would be entirely wrong. The Secretariat of the Convention on Biological Diversity (2010) notes that in spite of the high priority given to climate change and biodiversity loss for several years globally in the framework of the Rio Conventions, environmental problems keep threatening the world's populations (Secretariat of the Convention on Biological Diversity 2010).

Indigenous people in the Pacific have built up extensive ecological knowledge through observation of and experimentation upon the land and seascape over tens of thousands of years (Dewes 1993: Thaman 2000: Agrawal 1995: Crossman and Devisch 2002: Iaccarino 2003). They have successfully lived off the land and sea whilst maintaining the important balance of all things within the ecosystem. Indigenous people have developed seasonal calendars to illustrate the important connections between living things and atmospheric variability (Prober et al 2011: Clarke 2009: Nakashima et al 2012). Environmental observation has been used throughout time over generations of evolution within human societies. Environmental observation is an inherent component of life and existence. Environmental observation and awareness are essential for survival and livelihood. Recognisably, these days earth observation also has its limitations, which fall mainly into two categories: the limitations of technology and the availability of data (Aschbacher 2002:171–72).

4.3 Examination of the monitoring methods used in environmental observation

The five spheres of the earth system include the atmosphere, hydrosphere, biosphere, lithosphere and cryosphere (De Blij et al. 2005). Monitoring is conducted on biotic and abiotic components of these spheres by many different science disciplines. Monitoring is utilised in detecting baseline patterns and patterns of change in the *inter* and *intra* process relationships between and within these spheres. The interrelated processes that occur between the five spheres are characterised as physical, chemical and biological processes. The sampling of air, water and soil through environmental monitoring can produce data that can be used to understand the state and composition of the environment and its processes (Artiola et al. 2004; Bruns and Wiersma 2004). Environmental monitoring uses a variety of equipment and techniques depending on the focus of the monitoring.

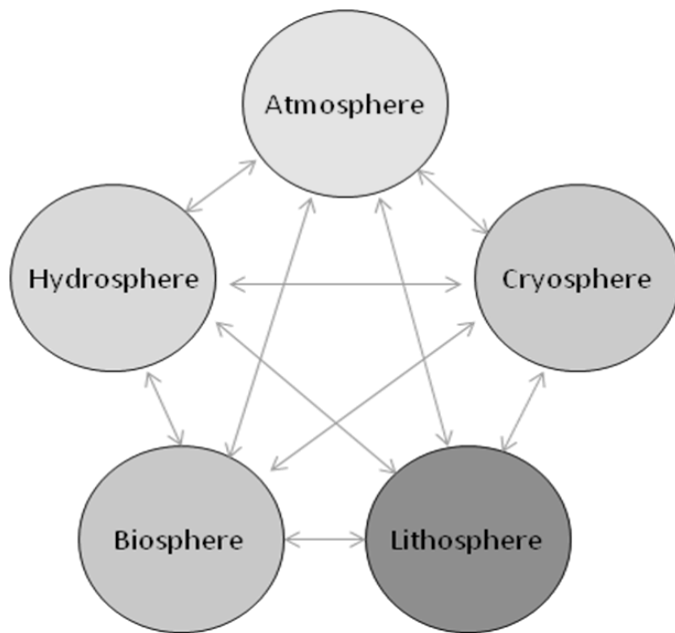


Figure 13: The five spheres of the earth system. Source: De Blij et al. 2005.

4.4 Origin of western scientific theory and environmental observation and monitoring

Environmental monitoring can be described as the systematic sampling of air, water, soil and biota in order to observe and study the environment, as well as to derive knowledge from these processes (Artiola et al. 2004; Wiersma 2004).

Monitoring is conducted for a number of purposes, including to establish environmental ‘baselines, trends and cumulative effects’ (Mitchell 2002:318), to test environmental modelling processes, to educate the public about environmental conditions, to inform policy design and decision-making, to ensure compliance with environmental regulations, to assess the effects of anthropogenic influences and to conduct an inventory of natural resources (Mitchell 2002). Environmental monitoring programs can vary significantly in their spatial and temporal scales.

‘Monitoring is inherently conducted under a rigorous application of the scientific method’ (Artiola et al. 2004) and that it is a ‘fundamental component of environmental science and policy’ (Lovett et al. 2007:253). Other fundamental components of effective monitoring programs include the application of quality assurance and quality control measures during the data collection process, data storage and access and the consultation of experienced statisticians during the sampling design process (Lindenmayer and Likens 2009; McDonald 2003; Wiersma 2004).

4.5 The monitoring methods and principles used in environmental observation

Most environmental observation and monitoring are conducted by government agencies or educational institutions, primarily organised in an administrative structure. These institutions advocate the considerations involved in developing a suite of indicators to monitor as well as the design and development of monitoring systems. They also describe methods and procedures for ecological assessment. Monitoring is usually undertaken by relevant state and federal departments, such as natural resource and environmental protection agencies (Artiola et al. 2004). These evaluations can then also be sourced to universities or scholars with particular expertise or interests. Monitoring occurs on local community, regional, national, international and global scales. Environmental monitoring is a necessary component of environmental science and policy design (Lovett et al. 2007). Any effective monitoring program must include focused and relevant questions, appropriate research designs, high quality data collection and management and careful analysis and interpretation of the results (ibid.).

Environmental monitoring includes the participation of scientists, statisticians, policy makers and natural resource managers (Lindenmayer and Likens 2009). Long-term monitoring programs often face the challenge of securing long-term funding that will remain stable in dynamic political environments (Lindenmayer and Likens 2009; Lovett et al. 2007). They are, to a great extent, dependant on institutional and political agendas including individual and global priorities, obstacles and influences.

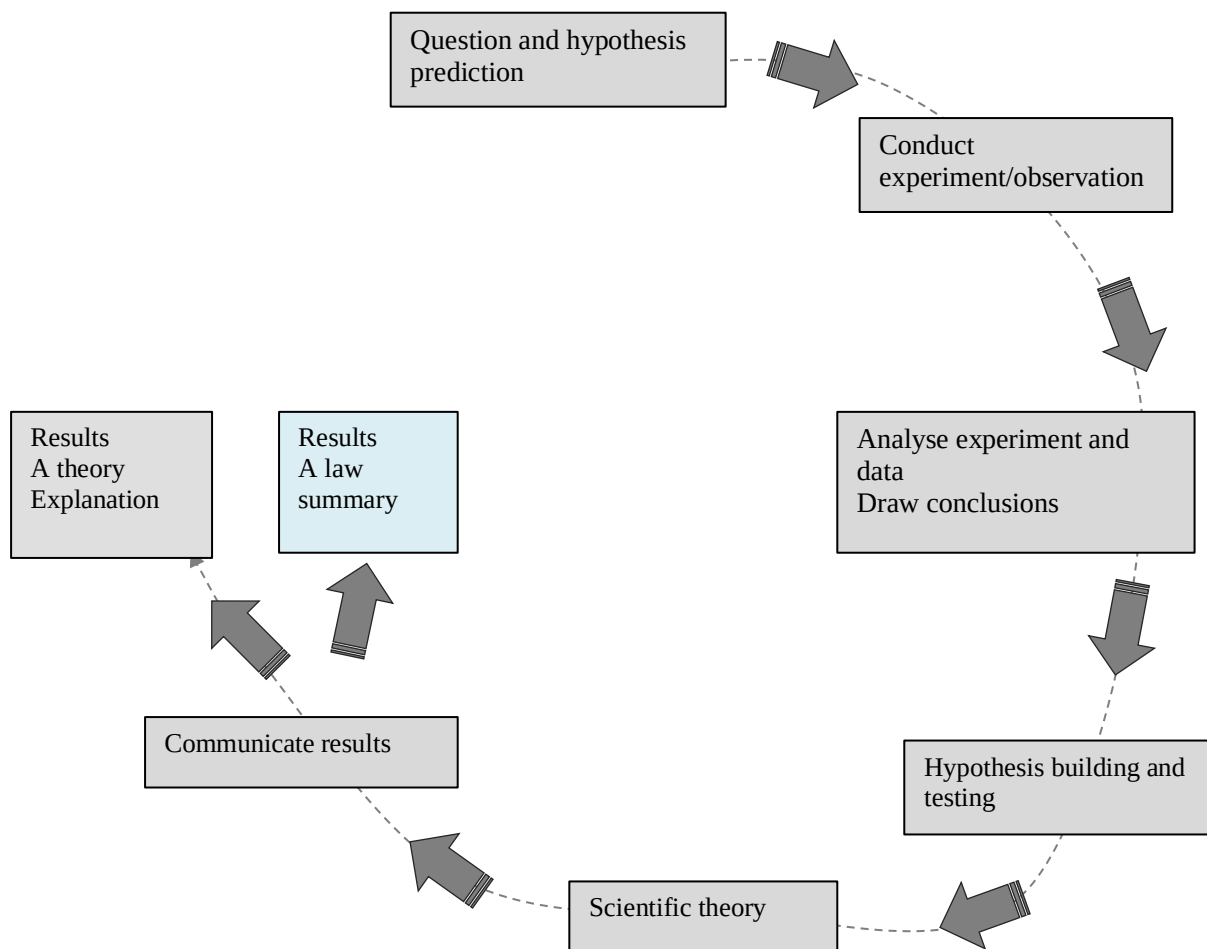


Figure 14: The process of scientific evaluation and outcomes. Adapted from the University of California Museum of Palaeontology's [Understanding Science](#).

4.6 Environmental knowledge and Indigenous knowledge systems

Traditional ecological knowledge (TEK) is the term used over the last few decades to describe Indigenous knowledge bases of environmental ecosystems and ecological processes (Berkes 1999: Gadgil et al 1993:Huntington 2000: Gambould 2002:Huntington et al 2004:Pearce et al 2009: Usher 2000: Lantz and Turner 2003). There is currently no universal definition of Indigenous ecological knowledge. What is evident is that the knowledge is associated with long-term survival, abiotic and biotic ecosystems, species understanding and how to manage resources. This is inherently embedded in cultural customary law and social order. Corsiglia and Snively (1997:22) state that ‘the practice

predates any form of written records and modern examination has found that there might be as many understandings of TEK as there have been human experiences to shape them.

The fundamental point that makes local knowledge traditional is its foundations in time earlier periods. The continued existence and practice of cultural knowledge maintains culture (Johnson 1992). The word traditional tends to have a connotation of 'unchanging' in Indigenous societies, but when applied to the knowledge of environment, this concept tends to be somewhat inapplicable as ecological environments are constantly evolving and changing over short (seasons) and long (succession, climatic fluctuations, climatic cycles like El Niño/La Niña) periods. Therefore, the elements of adaption and change are essential in the survival and application of Indigenous ecological knowledge. Agrawal (1995) states that a generalist definition of TEK systems cannot exist because knowledge evolves from very distinct historical patterns of change among various cultural groups, resulting in unique and heterogeneous systems.

Instead of signifying an inflexible adherence to the past, 'traditional' is rather a sign of time-tested knowledge and the process of knowledge generation itself; TEK should not be dismissed because its custodians no longer appear traditional to outsiders (Berkes 1999; Johnson 1992).

Ecological processes develop over time and are complex systems where numerous species from microorganisms to megafauna have roles to play in life's web. Knowledge of the roles that each species play in sustaining the balance and equilibrium requires detailed observation, interaction and co-existence. Graham and Payne (1990) refer to traditional knowledge as a complete system of concepts, beliefs and perceptions, as well as the process whereby knowledge is generated, stored and transmitted. The concept of TEK is not singularly a collective of factual ecologically applied information, but continues to play a role in sustaining Indigenous cultures and the environments in which they exist and rely on. Turner et al. (2000) describe ecological knowledge as a nexus of various features founded on knowledge of ecological principles such as succession and interrelatedness. The use of ecological indicators as adaptive strategies for monitoring, enhancing and sustainably harvesting resources is a primary component. This ecological knowledge also moves through effective systems of knowledge acquisition and transfer with respectful and interactive attitudes and philosophies. The continuing occupation of and close identification with ancestral lands and beliefs ties all the principles together, the fundamental component being the recognition of the power and spirituality of nature.

This nexus of principles is effectively what has enabled many groups of Aboriginal clans to live sustainably within their local environments for many thousands of years. In order for TEK to be

incorporated into current ecosystem-based management strategies, the complete nexus of cultural attributes, including its philosophies must be acknowledged and respected (Turner et al. 2000).

Over the last two centuries, the value and application of Aboriginal ecological knowledge (AEK) has been accepted and subsequently fused into western lifestyles in Australia without too much controversy. When the holistic-ness of AEK is deconstructed and its values are isolated into separate elements such as knowledge pertaining to the medicinal properties of many native plants (such as antiseptics eucalyptus and tea-tree) or the application of fire and land ecosystem management, it is evident that the knowledge has immediate value. Resistance and questioning of its relativity and worth happens more so when the holistic application of AEK is applied. In particular, links with Aboriginal customary livelihoods, culture and spirituality emphasise the holistic nature of Aboriginal natural resource management, which is essentially developed and adapted management regimes within a worldview that stresses respect for natural resources (Aikenhead and Ogawa 2007; Gadgil et al. 1993).

This application of holistic management contrasts with models built on western science, which focus on reductionist explanations and are accompanied by a worldview that isolates and separates humans from and above the natural world (ibid.). Folke et al. (2003) and Gadgil et al. (1993) see reductionism as an aid in manipulating and understanding simpler systems, but it is argued that it is less effective for managing complex social-ecological systems.

Concepts of sustainable living and social-ecological resilience are emerging in natural resource management (Folke et al. 2003; International Union for Conservation of Nature 2006). These concepts contain some attempt at holistic attributes, although the models are still in simple development and application (Barrett and Wuetherick 2012). Aboriginal ecological knowledge is inherently linked and connected to land and sea tenure. The origins and continuum of knowledge is embedded in traditions where many paths or song lines travelled by ancestral beings encrypt environmental knowledge (Baker 1993; Newsome 1980). Aboriginal livelihoods will always be strongly connected to land, sea and resource tenure, which in turn is linked intrinsically with environmental knowledge of country through the agency of mythology (Barrett and Wuetherick 2012).

In western concepts, the term given to intellectual and practical activity encompassing the systematic study of the structure and behaviour of the physical and natural world through observation and experiments is science (Lexico 2019). The fact that Indigenous knowledge systems and the term TEK are constantly being interpreted as comparative to science or an Indigenous means of environmental observation has consequences wherein most scholars attempting to apply western science ideologies

on the Indigenous systems fail to recognise that Indigenous knowledge systems within culture contain so many layers and realms (Berkes 1999: Gadgil et al 1993:Huntington 2000: Gambould 2002:Huntington et al 2004:Pearce et al 2009: Usher 2000: Lantz and Turner 2003). To extract and compartmentalise one component without the rest misrepresents the true value of the logic in Aboriginal knowledge.

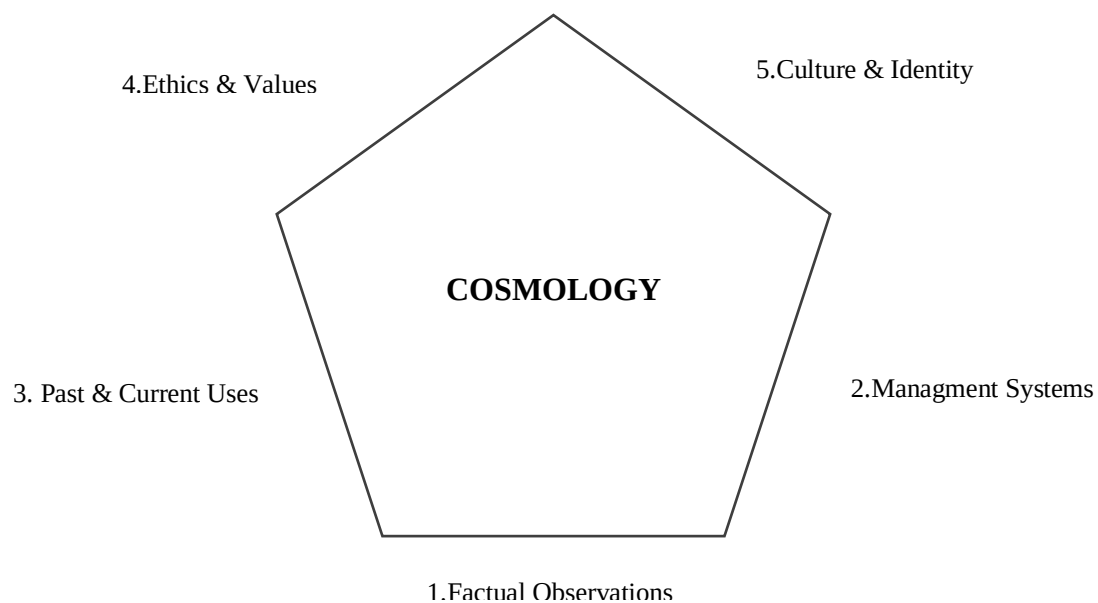


Figure 15: The six faces of traditional ecological knowledge: challenges and opportunities for Canadian co-management arrangements. Source: Houde 2007.

4.7 A comparison with western scientific theory and method

As we move deeper into a science-conscious age, there are almost daily media highlights of new developments in science and scientific research. It is important to understand what science really is, from the early days of phenomena, magic, and the alchemists and astrologers who questioned the nexus of existence and fundamentals of life. All components of science start with a scientist who by nature has an inbuilt problem-solving mentality and curiosity about the natural world. It is this curiosity about the living world, that in retrospect evolves from a profound respect for nature, that binds by an invisible thread those involved in the research of biological science. However, this mysterious fascination moves quickly into the application of the scientific method, the application of rigorous, complicated formulas based on organised common sense. As English biologist T.H. Huxley (1825–95) stated, 'The scientific method is nothing but trained and organised common sense. Its power in the hands of a scientist stems from the rigor of its application' (Bradford 2017).

The very first step in a process of scientific theory begins with formulating a hypothesis, as science is obsessed with material universe facts and how these fit into conceptual schemes, essentially theories or laws that aim to bring clarity to the relationships between them. An essential start point is the observation, either directly or indirectly, occurring naturally or through manipulated experiments, of objects or events in time and space within the physical universe. Science has difficulty dealing with anything that cannot be observed. Science rests on the philosophical assumption that all universal events can be described by physical theories and laws, and that data is formulated by and comes from our senses.

Science readily acknowledges the imperfections associated with human sensory perception and the neural processing imposed on the world around us. This interaction between phenomena and observer, through preconceived notions, experiences and physical presence, adds to chances of effecting observation and experiment.

The first step in the scientific method starts with formulating the question to be queried. Essentially questioning the question, this involves sorting what is trivial and which questions are worth answering. Is it a good question to ask? Will it result in providing an answer to the hypothesis?

The following step is to answer the question. This involves understanding and interpreting the research, which involves observations. This also includes rigorous questioning of what to include and what to ignore in observation and how to take measurements and record the data. This is the crux of a successful observation. Any oversight here can leave the work useless in data collection and application. Following this collection of observations and isolated data, information then needs to be transformed through an analysis and moved into a coherent pattern or generalisation. A formal generalisation or hypothesis can then be formulated, but only if adequate observations have been made to give a basis for the generalisation (Chalmers 1982). A good recent discussion on how to minimize uncertainty in data sampling can be found in Rivera-Rodriguez et al (2018).

However, due to the fact that data can be interpreted in many clever and creative ways, the next step is devising ways for the testing hypothesis. This involves formulating predictions based on the hypotheses and checking to test the accuracy of the predictions. It is aimed at detecting discrepancies between the hypothesis and the data or test results (Degen and MaFLA 2017). If any are found, this then prompts a change to the generalisation. However, if the data and/or test results support the prediction and hypothesis and contain a very high degree of probability and the scientist has great confidence, the hypothesis is well on its way to becoming scientific theory. A theory is a hypothesis

that has been repeatedly and extensively tested, is supported by gathered data and assists in the order and explanation of that data (Chalmers 1982). One must also recognise that no theory in science is absolute. New evidence and contradictions are always present.

4.8 Inherent limitations in the classical scientific way of analysing nature and ecological systems/biodiversity monitoring

In its simplest form, the scientific method begins with careful observations that must be shaped into hypothesis. The hypothesis suggests predictions, which must be tested. The tests furthermore have to be controlled. Controlling a test means that the effects observed result from the phenomenon being tested not from some tangential source. The most practiced way of controlling an experiment is to perform the same process or test over and over, time and time again, varying minute parts.

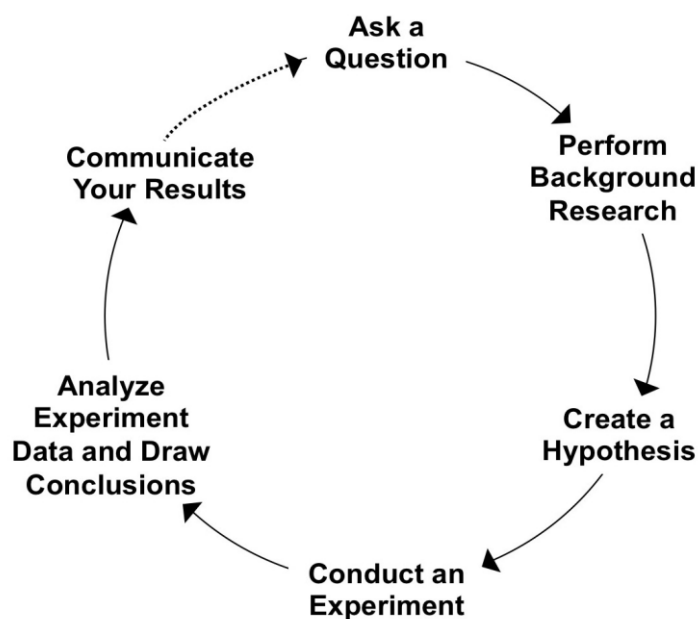


Figure 16: Science 101, 2012–16. Source: Degen and MaFLA 2017.

Scientific investigation is dependent on combined subjective judgements and objective tests, a mixture of intuition and logic. Therefore, scientific research is really a subtle art, the ability to make insightful guesses and imagine clever and critical ways in which to test them where observations are accurate and hypotheses testable with mechanisms on hand to alter and conform to the evidence. (Chalmers 1982).

By now, one could be thinking that this scientific method is very pliable and could possibly be seen to conclude anything it wants as long as the stringent method is applied. Which leads to the limitations of the scientific method. The insistence of testability does limit the range of application.

An example is the notion held by scientists and non-scientists that a supernatural being works through the natural laws of the universe and cannot be evaluated by science. Science can neither confirm nor refute it. It can, however, dominate it. Science cannot make value judgements, it cannot make moral judgements, however it can analyse.

The history of western science as we know it today stems from a long chronicle of beliefs, idolism, religious domination, revolt and purism. These factors shaped and built what scientific theory and ideology is today. As you will see later in the chapter, western science has historical roots embedded in extremist thought processes, in religion, and then the extreme scale opposite in purist notions of scientific theory (Chalmers 1982). The extreme contrast of this evolution somewhat eliminated the human element of participation and a component of this formula.

Indigenous	Western	Overlap
Stories and law	Facts and figures	Belief systems
Earned knowledge	Learned knowledge	Knowledge systems (united)
Qualitative (i.e. Big Tree)	Quantitative (i.e. 75m Tree)	Qualitative and quantitative information (data)
Ecosystem approach	Single species approach	Single and multiple species within an ecosystem and cyclic processes
Acceptance	Validation	Rational articulated
Part of environment	Separated from environment	Multiple perspectives
Time immemorial (trial and error)	Maximum of 220 + years quantitative evidence	Traditional and contemporary indicators

Table 2: Comparison of Indigenous and western observational knowledge. Source: C. Marshall 2018.

Associations of key factors in cultural systems

Associations	Key factors in applied in cultural attributes	
Language	Creation, social organisation, resources and trade,	
Social organisation	Subtribes, family clans, sections	
Spatial distribution patterns	Family clans	Navigation
Economic resource	Farming, preserving cultivation	Trade
Traditional systems of management	Sections and level of hierarchy	Geographic areas/why
Sustenance	Land and sea (where what places/habitats)	Food types
Creation	Spirituality, belief systems	
Spirituality	Governance systems	
Ceremony	Spirituality, belief systems	
Inherent responsibilities (custodianship)	Spirituality, resources and trade, gender, age, Sections and level of hierarchy, ceremony, family clans	

Table 3: The variables in environmental monitoring and holistic cultural attributes. Source: C. Marshall 2017.

4.9 What is Indigenous science?

In my personal, Indigenous, professional and academic experiences, I have understood from a very young age that environmental observation has been used throughout time over generations of evolution within human societies. Environmental observation is an inherent component of life and existence. Environmental observation and awareness are essential for survival and livelihood and in the appreciation of knowing about my culture and its inherent connection to the environment.

Indigenous knowledge of and connection to cultural land and seascapes dates back thousands of years, chronologically preceding the development of western scientific ideologies. Yet, over 150 years after colonisation, the merit of Indigenous knowledge in the context of conservation and research is still often defined by western ideology, knowledge systems and concepts (AIATSIS 2014).

I undertook spatial analysis and mapping of cultural knowledge as it relates to species and habitats in a Gumbaynggirr marine protected area as part of my Master of Arts in marine science and management (Marshall 2012). I have found now, in undertaking this PhD on Indigenous knowledge as

it relates to seasonal cycles, atmospheres, oceans, species and people, that one of the key fundamentals in 'using', 'having', 'finding' or 'inserting' a place for Indigenous knowledge is the fact that Indigenous local knowledge (ILK), traditional ecological knowledge (TEK) and Indigenous knowledge systems (IKS) need a place as a separate accepted knowledge system. Excluding Indigenous knowledge advances a Euro-centric foundation and excludes all other knowledges, otherwise known as cognitive imperialism (Battiste, 2013). Dr. Battiste defines this as "a form of cognitive manipulation used to discredit other knowledge bases and values and seeks to validate one source of knowledge and empower it through public education" (as cited in Battiste, 1998).

I make this statement in comparison to western science, which for centuries has had its place in factual accounts and formulated methodology and is used as the basis in many decision-making processes in science and policy both locally and globally (Lovett et al., 2007). The methodology of Indigenous knowledge systems is crucial in supporting the process of participatory development between Indigenous knowledge and science it is also important in advancing Aboriginal peoples place in society.

Many 'scientific' papers on the amalgamation and blending of ILK, TEK, Indigenous ecological knowledge (IEK) and IKS focus on the integration of ILK, TEK and IEK, even the compartmentalising of IKS, and what components can be utilised to 'assist' western science. All such papers in time and place make quite valid enquiries, but with the intent of finding a place where this knowledge sits as either integrated into western science, has components blended with western science or has components used by western science. Many papers and documents also attempt to justify IKS' role and place alongside western science.

The inherent problem is the differences between IKS and western science as detailed in table 3. The history of western science stems from a long chronicle of beliefs, idolism, religious domination, revolt and purism based on the notion that facts can be proven through a process of observation, experiment and hypothesis (Chalmers 1982). These factors have shaped and built what scientific theory and ideology is today. This history had roots embedded in extremist thought processes, in religion and on the extreme scale opposite, in purist notions of scientific theory. The extreme contrast of this evolution somewhat eliminated the human element of participation as a component of this scientific formula (Sparkes and Piercey 2015).

IKS and western science both use environmental monitoring, which can be conducted for a number of purposes, including to establish environmental 'baselines, trends, and cumulative effects' (Mitchell 2002:318), to test environmental modelling processes, to educate the community about

environmental conditions, to inform policy design and decision-making governance, to ensure compliance with environmental regulations, to assess the effects of anthropogenic influences or to conduct an inventory of natural resources (Mitchell 2002). Environmental monitoring programs can also vary significantly in their spatial and temporal scales.

In looking at the origin of 'western science' ethics and method, where the question, hypothesis or prediction leads to the conducting of the experiment or observation, then the analysis of the experiment and data with conclusions drawn, the hypothesis and testing and then the scientific theory, the function of this process has led to this 'science' not moving or changing for centuries and being quite linear in its function. This is opposed to most ILK systems, which are, particularly when dealing with species and environment, cyclic and based on observation throughout time and space. In many instances, they are amalgamated into cultural practice and teaching. The ethics and principles applied to Indigenous theory and environmental observation (ITEO) are also very cultural and habitat-based.

I feel that if the origin and application of ITEO, which leads to IKS, is not given a place, or acknowledge as a 'recognised entity' in a toolbox of monitoring applications, it will always be an add on or novelty for western science and scientists. It will also always be deconstructed, compartmentalised and used without its complete, holistic ethics and methods. This, in reality, poses obstacles at the institutional and policy levels when applying its validity. Indigenous science represents the cumulative place-based observations of natural phenomena that includes humans and non-human others, and fully integrates and acknowledges humans as part of the natural world and its ecosystem processes. The use of traditional knowledge and Indigenous science has been suggested as a way to mitigate the current weaknesses in areas beyond sustainability science.

I personally have no doubt about the IKS contributions to conservation and sustainable use of biodiversity. They have benefited the ideologies and perspectives of both non-Indigenous and Indigenous peoples. Acknowledgement of 'another science' flowing onto species, habitats, ecosystems and interactive biosphere dynamics, management, conservation of biodiversity and climate change challenges can only be a positive and adaptive mechanism.

Chapter 5: The Elements of the Visual and Intangible in Cultural Expression and Knowledge

There is grave concern that the ecological knowledge held by Indigenous people will be lost to the world's bank of scientific data.

David Harrison, Linguistics Professor, 2007

5.1 Introduction

To really know what the ocean is, you have to see it, you have to hear it, you have to taste it, you have to feel its power. To really know the ocean, you have to live it. An ancient place, a mixture of matter and energy, a temperament, the ocean is breathing, living, alive connected to the people that have integrated societies and religions around its power, resources, healing and existence.

The following cultural scientific creative works investigate and document through multimedia the Indigenous knowledge systems of Pacific peoples' relationships with the ocean, atmosphere and coastal resources. By visually exploring the connections between cultural environmental knowledge, marine habitats, species and Indigenous people as they relate to seasonal variation, this chapter moves closer to how Indigenous peoples view the environment and their relationship with it. Ethnographic material was used by analysis of available and culturally appropriate project content, other public documentation and critical writing. The result better illustrates Indigenous perspectives and is therefore a more accessible and culturally nuanced means of displaying knowledge to both Indigenous and wider audiences.

This chapter includes the exploration of cultural elements in connection and how these elements are integral to the sustenance of livelihood, local resources, cultural traditions and associated responsibilities in a physical and metaphysical way. These natural elemental properties are creatively displayed and shared through a digital story of light projection, moving photography and animated digital interface. This approach is well suited to best articulating the narrative visual voice of Indigenous marine people's interpretations of their ocean. The narrative and visual are deliberately combined to provide a cultural methodology to presenting cultural scientific creative works in conjunction with the Indigenous communities within the Pacific and illuminate cultural injection to scientific academic research. Multimedia documentation and synthesis of Indigenous people, environment and species forms a holistic approach to the research by giving the subject a place and

a creative visual dimension. In a creative, culturally sensitive manner, with support from individuals and the communities, several cultural artistic components aimed to creatively portray the key elements of traditional calendars, seasonal knowledge and intergenerational knowledge transfer. The elements of the digital storytelling framework are given life through photographic light projection. These works aim to embed creativity and cultural production in 'traditional' ways of life and knowing in a visual perspective. The cultural systems are injected onto the medium, providing the capacity to create new ways of looking at familiar objects or subjects.

This shows the issues of climate change and Indigenous peoples' physical and metaphysical connections to climate, environment and species from a different perspective and approach that deviates from western standards in knowledge presentation. The emphasis is on the creative approach or a different way of knowing and thinking, which extends into diversifying cultural scientific presentations of Indigenous mind frame and approaches. This is intended to create and generate innovative work to explore the intangible and extend the diversity of cultural expression in scientific presentation.

5.2 Cultural artistic methodologies in change production

One of the key components flowing through the Pacific as a common thread is traditional and contemporary cultural arts and the ocean. This is a continuing form of expression and intergenerational knowledge transfer. It is also a way of developing cultural and community confidence in practicing cultural obligations, retaining knowledge and passing on traditions and associated knowledge. It is part of the cultural knowledge system. An example is traditional Māori art, which is characterised by an integration of form and function. Objects were primarily manufactured to serve practical and symbolic purpose. They gave visual form and shape to cultural belief systems and expressed spiritual ideas in natural materials (wood, bone, stone, plants (flax)). A communal input embodied the artistic method, with *tohunga* (expert practitioners) also evolving from this process (McLintock 1966a). In Australia, it is common knowledge that Aboriginal peoples are the first inventors of art and continue to guide and provide cultural wellbeing and connection for many people.

The use of cultural artistic interpretation can change how we experience flattened imagery and associated issues by adding spatial and sculptural qualities of the world around us. I can write a book, which will sit on a shelf, and only interested people will read. I can write a paper for a journal and let peers scrutinise. Or I can be creative, scientific and academic from an Indigenous perspective, literally exposing the visual essence of the subject in a manner that allows thought, contemplation and

exposure to the inner nexus of cultural being, allowing me the chance to create a visual reflection of humanity's behaviours and impact from a Aboriginal female perspective. Combining my artistic and scientific perspectives allows innovative arts to explore the new frontier.

There are many forms of protecting the process of intergenerational knowledge transfer and cultural retainment. One in particular is *The Convention on the Protection and Promotion of the Diversity of Cultural Expressions*, adopted by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 2005.

This convention is a legally binding international agreement that 'ensures artists, cultural professionals, practitioners and citizens worldwide can create, produce, disseminate and enjoy a broad range of cultural goods, services and activities, including their own' (ibid.).

The interpretation and implementation of the UNESCO convention lies with each region or country and their willingness to promote national and international leadership. UNESCO works with a broad but flexible conception of art as a 'culture cycle' that encompasses 'all aspects of the cultural expression or activities, goods and services in their diverse modes of creation, production, dissemination, distribution and access, whatever the means and technologies used' (ibid.). It aims to support aspects of creation, production, exposure and access to visual arts and craft practices that are strongly linked to traditional forms of life, in particular to custodial and customary relationships to land (ibid.).

Australia became a signatory to this convention in 2009. Signatories to the convention take on the 'right and obligation' to develop policies and adopt measures to protect and promote the diversity of cultural expressions within their territory. A memorandum of understanding was signed between the Australia Council and UNSECO in 2012 to promote cultural diversity in the Asia Pacific.

In a rapidly changing world spearheaded by technology and economic resource consumption with economic capital, the essence of artistic expression can get lost in a world of preoccupation and mindset focused on existing in this labyrinth of western fundamentals, all of which is a relatively new cultural ideology for many Indigenous groups of the Pacific. This interconnected, globalised world can promote monocultural dimensions in culture and society. It is imperative that diversity is seen as an asset and not a liability for individuals and societies (Mar and Ang 2015). Cultural diversity is now seen as an essential requirement of sustainable development, because a world where diversity flourishes increases the range of choices for people and communities, thus nurturing their capacities for creativity and innovation (Mar and Ang 2015). Appreciation must be unearthed. Mar and Ang (2015)

assert that promoting and protecting diversity is essential for world peace, as it boosts the potential for creative dialogues resulting from interactions of diverse cultures, both nationally and globally.

One evident issue I have observed in my professional career is the general collective of western urban societies, ethnic isolations and religious sects' disassociation with, or ignorance of, Indigenous peoples' deep, intricate connections to nature. This psychology brings with it new generations of 'nature deficiency', a now recognised psychological syndrome in many western cultures. One effect of industrialism and technology has been to enclose much of the general population inside buildings or nestled within the comforts of built industrialised societies, increasingly distant from the natural world.

Exposure to the raw environment and environmental processes is becoming less. The rapid changes of the global economy and economic pressures have played a significant role in the oblivious demise, damage and destruction of our natural environment and our connective habitation in these ecological systems. The very existence of increasing population, global economic pressures and resource competition poses a threat to fragile habitats and environments. The issue of rapid human-induced climatic change is an unaccustomed space, a new frontier, no one has really experienced.

As such, the ability to create new ways of looking at familiar objects or subjects such as human-induced climate change and the roles of Indigenous Pacific peoples in this matter is of utmost importance. The issue of climate change and its effect on the people of the Pacific, I feel, has become a 'common familiar', where disconnection and denial of our everyday actions or moral justification of actions are used to avoid the issue of human-induced climate change.

Nevertheless, the detailed case studies provide relevant material for discussion and insight into the practical opportunities to advance and provide sentinel support to the key fundamentals of protection and promotion of the diversity in cultural knowledge with frameworks that broaden perspectives of Indigenous ways of knowing and thinking. There is a great deal of merit in promoting diversity of cultural expressions through an improved dialogue around interest in, and ultimately increased uptake of, the meanings behind the *Convention on the Protection and Promotion of the Diversity of Cultural Expressions*. Such a process is relevant not just in Australia and the wider Asia-Pacific region but globally, as it promotes significant shifts in thinking and practice around the arts, science and cultural diversity in the Pacific. This involves moving beyond a narrow 'multicultural arts' perspective that frames distinct minority groups as set apart from a cultural mainstream and recognising cultural diversity as an inescapable interactive context (Mar and Ang 2015).

The 'cultural scientific works' approach was trialed at the Australian Museum in Sydney, Australia, and the Interactive Gumbaynggirr Seasonal Calendar and the Gumbaynggirr Women's Spirit animation at the 2018 Boden Conference — Ecological Surprises and Rapid Collapse of Ecosystems in a Changing World at the Australian Academy of Science in Canberra. This was also projected onto the landscape and country (*jagun/barri*) at Janinbirry (Valla, NSW) of which it originates to the Traditional Owners of Baga Baga/Ngambaa Southern Gumbaynggirr.

The moving photography was presented to the waka sailing crew and community of Auckland, New Zealand. The species and climate change photography *Gangaagundi Guunuwaygan (Future Life)* exhibit was presented at the University of New South Wales (UNSW) 3rd Australia New Zealand Marine Biotechnology Society Conference in collaboration with the UNSW Global Water Institute, UNSW Library and UNSW Art Collection as part of the opening of the art exhibits *Sea Country: Yolngu Bark Paintings in the UNSW Art Collection* and *Gangaagundi Guunuwaygan (Future Life): Recent works by Chels Marshall*.

Since the research was initially conducted and the associated cultural creative works completed, many of these projects have evolved and expanded. The Australian Museum has revealed that more than 750,000 people have interacted with the Gumbaynggirr Seasonal Calendar. The Gumbaynggirr Women's Spirit animation has been showcased and viewed worldwide via social media. The *Future Life* exhibition has been watched by more than 1000 people in scientific forums in four months (Pers.Com L.McBride 2019).

5.3 Calendars, time and seasonality

The diversity of methods and approaches to time keeping has been established in the creation of calendars. A calendar is a system of organising units of time for the purpose of reckoning time over extended periods (Aveni 2003). The day is the smallest calendrical unit of time; the measurement of fractions of a day is classified as timekeeping. Most calendars are methodised and transmitted in written laws; others are transmitted by oral tradition. They ultimately are a source of function and calculation that influences cultural behaviours.

Most Indigenous calendars tend to replicate astronomical cycles and seasonal oscillations and the associated patterns of species biology, bringing social order and cultural identity. Calendars have

influenced and directed the planning and accomplishment of agriculture, migration and hunting cycles, the maintenance of religious conducts and significant events (ibid.).

5.4 Astronomical bases of calendars

The fundamental components of astronomical cycles are the day (based on the rotation of the earth on its axis), the year (based on the movement and time the earth moves around the sun) and the month (based on the revolution of the moon around the earth). The complexity of calendars arises because these cycles of revolution do not comprise an integral number of days, and because astronomical cycles are neither constant nor perfectly commensurable with each other (Douma 2008).

The tropical year is defined as the mean interval between vernal equinoxes; it corresponds to the cycle of the seasons. The following expression, based on the orbital elements of Laskar (1986), is used for calculating the length of the tropical year:

$$365.2421896698 - 0.00000615359 T - 7.29E-10 T^2 + 2.64E-10 T^3 \text{ [days]}$$

where $T = (JD - 2451545.0)/36525$ and JD is the Julian day number. However, the interval from a particular vernal equinox to the next may vary from this mean by several minutes.

The synodic month, the mean interval between conjunctions of the moon and sun, corresponds to the cycle of lunar phases. The following expression for the synodic month is based on the lunar theory of Chapront-Touze and Chapront (1988):

$$29.5305888531 + 0.00000021621 T - 3.64E-10 T^2 \text{ [days].}$$

Again $T = (JD - 2451545.0)/36525$ and JD is the Julian day number. Any particular phase cycle may vary from the mean by up to seven hours (Douma 2008).

5.5 The Gregorian calendar

A variety of calendars are in use today, but they are limited to particular religions or cultural dimensions. The original western calendar was the Julian calendar. Then, during the 16th century, a replacement was proclaimed through the Roman Catholic world, with the Gregorian calendar evolving from a desire to reform the method of calculating and standardising the time of Easter, the celebration of the resurrection, the three-day death and the reappearance of Jesus Christ. This event is known as the most important time for Christians.

The Gregorian calendar is the international standard for social order and routine. It regulates the ceremonial cycle of the Roman Catholic and Protestant churches (Coyne et al. 1983). 5;7Its original

purpose was ecclesiastical. Now, given the proclaimed ascendancy of Christian ideology throughout the world, regardless of global position and the seasons, sun position, time and species associations, the dominance of Christian ideology has spanned worldwide more than three centuries and dictates the time we all operate on (Coyne et al. 1983).

5.6 Traditional knowledge, space and time

Ecological and seasonal calendars are typically a western science construction of Indigenous knowledge and spatial patterns of resources, using them as an oral knowledge transposed into graphical visuals. This knowledge is inherently based on factual observations over time and shows a range of environmental knowledge elements. Links among physical phenomena such as astronomy, weather, land/seascapes and biological attributes such as insects, plants and animals, along with spatial and temporal variation (Prober et al. 2011), are included in the calendar arrangement.

Indigenous	Western
Indigenous concepts built around ecological time	Gregorian calendar focuses on structural time
Ecological time based on environmental shifts in atmosphere,	Seasons and place specific seasonal characteristics
Emphasising cyclical processes of astrological attributes, environmental and biological	Fixed system of reference in time dealing particularly with social concerns (Aveni 1989)
Embedded strongly in place and the ecology of that place (Usher 2000)	Explicit seasons for heterogeneous environments
Ultimately linked with processes that drive natural resource management	Christian ideology — processes that drive religious events in time

Table 4: A comparison of Indigenous and western methods and practices in calendars. Source: C. Marshall.

Knowledge of ecological systems includes baseline processes and components of ecosystems, their short and long-term dynamics and the interrelationships between. Information of this type is relevant in the monitoring, prediction and response to change (Houde 2007; Usher 2000). An emerging application of baseline Aboriginal seasonal knowledge is its relevance to climate change research and adaptation (Green et al. 2010). In addition to environmental data and species cycles, Aboriginal

seasonal knowledge reflects traditional Aboriginal land and sea use and management (Houde 2007; Usher 2000). Traditional seasonal ecological calendars can provide an overview of the diversity of species traditionally used and may describe or imply other measures taken to maintain a sustainable resource (Prober et al. 2011). Indigenous seasonal knowledge has a fundamental role in organising biological knowledge and interrelated cyclic processes. Ecological calendars can capture direct links among the seasonal cycles and the ecological, cultural and spiritual aspects of traditional life (Clarke 2009; Lantz and Turner 2003).

Seasonal knowledge of space and time in atmospheric cycles and their relationship to indicators also triggers cultural obligations to spatiotemporal approaches in sustainable resource use. A notable example is the knowledge of the Brambuk people regarding the appearance of the emu constellation in the Milky Way galaxy, which marks the spring richness of bird eggs and other abundant foods. This emu in the stars indicated the occasion of large gatherings to trade, arrange marriage partners and hold dance and corroborees (Bureau of Meteorology 2016). The people of Gumbaynggirr country still retain and apply the seasonal knowledge for marine species utilisation. An example is the oyster, where harvesting is discouraged outside of the 'fat months' as they are 'weak' and not that good nutritionally.

Indicators are a key component of the Southern Gumbaynggirr calendar, which usually consists of plant cycles and insect behaviours. Gumbaynggirr count years in *galaagarr* (summers) or *maguurr* (winters). Hence, 'in four years' is 'in four summers' (*bularri-bularrija galaagarr*) or 'in four winters' (*bularri-bularrija maguuda*). The way of life for Aboriginal peoples demanded a detailed knowledge of the relationships between weather and the landscape, enabling them to observe and forecast its constant change and variability (Jones 1985; Rose 2003; Simpson 1997; Stevenson 1985).

Indigenous ways of knowing are holistic, acknowledging the 'interconnectedness of physical, mental, emotional and spiritual aspects of individuals with all living things and with Earth, the star world, and the universe' (Lavallee 2009). The conventionally framed resource management approaches are able to contend with factual observations, past and current land uses and some traditional land management systems, however they do not effectively grapple with issues of cosmology (Houde 2007). The importance and relevance of the marine environment to the Gumbaynggirr considers Gumbaynggirr Aboriginal perception of the marine environment, outlines the factors that have influenced the knowledge used in marine hunting and fishing techniques and the relevance of marine locations and their resources to the First Peoples of the Pacific.

5.7 Case study 1: Gumbaynggirr Seasonal Calendar

5.7.1 Background

Gumbaynggirr is the tribal name that relates to an area on the mid-north coast of New South Wales that roughly extends from the Nambucca River to the Clarence River on the coast, and inland to the Northern Tablelands. The ocean is the Gumbaynggirr peoples' totem and is held in high regard and with the utmost respect. Gumbaynggirr worldviews are based on the totemic associations to the ocean as a living entity.

I have always known that Aboriginal peoples hold extensive ecological knowledge about country. This was transmitted to me by my uncles and father, aunts and mother. This knowledge is held in landscape, language, mindset and culture. For too long, this valuable ecological knowledge has been ignored. The dominating view by European colonisers, continues to dominate in Australia today. The omitting of Indigenous knowledge advances a Euro-centric foundation and excludes all other knowledges, otherwise known as cognitive imperialism (Battiste, 2013). Dr. Battiste defines this as “a form of cognitive manipulation used to discredit other knowledge bases and values and seeks to validate one source of knowledge and empower it through public education” (as cited in Battiste, 1998). It is in my view that this “colonist derived” ideology is that humans can exploit and control the environment to suit the needs of a capitalist-based society. Some examples of this are the logging native forests, damming catchments, extractive industry and farming hooved animals, to name a few. All these practices have extremely negative consequences on the landscape. On top of this, the government, in partnership with global companies, ravages the land for minerals through mining and, in the process, eliminates thousands of years of ecological knowledge by destroying art, carvings and petroglyphs that oversee that country. Now, it may be thought that the loss of Indigenous knowledge is of little or no concern to the health and wellbeing of the ‘modern’ globalising world, but this thought would be entirely wrong.

Aboriginal peoples in NSW have built up extensive ecological knowledge through observation and experimentation upon the landscape over tens of thousands of years. They have successfully lived off the land whilst maintaining the important balance of all things within the ecosystem. Recently, Aboriginal peoples have developed seasonal calendars to illustrate the important connections between living things.

The creation of the interactive Gumbaynggirr Seasonal Calendar came about from years of documentation by myself. I undertook a process of writing down the information and knowledge attached to *jagun* and *bari* (my homelands) taught to me by my parents, grandparents, uncles and aunts. I was approached by the Australian Museum when they learned that I was developing an east coast NSW seasonal calendar. In line with cultural protocol in my family, I discussed the development of this calendar for my thesis and for the Australian Museum. This was also discussed with my Gumbaynggirr Elders.

The objective was to produce a multiuser touchscreen to illustrate and animate traditional Gumbaynggirr Aboriginal knowledge of climatic seasons for the Stage II Garrigarrang: Sea Country exhibition to be delivered in June 2016 at the Australian Museum. The Seasonal Calendar is based on Gumbaynggirr country (North Coast NSW) and illustrates the activities of flora and fauna in various sea and land habitats across a year divided into seven seasons.

The primary aim of the calendar was to build an educational medium that can:

- hold an extensive portion of Gumbaynggirr ecological knowledge in perpetuity for future generations
- share this knowledge with all users to educate and hopefully convince future generations to stop the destruction of the environment and start reversing the impact of the human footprint upon the earth and
- provide an educational medium that assists in understanding of Aboriginal worldview.

The anticipated outcomes was that users of the Gumbaynggirr Seasonal Calendar should learn that:

- Aboriginal peoples actively maintained the environment to support the balance of all living things within the ecosystem.
- Aboriginal peoples hold extensive ecological knowledge of their country. This locally based knowledge was learned from birth and maintained in language and culture.
- Gumbaynggirr people and other Saltwater mobs not only had ecological knowledge of the land but also the sea and sky (weather and atmospheric knowledge).
- Gumbaynggirr people could observe processes occurring on the land as indicators for what was happening in the sea.
- Gumbaynggirr people would only harvest plants and animals at times that would produce the most nutritious food whilst maintaining that population of plants and animals.

- Gumbaynggirr people would manipulate the environment so that plants and animals would thrive whilst creating conditions that minimised the amount of time needed to harvest those plants and animals.
- Gumbaynggirr people have no hierarchy of plants and animals. They know the value of all living things and therefore do not classify one as more important than the other. To ensure all knowledge of such plants and animals was maintained, specific people were given allocations of responsibilities for those species. Westerners often refer to these relationships that individuals have with specific plants or animals as totems.
- Current practices around the world are destroying the environment at a rate never before seen in the earth's history. The exponential rate of climate change occurring now will have dire consequences for all living things, including humans.

5.7.2 Climate

The climate of the north coast of NSW in Gumbaynggirr country is subtropical with warm to very warm wet summers and cool to mild dry winters. The main factor controlling the climate of the region is the transitional zone between the steady trade winds to the north and the anticyclone belt to the south, which oscillates northwards and southwards over the region annually. Strong wind gusts affect the region from time to time, which tends to be in association with meteorological phenomena such as the passage of cold fronts, severe local storms or ex-tropical cyclones (Bureau of Meteorology 2008). Within the Gumbaynggirr coastal environs, the Ganay Jindas (Goanna Sisters) are the creators of the north (*birraw*) and south (*wanggaan*) winds, which influence the atmospheric and physical coastline of the area. The sisters are also responsible for the making of the coastline.

Temperate waters dominate the Gumbaynggirr oceanic habitat, where a number of marine organisms are ecologically unique to the region (NSW Marine Parks Authority 2010). The biological diversity is primarily influenced by the East Australian Current (EAC), which flows in a southerly direction from the Coral Sea along the eastern coast, moving tropical warm waters. At points, cold core and warm core eddies detach off toward the Tasman Sea (NSW Marine Parks Authority 2010).

The oceanic waters of the area are low in nutrients and primary productivity. This is altered when convergence occurs, causing seasonal upwellings, promoting 'hot spots' of primary production and drawing nutrient-rich waters from depths of 200 metres plus. These often occur around the Cape Byron, Smokey Cape and Sugar Loaf features (ibid.).

Parallel to the outer shelf is a sequence of seamounts. Their interaction with currents promotes the movement of nutrients, detritus and organisms to a variation of habitats on the seamount slopes. These then promote large aggregations of deep-water fish such as orange roughy. Water depth ranges from 200 to 5800 metres in valleys and holes. Like the terrestrial geological shaping, the benthos contains basins, plateaus, ridges, canyons, shelves, terraces and slopes. Large predatory species (sharks, marlin, swordfish, whales and tuna) reside and migrate through the region (Commonwealth of Australia 2006).

5.7.3 The people: Gumbaynggirr area/clans spatial distribution

Approximately one thousand Gumbaynggirr people lived on the coast of southeast Australia before the disruption and onslaught of white settlement (Morelli 2008). There were many commonalities between the people, including a language, initiations, section names and creation stories. At the same time, loyalty and commitment to one's own clan and *jagun* (homeland) existed along with their dialects and traditions. An example is the Bagabaga (Nambucca) ancestors who belonged to the sea and the rainforest and the river hinterland. In each area, different clans (usually family groups) occupied the landscape; the people were as distinct as the landscape itself. Each *jagun* had its sacred paths and areas where the ancestral heroes passed on rites of passage and gods were remembered and honoured, but primarily by those clans who were *guumunbu* (belonged or related to each place). These clans were united by the women of the groups who were expected to marry outside of their own clan and spatial distribution, but inside the Gumbaynggirr tribe (Morelli 2008).

Marine harvesting and fishing practices for food and material resources would have probably dominated the lifestyle. The effects and changes of tides, seasons and moon cycles played significant roles in the sustenance processes of the coastal Gumbaynggirr marine people.

Sustenance was undertaken in all areas of coastal marine ecosystems and habitat types whether for the purpose of ceremony or sustenance. These species have sustained Gumbaynggirr people and their visitors for thousands of years and were harvested and managed according to Gumbaynggirr traditions and laws. In a contemporary context, coastal families continue to rely on the availability and abundance of these species for food, health and connection to Gumbaynggirr totem (the ocean).

Archaeological midden sites are tangible evidence of occupation associated with livelihoods and include burials and remains, tools and remains of species both marine and terrestrial (bones, shell). They are representative of campsites or occupation areas. Depending on habitat, the dominant

species indicate the staple diet from any given area (Collins 2004). An analysis of archaeological records of midden contents undertaken by Collins in 2004 found that dominant species include those from the gastropod, bivalve and mollusc families.



Figure 17: The Traditional Owners of Urunga and the Bellinger Valley. Source: Hodgkinson 1845.

The Gumbaynggirr are predominantly a coastal group. Much of the coastal environment provided adequate resources for continuous occupation throughout each season. The people of coastal Gumbaynggirr were heavily reliant on coastal resources.

The organisational context of Gumbaynggirr groups is quite interesting, as tribes on this coast extended considerable distances inland. Most encompassed the drainage basin of one river and stretched from the shoreline up to the coastal escarpment at least 30 kilometres inland (Flood 1995). It is uncertain how far back this territorial organisation goes, but it may well be quite ancient (ibid.). It meant that during sea level fluctuations tribes were pushed back into their hinterland rather than the territory of other tribes, providing a much less traumatic experience, as conflict for territory or resources was not required (Flood 1995:112). There is also a close link between the holding of lengthy ceremonies and the management of food resources. As a society becomes more complex, it increases its demand on the economy; a more intensive social system is linked to more intensive food management (Flood 1995:119).

The archaeological evidence of this complex society is seen at a midden located at the Golden Hole south of Stuarts Point, NSW. This area contains a series of extensive and preserved midden deposits (NPWS 2005). The Clybucca-Stuarts Point midden complex is the largest of its type (estuarine midden) in temperate Australia (Hughes and Sullivan 2002) and the largest in the southern hemisphere. It has been estimated that the Clybucca-Stuarts Point midden complex has a total volume of between 150,000 and 200,000 metres³ (NPWS 2005). It is somewhat continuous for 14 kilometres and consists of a band of deposits that lie parallel to an estuarine inlet. The midden contains fluctuating periods and species of estuary food resources. The archaeological examination of the middens revealed the shells of 16 species of molluscs and bones of six fish species, three species of sea bird, six species of land mammal and three species of sea mammal (Knuckley 1999). In comparison, the majority of larger middens in tropical Australia generally consist almost entirely of one species of cockle, *Anadara granosa* (Hughes and Sullivan 2002). In close proximity to the Golden Hole are a number of ceremonial areas; it is also in proximity to tribal boundaries. The area was primarily used as a trade, ceremony and gathering area for many tribes who travelled great distances to feast on the volumes of marine resources. The midden is a remnant and reminder of the vast trade that occurred and of the resource availability to sustain such large numbers of visitors for these events.

The forbidding regions of the northern NSW tablelands around Armidale are particularly cold and windy environments, and only one occupation site has been found at an elevation of over 1000 metres (AHIMS 2010; Flood 1995). However, ceremonial sites and art sites are moderately common. There are over a dozen bora grounds and stone arrangements associated with ceremonial practices. This high country is of religious importance as it's associated with the belief in a sky god (Flood 1995). This is also documented by Elkin (1977), who notes that medicine men of the Gumbaynggirr, a Bellinger River tribe, went to the mountains at set seasons of the year to undertake rituals with Yuludarla.

The Aboriginal worldview, in some areas referred to as the Dreaming, provided the basis for Aboriginal common law (customary law), which stipulated the relationship between the people and the environment or country (land and seascape). Similar to Aboriginal relationships with country, Aboriginal law may be described as 'holistic'. It governed every aspect of life. The law defined the physical and spiritual relationships between people and country, including natural resources (Schnierer et al. 2001). Intrinsically, Aboriginal law exemplified a form of natural resource management that ensured a balanced and sustainable use of resources. This type of management was characterised not only by its sustainable outcomes, but also by spiritual, familial and totemic aspects, which also gave affect to law and management. Such management is often referred to as 'caring for country'. This also includes water and its biodiversity (ibid.).

5.7.4 Constructing an interactive cultural calendar

Understanding and documenting resources, systems and processes operating in the Gumbaynggirr marine environment and traditional coastal landscape is not an easy task. The multi-layered cultural systems of the Gumbaynggirr and the interconnectedness between cultural biodiversity, social and cultural values and social systems is a multidimensional assessment.

The Seasonal Calendar now on permanent display at the Australian Museum aims to link the concept of interconnectedness between cultural biodiversity, social and cultural values and the relationship of the changing variabilities of the coastal marine environment. This includes the connection between ecological knowledge, cultural use, known resource information and ecological habitat communities, focusing on the marine and terrestrial interface of the coastal zone. It also enhances intergenerational knowledge transfer and retainment of ecological knowledge. I first undertook the documenting of my families marine TEK as part of my Masters of Marine science in 2011. I was then approached by the Australian Museum who were interested in the calendar as a permanent display. At this time, the Australian Museum was developing a Sea Country exhibition that aimed to launch during Corroboree Sydney in November 2014. Sea Country tells the story of Indigenous Australian relationships with the sea and coast lines and illustrates the extensive knowledge, technology and spiritual connections that are so unique to our coastal Aboriginal communities. I was approached and commissioned to design the calendar into a 3D interactive display as a permanent display in the museum.

Putting together the Seasonal Calendar was essentially an exercise in mind mapping, relating oral tradition, species ecology and species movement of migrations from an oral tradition into an animated visual, graphical, digitised and computerised context. It required a framework and a formula that encompassed the essence of knowledge and that relationship to species and environment. It included identification of primary and secondary species of ecological knowledge and then primary and secondary habitats, the associative context to atmospheric and oceanic variabilities or patterns and time.

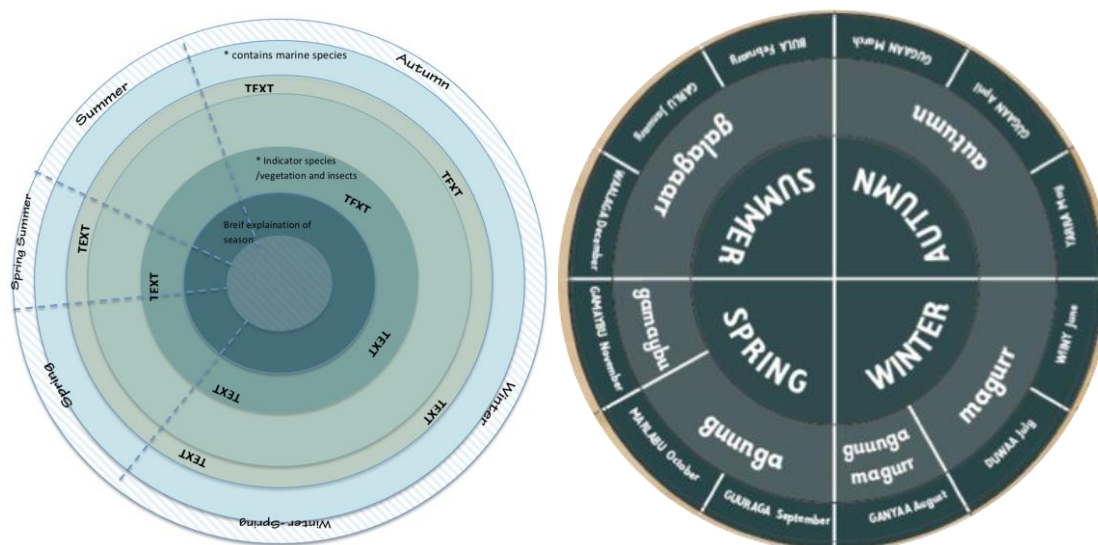


Figure 18: First draft of the Gumbaynggirr calendar and mind mapping of species and text (left). Second draft of two-dimensional static display (right). Source: C. Marshall.

The target species then needed context into habitat and then habitat into contextual arrangement and then, design. This technological method of knowledge transfer and storage required detailed thought on intaking an oral tradition and knowledge that has been passed onto me over years through oral and real time visuals and hundreds of decades of learning and translating it into one contextualised and technological design. Admittedly, it took a lot of working out in relation to the contextual and structural framework, two years actually. Then, on top of that, was the western components of resources, resource availability and space available in digital formatting, space being the primary factor in how many species could be represented and what seasons could be displayed and interpreted. This then left a lot of species and interconnected or secondary species out of the calendar, because of the limited capacity of the computer, resources and design to hold the certain amount of species.

At this time, the Australian Museum was developing a Sea Country exhibition that aimed to launch during Corroboree Sydney in November 2014. Sea Country tells the story of Indigenous Australian relationships with the sea and coast lines and illustrates the extensive knowledge, technology and spiritual connections that are so unique to our coastal Aboriginal communities. I was approached and commissioned to design the calendar into a 3D interactive display as a permanent display in the museum.

As part of this exhibition, it was extremely important to illustrate traditional ownership of the Sea Country through language, knowledge and oceanic totems. The creative displays varied with each group's contribution, showing the many different individual components of Sea Country connecting the coastal groups through the medium and element of ocean. This exhibit also aimed to educate audiences on the different nations and individual group's relations and responsibilities over their Sea Countries. Consideration was given to the fact that sometimes audiences do not understand the diversity and depth of Indigenous Australian culture and this was an ideal opportunity to educate and share with a range of audiences.

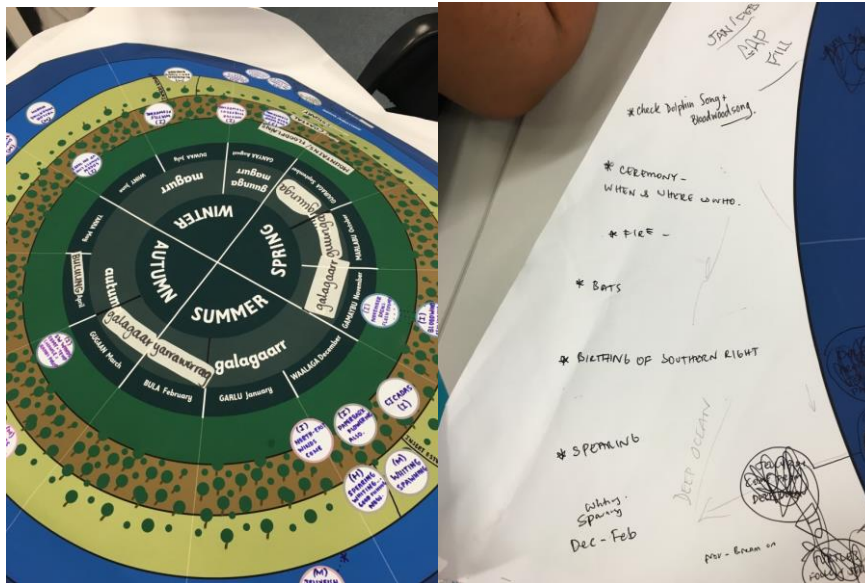


Figure 19: Third draft and the organisation of connectors and sequences of flow in drafting knowledge visually. Source: C. Marshall.

5.7.5 Garrigarrang: Sea Country exhibition at Australian Museum

5.7.5.1 The Gumbaynggirr Seasonal Calendar touchscreen

As outlined, the Gumbaynggirr Seasonal Calendar started its life as oral tradition transferred into data within an Excel spreadsheet (see tables 5 and 6). It then manifested into a six-millimetre ply static display. Two years later, in conjunction with the Australian Museum, I developed, designed, stylised, and arranged the exhibition content and associated technical specification a multiuser touchscreen to illustrate and animate traditional Aboriginal knowledge of climatic seasons for the Stage II Garrigarrang: Sea Country exhibition delivered in June 2016. L. McBride was the exhibition curator and project manager of the funding. Eye Candy Animators built the models and inserted the species into 3D models and undertook the technical specs from myself.

The Seasonal Calendar based on Gumbaynggirr country (North Coast NSW) illustrates the activities of flora and fauna in various sea and land habitats across a year divided into six seasons, highlighting the interconnectedness of atmospheric and oceanic changes and the response of ocean and terrestrial species. It then highlights the intimate knowledge that Gumbaynggirr people had of climate, the environment and its ecological cycles.

The detailed content and information required the ability of users or visitors (including international visitors) to interact with the following information:

- Gumbaynggirr seasons/times of year
- oceanic/atmospheric occurrences
- Gumbaynggirr country habitat
- Gumbaynggirr country seasonal land flora and fauna activity
- Gumbaynggirr country seasonal marine species (and the actions they undertake)
- Human action
- Climate change

5.7.5.2 Design concept — technical specifications

The fundamental design technicality was the development of software to meet the following specifications:

- Delivery of a fully working program and hardware, preferably not on a Mac system.
- Preferably a small format computer or Bright Sign media player.
- The user interface to have a seasonal calendar as a background with approximately seven hot spots enabling users to move to the next interface of seven habitat hot spots, which could then move to a landscape cross section with six to eight hot spots providing text boxes of information when activated. This hot spot should then also create a corresponding hot spot to be activated, possibly including the sound of Aboriginal language words. Two other layers of information involving human impact on the environment and the traditional cultural practices associated with seasons was also to be included.
- Attraction or screen saver mode to be automatically started after two minutes of idle time. Auto start and shut down options required.
- The touchscreen would display a circular calendar with a hot spot on each season where the user could select a habitat or species. This would then activate a screen from which the visitor could choose from seven different land and sea habitats such as mangroves, open seas, headlands or forest to discover.
- Preferably the display being an 80" screen with a 4k resolution. Installation and space specifications were also included.
- By selecting a habitat, the user is then taken to a detailed cross section of that habitat populated with plants, fish, animals and sea currents to learn about land/sea connections.
- Once selected, the user would discover how activities on land can tell us about what is happening in the sea, i.e. crabs are plentiful, wattle plant is flowering, etc.
- In addition to the above information, the technical design also needed to include:

- traditional cultural practices connected to land and sea activity
- images and information explaining seasonal cultural practices such as ceremonies, meetings and corroborees
- how human impact is changing the environment
- images and information on the various man-made structures and activities in the last 200 years that have affected the traditional activity of flora and fauna and climate change.

5.7.5.3 Design concept

I was primarily trying to portray sciences of knowledge. There were intense design considerations in how to communicate this:

- Mood board — for cultural authenticity and motion.
- List of creatures and connectors (indicator and secondary indicator species).
- Habitats and environment.
- Models of species selected.
- Where to place elements, where each object fits.
- How creatures/species fit/sit in the landscape; perspectives.
- How to stylise species differentiation from each other, how to individualise each object, and how these fit with other species' movement.
- Learn about land/sea connections.
- Once selected, discover how activities on land can tell us about what is happening in the sea.

The design concept required the ability of the user to:

- Select a season.
- The touchscreen would then display a circular calendar with a hot spot on each season in which the user can select a habitat.
- This would then activate a screen from which the user could choose from seven different land and sea habitats such as mangroves, open seas, headlands or forest to discover. By selecting a habitat, the user would then be taken to a detailed cross section of that habitat populated with plants, fish, animals and sea currents.

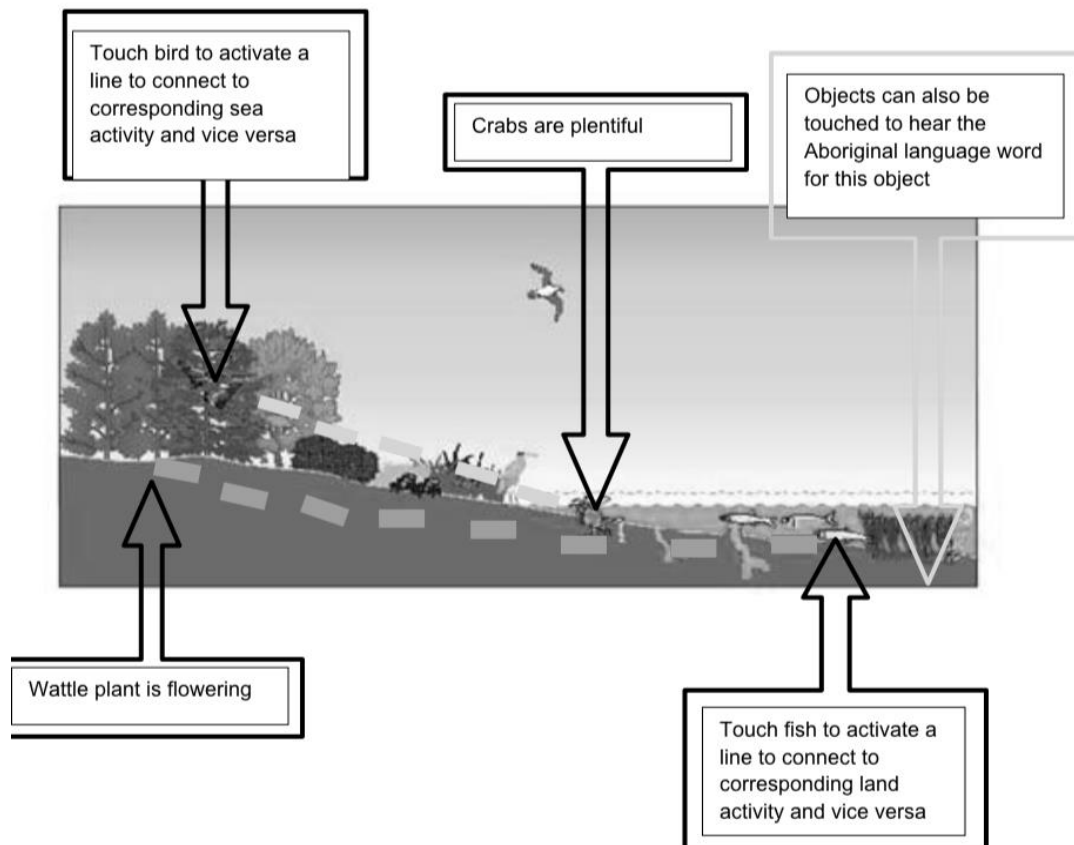
In addition to the above information, the calendar needed to include living culture and current cultural resource issues. Therefore, the interactive display also needed to include:

- traditional cultural practices connected to land and sea activity
- images and information explaining seasonal cultural practices such as ceremonies, meetings and corroborees
- how human impact is changing the environment
- images and information on the various man-made structures and activities in the last 200 years that have changed the traditional activity of flora and fauna and climate change.

The following panels from the display illustrate the cultural basis of the displays and their interactive nature.

Learn about land / sea connections

Once selected, discover how activities on land can tell us about what is happening in the sea.



In addition to the above information we would like to include:

Figure 20: The relationships of graphics and interconnections of species designed by C. Marshall and L. McBride 2016.

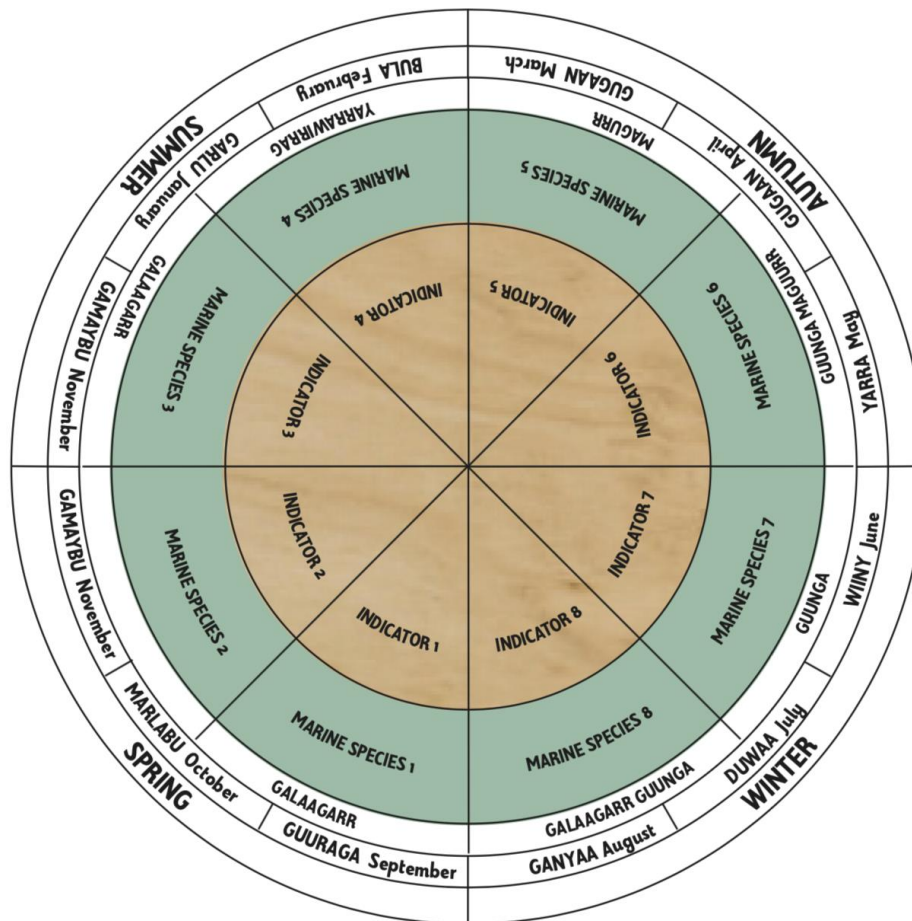


Figure 21: Second draft of calendar with species and indicators organised. Source: C. Marshall.

5.7.5.4 Converting and inserting cultural environmental data

Development of a methodology for the assessment of habitat associations was directed by three key factors. The first was recognition that language played an essential part in governing the attributes to culture and landscape and understanding the range of habitats within the study area. Secondly, a uniform approach to the storage and conversion of data and the adaptable analysing of this information was required to maintain consistency in the display of marine cultural biodiversity and habitat information. Lastly, in understanding the range and multi-dimensional degree of Gumbaynggirr cultural places present in the marine environment and the assessment of the cultural values attached, it was pertinent to explore associated information about activities and features and the connection between all element types. This approach looked at events and activities that linked elements of life and cultural history. The methodology approach followed similar cultural values and attachment studies applied within Australia and abroad.

The context and relevance of information primarily led the focus of elements and variables to include information where relationships could be detailed in a systematised manner. The secondary component was allowing this scale to be used in species values. The various cultural attributes to these sites was also expanded on, giving rationale to the significance of bio-cultural elements.

A system was devised to translate oral knowledge into a spatial format by extracting explicit details of resource, species and habitat and associated linkages or secondary variables into feature point locations or polygon areas.

The following data was the foundational layer of the build. It was the basis of the design and the flow of knowledge connections. Gumbaynggirr country, like most Indigenous language groups, has more descriptors for seasons than the standard European or northern hemisphere seasonal language. There are seven seasons of shorter periods but relevant to the locational variability in bio region, geography or weather and climatic variables.

Gumbaynggirr people have given western calendar months their own language names:

1. January — Garlu
2. February — Bula
3. March — Gugaan
4. April — Buluung
5. May — Yarra
6. June — Wiiny
7. July — Duwaa
8. August — Ganyaa
9. September — Guuraga
10. October — Marlabu
11. November — Gamaybu
12. December — Waalaga

The associated six seasons are:

- Galagaarr — December, January, February. This season is characterised by *galnyam wiigun* (heat and moisture) and *barraa* (big rains).

- Yarrawirrag — March, April, May. *Niirum* (getting cold).
- Maguurr — June and July. *Niirum* (cold, frost and ice on mountains). *Darrabin maguurr* (dry time).
- Guunga Maguurr — August. This is a transition season called Winter-Spring in English. Characterised by *gaabalay* (westerly winds) and *guluun* (rain).
- Guunga — September. Warming and birds and other animals starting to nest.
- Galagaarr Guunga — October and November. Characterised by *barraa* (big rains/rainfall), *guluun* (rain) and *gaabalay* (westerly winds).

Galaagarr		Yarrawirrag			Maguurr		Guunga Maguurr		Guunga	Galaagarr Guunga		Galaagarr
SUMMER		AUTUMN			WINTER		SPRING			SUMMER		
Summer	Wiigun – wunba		Cold		Winter		Winter –Spring			Spring Summer		Summer
Hot moist (Galnyam wiigun)			(niirum)		Dry (Darrabin Maguurr)		Westerly winds (Gaabalay)/rainfall Guluun			Big rains (Barraa)Rainfall Guluun /westerly winds (Gaabalay)		
Big rains (Barraa)												
January	February	March	April	May	June	July	August		September	October	November	December
Garlu	Bula	Gugaan	Buluung	Yarra	Wiiny	Duwaa	Ganyaa		Guuraga	Marlabu	Gamaybu	Waalaga

Table 5: First draft of organising oral climatic knowledge into an Excel spreadsheet.

	december waalaga	jan garlu	feb bula	march gugaan	april buluung	may yarra	june wiiny	july duwaa	august ganyaa	september guuraga	october marlabu	november gamaybu	
	summer			autumn			winter			spring			
	galaagarr			yarrawirrag			magurr		guunga maguurr	guunga		gamaybu	
	Bloodwood flowering and Paper Bark Flowering				Red black n yellow Butterfly			Wattle flowering				Bloodwood flowering and Paper Bark Flowering	
	Dogwood bush flowering			White Butterfly	Large green sawfly in limes down trees				Dogwood bush flowering				
	Cicadas calling					Mutton Birds migrating and nesting			Coastal Tea tree flowering indicator Native Hibiscus flowering		Cicadas calling		
	Bream on the bite				Sea Mullet start Migration Up Coast		Tailor run up coast and Cod active			Sharks around following migration fish			Bream on the bite
	Oysters fat and good to eat				cobras best as water clear and clean		Bream spawning in close near estuary entrance			Pilchards start spawning	Oysters getting fat		Oysters fat and good to eat
	Snapper in close to shore and Prawns running		spies best and fat			Drummer active around rocky shores			Whiting good for eating fat			Snapper in close to shore and Prawns running	
	Whiting Spawning. River mouths, good spawning			Ludrick/Blackfish spawning near estuary opening				Blackfish abundant seagrass and rocky shores				Gar fish start moving and become abundant	
	Humpback whale south migration			Mullet leave estuaries for migration			Humpback whale fish migration				Humpback whale south migration		

Table 6: Second draft of organising species and climatic oral knowledge into a spreadsheet. Source: C. Marshall.

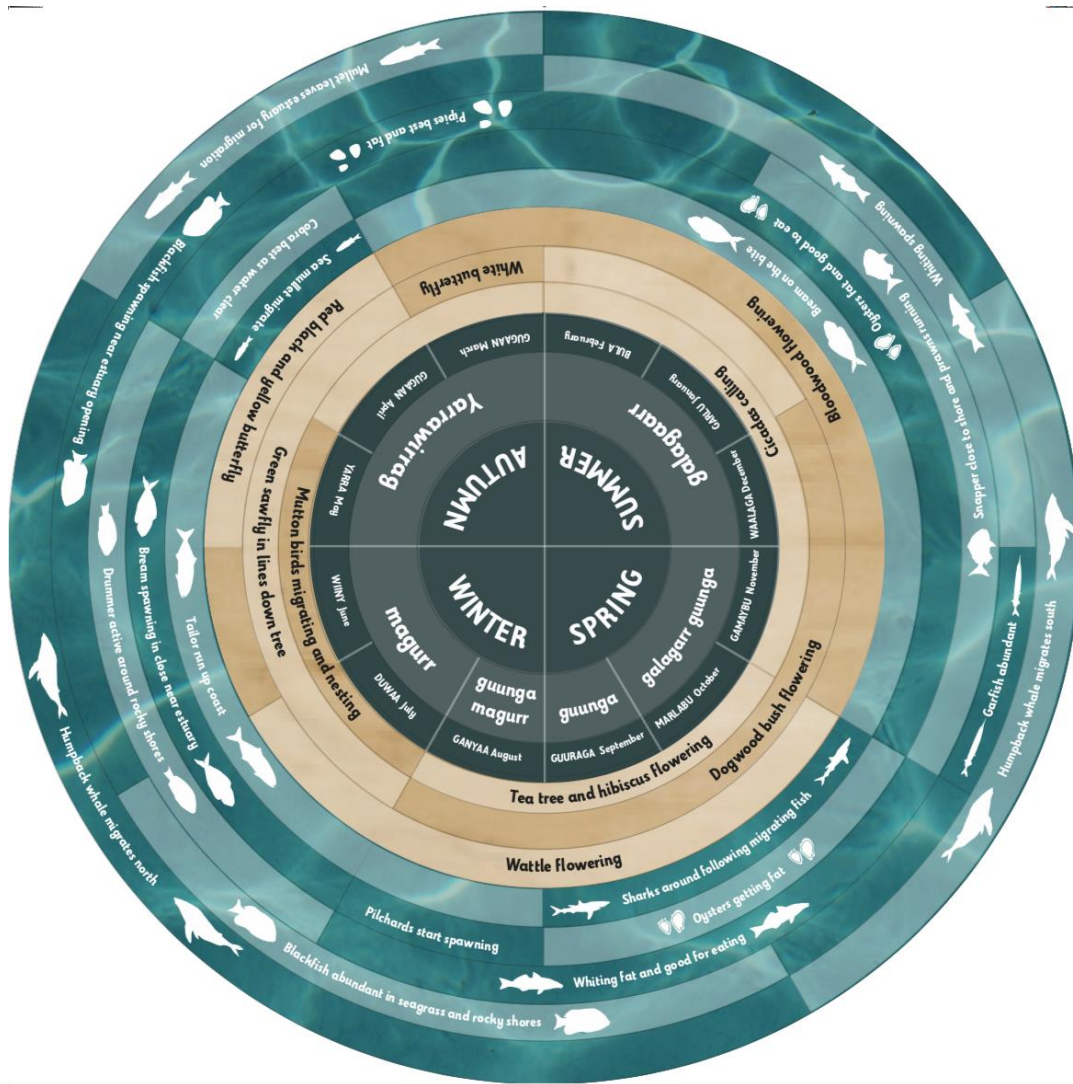


Figure 22: The final version of calendar one in a two-dimensional layout. The initial design comprised of six-millimetre plywood with decals. Source: C. Marshall.



Figure 23: The installation of the two-dimensional calendar at the Australian Museum in 2015.

Source: C. Marshall.

5.7.5.5 The seasonal calendar and species and technical specifications

Relating oral tradition, species ecology and species movement of migrations from memory within an oral tradition into a graphical and computerised context that required a framework and a formula that in essence attempted to organise species into habitat and then that habitat into contextual arrangement and ultimately design was difficult. The initial design comprised of six-millimetre plywood with decals. Then, as a second stage, the two-dimensional calendar was converted into a multi-dimensional interactive display. It was important to then present all species in Gumbaynggirr language. Intaking an oral tradition and knowledge that have been passed onto me over four decades of cultural learning into one contextualised, technological design took a lot of mind mapping and working out in relation to the contextual and structural framework. Then, on top of that is the technical western components of resources, resource availability and space available in digital formatting, space being the primary component of how many species can be represented and over what seasons can be displayed and interpreted. A lot of species and interconnected or secondary species were then left out of the calendar due of the inability of the computer and design to hold the amount of species and resources applied.

Development of the multi-user interactive tabletop required detailed consideration to written material and specific imagery to feature within the interactive components, including:

- concept/user experience design
- art/design – type of animals and design
- concept/visual design
- environment creation
- creature/asset creation stylised – constructing 3D animals
- creature/asset animation – making sure they can move and don't look unusual
- UI design/creation – implementation of motion to enhance interactivity
- Code programming
- A functional prototype
- animal AI (Artificial Intelligence)
- implementation of art and UI
- implementation of special effects
- environment interactivity – connections interface for species to environment
- a final PC for the multi-user touchscreen
- hardware
- PC gaming spec and
- a NEXPRO 65" screen.

5.7.5.6 The process of animation and movement

The process of animation and movement included:

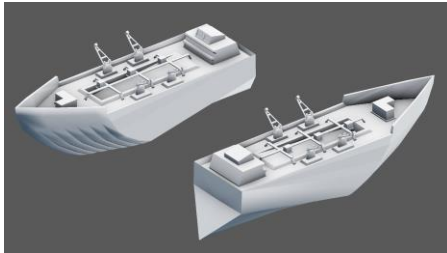
- linking species and their motions
- a move into interactive format
- pop ups and cultural information inserted, then linked to each element and its form
- testing and playing through each element (pop up narrative and time and space)
- in testing space, ensuring that each narrative (pop up) has enough space to move
- putting on hard wear
- modelling stats in digital node with no colour or surface, colours and texting and surfacing elements together in interactive space (software form) and using to test calendar rotating seasons moving with species and species moving with seasons

- bone or skeleton systems within human digital puppets
- setting up camera and lights
- similar to a moving diorama
- articulating in each camera movement
- enhancing the learning experience and
- allowing for greater interactivity in creative expression.

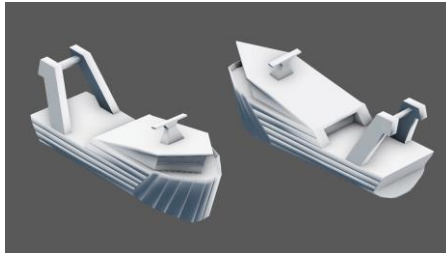


Garrigarrang Exhibition, Seasonal Calendar Touchscreen: Elements: Human Impacts

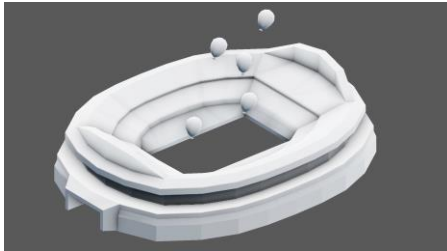
Dredging Ship



Fishing Boat



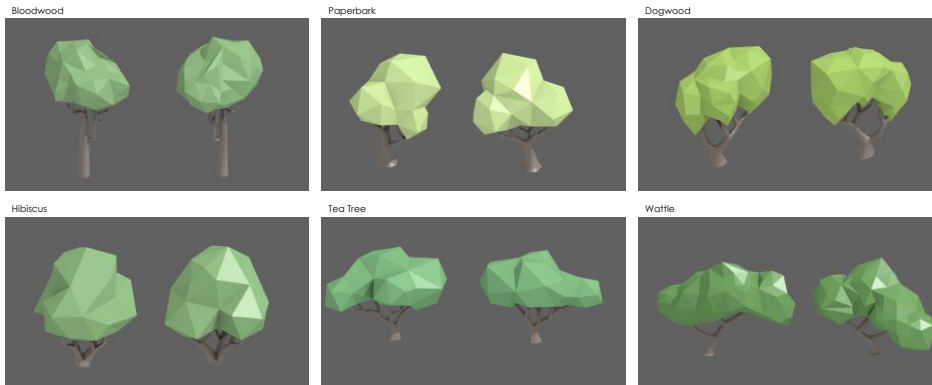
Stadium



16 PETRIE PLAZA CANBERRA CITY - PO BOX 734 CIVIC SQUARE ACT 2608
CBE: +61 2 6162 1933 - STD: +61 2 9514 1000 - eyecandyanimation.com

Figure 24: The human influences on ecological cycles 3D models. Source: Eye Candy Animations 2016.

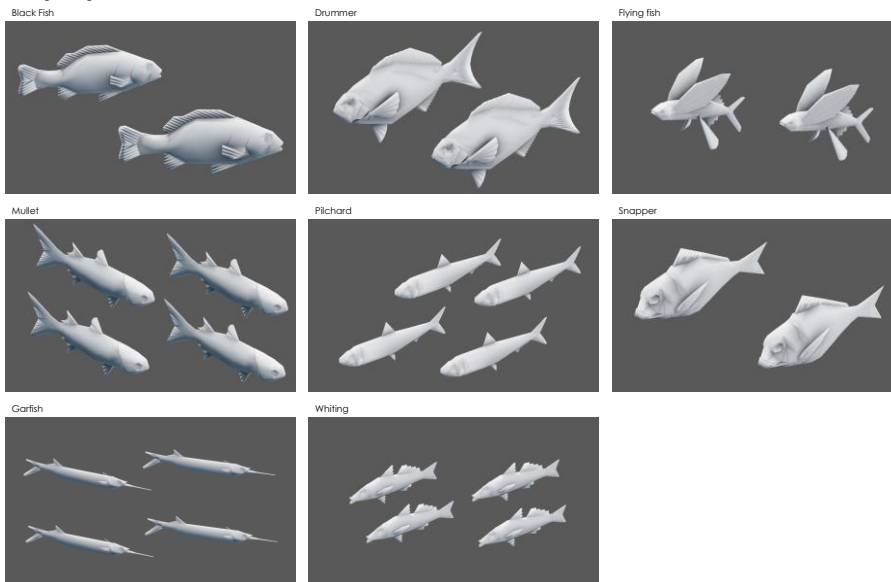
Garrigarrang Exhibition, Seasonal Calendar Touchscreen: Elements: Trees



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Figure 25: Vegetation indicator species 3D models. Source: Eye Candy Animations 2017.

Garrigarrang Exhibition, Seasonal Calendar Touchscreen: Elements



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Figure 26: Fish species as a primary resource and indicator species 3D models. Source: Eye Candy Animations 2016.

Garrigarrang Exhibition, Seasonal Calendar Touchscreen: Elements

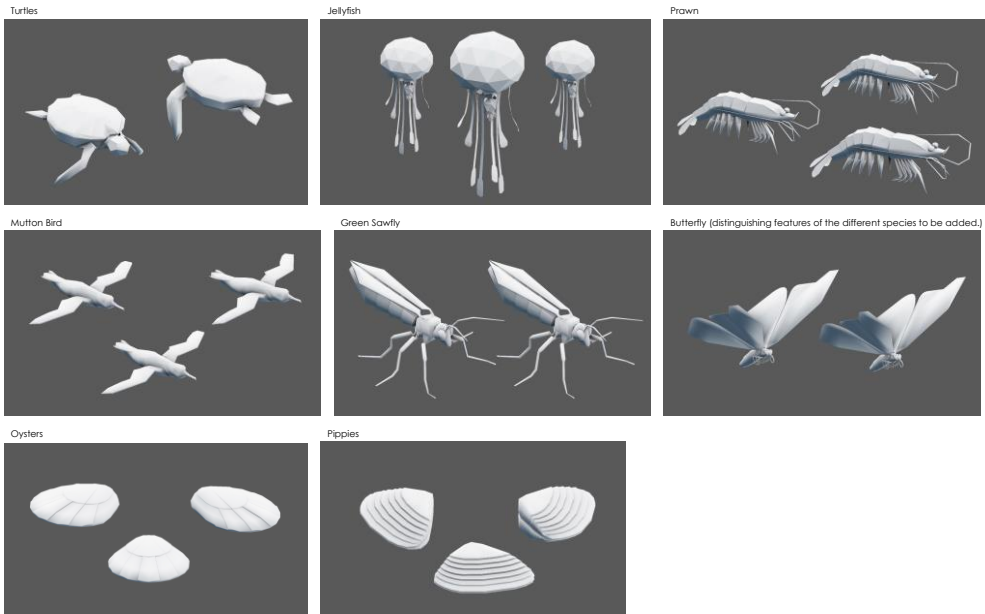


Figure 27: The making of indicator species and secondary species 3D models. Source: C. Marshall and Eye Candy Animations 2017.

Garrigarrang Exhibition, Seasonal Calendar Touchscreen: Elements: Humans

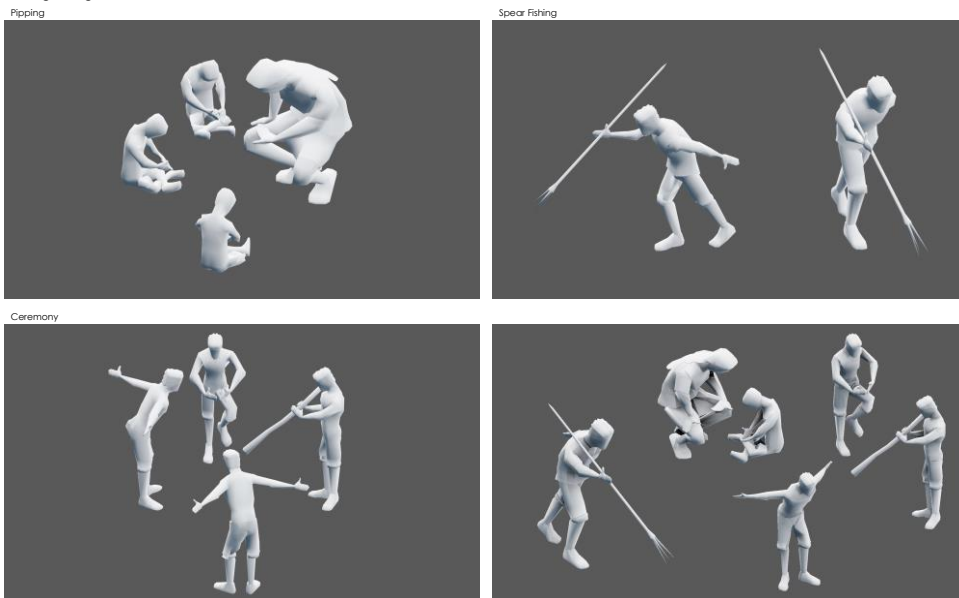


Figure 28: The interactions of people with landscape and seasonal activity 3D modeling. Source: Eye Candy Animations 2017.

Garrigarrang Exhibition, Seasonal Calendar Touchscreen

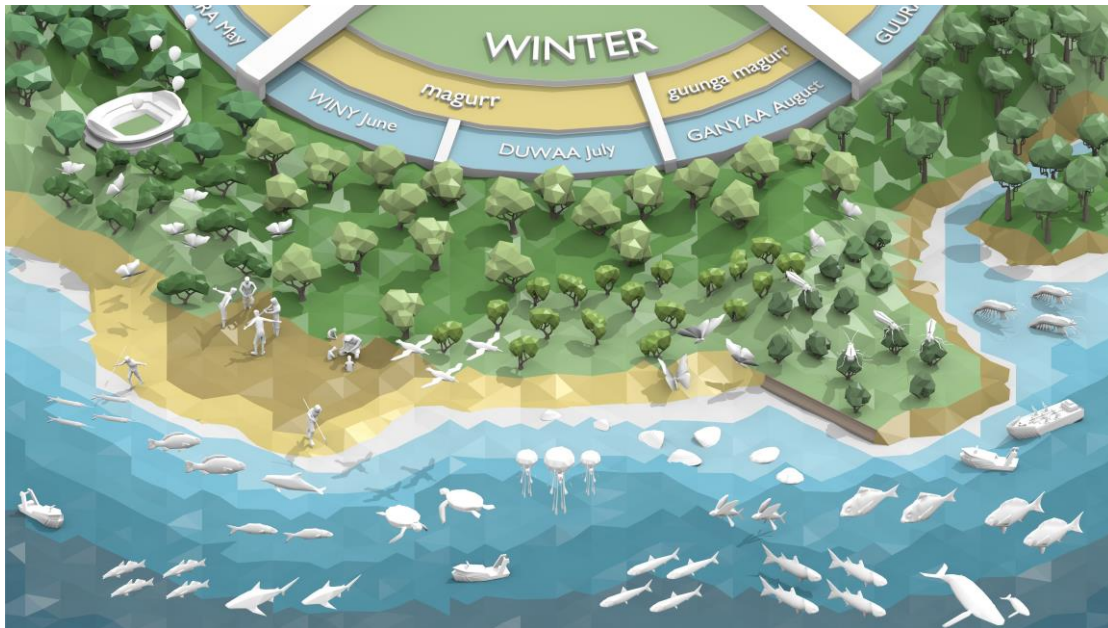


Figure 29: The final version of calendar two in digital format with all species and human influences. Source: C. Marshall and Eye Candy Animations 2017.



Figure 30: Australian Museum Aboriginal guides test the Gumbaynggirr Seasonal Calendar digital installation at the Australian Museum in 2017. Since installation, approximately 80,000 people have interacted with the calendar, based on touch programming and entry to exhibit (pers. Com L.

McBride Australian Museum).

5.8 Case study 2: Gumbaynggirr Women's Spirit animation

5.8.1 Introduction

The making of the landscape, mountains, rivers and stone formations took place in a time none of us can comprehend. In time and scale it is immortal. Our Aboriginal traditions have been passed down through oral history for generations and generations. Events in Gumbaynggirr oral history speak of creation, particularly creation of landscape and geography, which give meaning to place. Creation links people to the geographic place or place to people. These stories have been handed down over decades, even centuries, in Aboriginal cultural time scales.

The making of Gumbaynggirr country involves many ancestral beings. They provide meaning and reason for existence. The story, the reason it was created and the evidence of the event can be seen in this cultural land and seascape and have attachment to language. The whole existence of people revolved around dynamics and events in the landscape, Earth, moon, sea and universe.

In the story, being the reason for it happening and the evidence of the event, the ecological knowledge attached and the visual explanation in species behaviour, atmospheric events or geological features in the landscape can be seen. This formation of landscape was described by Gumbaynggirr people and language developed to explain. Terms and references to new and evolved land and environmental components, ecosystems and biodiversity give explanations to these processes. The whole existence of people revolved around dynamics and events in the landscape, Earth, moon and universe as well as environmental changes and changes to the landscape. Spirituality of place plays a large role in the understanding of events (sea rise, seasons, weather, resources, natural forces, wind, rain, air, the solar system, stars, meteorites, geographical land formation, etc.).

The Gumbaynggirr Women's Spirit animation highlights the role and function of women in Sea Country. The emphasis is on nurturing and illuminating these roles to demonstrate how they maintain the connection between humans and the ocean. It explains visually and by narrative the intricate relationships and unions reinforced by ceremony and sacrifice.

ASSOCIATIONS	Key Factors in Applied in Cultural Attributes
LANGUAGE	Creation, social organisation, resources and trade, spirituality, spatial distribution (dialects)
SOCIAL ORGANISATION	Sub tribes, Family clans, Sections
SPATIAL DISTRIBUTION PATTERNS	Family clans and resource requirements, spirituality
ECONOMIC RESOURCE	Sub tribes, Family clans, Gender, age, Sections and level of hierarchy , locations, resources and trade, spirituality
TRADITIONAL SYSTEMS OF MGT	Sections and level of hierarchy, spirituality, ceremony
SUSTENANCE	Gender, age, Sections and level of hierarchy, tribes, Family clans , locations, resources and trade, spirituality
CREATION	Social organisation Governance systems
SPIRITUALITY	Governance systems
CEREMONY	Spirituality, resources and trade, gender, age, Sections and level of hierarchy, connection
INHERANT RESPONSIBILITIES (CUSTODIANSHIP)	Spirituality, resources and trade, gender, age, Sections and level of hierarchy, ceremony, Family clans

Table 7: Evaluation of associations and applied attributes of environmental landscapes. Source: Marshall 2012.

5.8.2 The making of gagaal (the sea) — totem of the Gumbaynggirr people

This story is one of the first ever told to me when I was about five years old. It explains the making of the ocean by two sisters and their place as the wind and the stars. The story also has deeper meanings in its narrative. To the Gumbaynggirr, the sea is life. It controls the earth's water and sustains our existence. It can sooth and heal yet be dangerous and destructive. It is an elemental force to be respected. This was my first understanding of the role women have in the caretaking and the sentinel components of the women and ocean ceremony.

A war party went out from the people living where Scotts Head is today. They went across where the sea is now; but there was no sea then. They left two young women, the Goanna Sisters, behind.

Young Mopoke man also stayed behind in a cave, which is now under the sea. He came out when the party had gone far away, for he wanted to marry the younger sister. He said to her, 'Stop! I want to marry you.'

But the older sister said, 'No, you have to marry me!' He then became angry and attacked the two sisters, leaving them unconscious. The older sister woke and helped her sister. They gathered yams and honey and then took them home. The Mopoke man came again and asked the younger sister to marry and if not, he would kill the both of them. After he left, the older sister told her sister to get some sap from a vine and mix it with some honey.

The young man came back again and asked the younger sister to marry him, but again the older sister said, 'No, you have to marry me!'. The younger sister could see he was getting really angry and

asked if he would like some honey to drink. He drank it and flew outside for it had turned him into a bird, and all he could say was 'mopoke, mopoke'.

The two sisters then made fun of him. They went to Ganaygal, the sacred place for yam sticks (where Moonie Beach is today). They cut two yam sticks from the 'never break' trees growing there.

The older sister said, 'Do the same as I do with this yam stick.' She started stabbing the ground and said, 'Turn to water' — water gushed out. She then struck the ground with the yam stick and said, 'Turn to sand!' — the soil turned to sand.

The younger sister stabbed the ground with her yam stick said, 'Turn to water' — water gushed out. She then struck the ground with the yam stick and said, 'Turn to sand' — the soil turned to sand.

The two Goanna Sisters then kept going making the sea and sand as they went. The older sister went south, that is why the stronger wind comes from the south. The younger sister went north, that is why the weaker wind comes from the north.

When they had finished making the coast they went up into the sky and became the star group ganay (yam sticks), the last two stars in the Pleiades constellation. The sacred place where they last rested is Split Solitary Island. You can still see their crossed yam sticks there as well.

Story told by Uncle Harry Buchanan, Gumbaynggirr Dreamings: The Stories of Uncle Harry Buchanan, Gumbaynggirr Language and Culture Group 1992.

5.8.3 Ancestors and spirituality — the creation stories, spirituality and belief systems

The making of Gumbaynggirr country involves many ancestral beings. They provide meaning and reason for existence. The story is the reason for it happening and the evidence of the event can be seen in the landscape and has attachment to language. The whole existence of people revolved around dynamics and events in the physical environs, ocean, landscape, Earth, moon and universe.

This formation of landscape was described by Gumbaynggirr people in story lines and they developed song lines to explain. Terms and references to new and evolved environmental components, ecosystem and biodiversity have spirituality to place and play a large role in the understanding of environmental events (sea rise, seasons, weather, resources, natural forces, wind, rain, air, the solar system, stars, meteorites, geographical land formation, etc.). Much of the Gumbaynggirr historic accounts are elemental in their nature.

The religious background of the Gumbaynggirr derives from one god — Yuludarra. As first recorded by A.C McDougall in *Science of Man* (1900), this foundational story was also documented by G. Laves in 1929/1930 and Eades in 1979. The origins of this creator are derived from the first man who came from the east, or rather the sea, the land of the sunrise, and travelled across to the land of the sunset in the west. Yuludarra is described as living on mountain tops and when death comes to the people of the land, Yuludarra will go with them to the other side of the sea (McDougall 1900). Yuludarra is also the creator of several waterholes and features that have association with other ancestor heroes' many *mirral*, or sacred places attributed to these ancestor creators.

The retained oral knowledge of spiritual connections to creators, landscape and elements along story/song lines shows interconnected sites, anchoring cultural identity and place. In his paper *A Sea of Dreams: Valuing Culture in Marine Conservation*, Cordell (2007) found common themes running through the ethnographies of both Melanesian and Aboriginal societies related to the origin of people's spiritual connections with the natural world through the creation acts of primordial beings along 'Dreaming tracks', a series of linked sites, story places or song lines.

Creation stories give explanations to the origins and systems of life and the surrounding landscapes and environments (story lines). Many either reflect historical events in time and space or provide guidance on how to live with meanings of fundamental issues of life. There can be many versions based on gender, status or group, but all contain the core essence of origins and systems of life. The laws, values and customs form part of religious systems and societal structure.

It is through these story lines that song cycles, rituals and ceremonies are undertaken and the deeds of the various gods and beings remind Aboriginal peoples of origins and distinct ways of knowing. This is passed down through oral tradition, where acquired knowledge of taboo rituals and environmental attributes such as seasons and species provide sustenance, appreciation and social cohesion within the tribe and reassurance of life, including social rituals, sacred places and objects and totemism (Barrett and Wuetherick 2012). Much like today, social ritual played a vital role in resource access, use and acquisition. Ceremonies for increase are performed to maintain a continued and improved supply of food species (Muurrbay Aboriginal Language Centre 2005). These include such ceremonies as transversing with the *miirlarl* (special place) by men and women who were *guumunbu* (belonged) in origin to that area (ibid.).

Another significant ceremony is for increase where transmission is performed to maintain a continued and improved supply of food species (Morelli 2008). Arrangements or markings could also be cleaned up or retouched (ibid.). In Gumbaynggirr country, sacred areas are usually associated with danger or

powerful areas, some often secret. *Jaagi* or *jagii* refers to sacred rituals objects and places in the Gumbaynggirr language. Objects can be any natural element that has an association with place or site.

5.8.4 Spirituality and connection

Spirituality, cultural practices and connection are an interconnected realm; it is the nexus of Gumbaynggirr culture and knowledge. On review of creation stories associated with marine environments, these stories and the liminal beings involved showed equity in existence. Belief systems hold regard to every organism having right and place to exist and undertake a role in ecosystem dynamics.

The underlying messages contained in such creation stories show elements of lore and customs such as the ceremonies for increase sites. The oral knowledge handed down exposes means that explicitly outline how to exist, live and use resources sustainably (i.e. the Muurrbay tree, another Gumbaynggirr story that relates to issues such as greed), the use of totemism and anima (concept of hybrid liminal being taking two forms, that of human and animal) in relationships and society framework. Assisted in environmental ecosystem function, these primarily deciphered law and order. This then lead to how marine resources were managed and knowledge of species ecology, species habitat and ecomorphology, including such things as harvest times (based on abundance and potentially high nutrition (protein yield) or biological understandings, i.e. knowledge of biotic factors, physiology, spawning, structure, growth and functioning, therefore providing abundant resources).

The physical aspects of the ocean, land, atmosphere and their associated environments, products and features are cultural landscapes given significance by Indigenous doctrinal systems (Elkin 1994). These cultural landscapes are both the result of, and provide the focus for, ancestral events, together with Indigenous peoples' social, political and religious systems. Lands and environments are interwoven into a tightly integrated cultural system. This integrated cultural system forms the basis for Indigenous knowledge.

Cultural practices and connection were an interconnected realm, the equity in existence, where beliefs systems held regard to every creature having right and place to exist and undertake a role in nature dynamics. Stories of creation and the liminal beings who constructed landscapes and natural features hold meanings in how to exist.

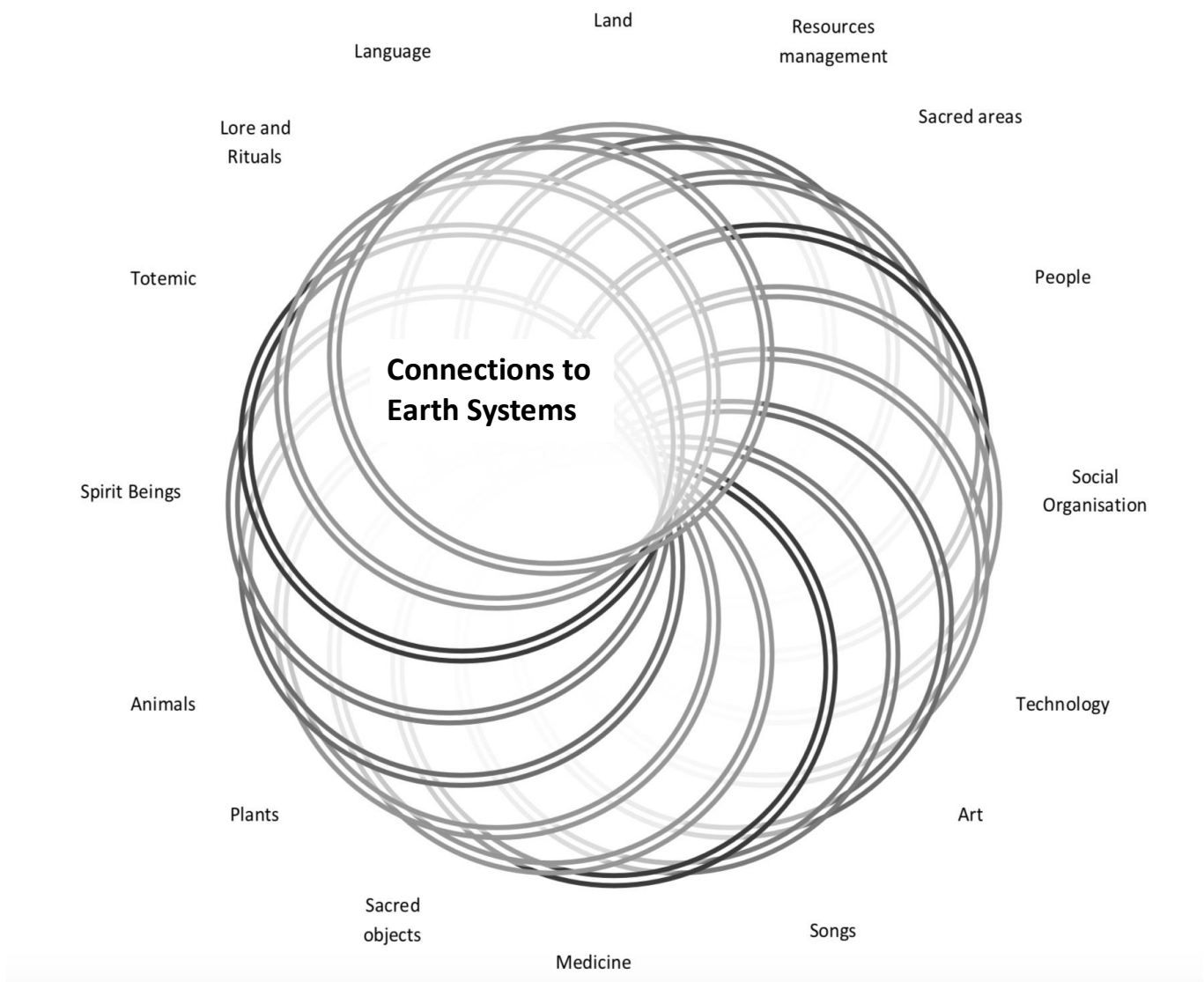


Figure 31: The twenty spheres of Aboriginal connections to Earth systems

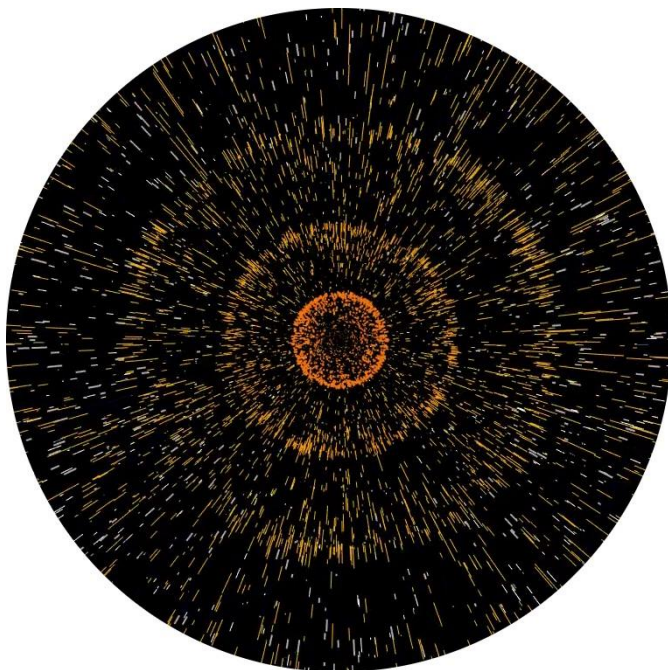
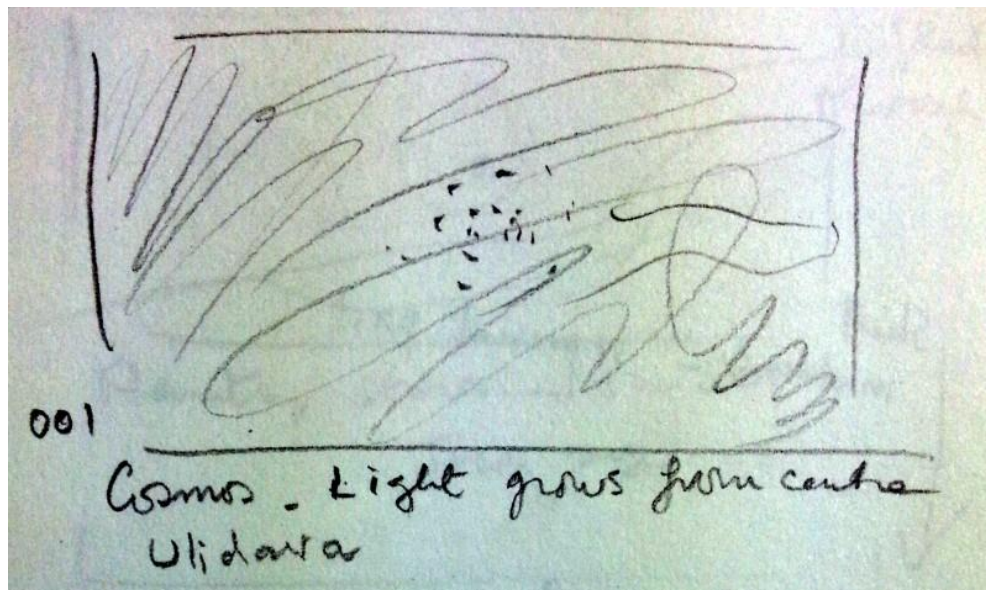
5.8.5 Gumbaynggirr Ngumi creation story — animation storyboard

Story/Gumbaynggirr cultural knowledge/design: Chels Marshall

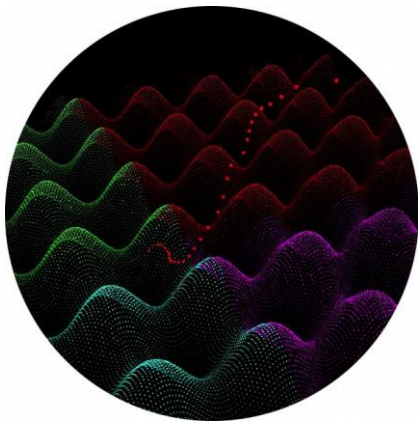
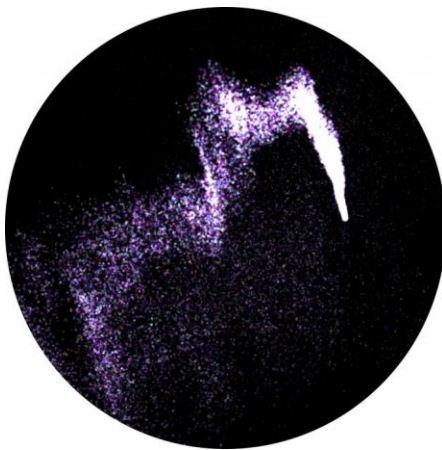
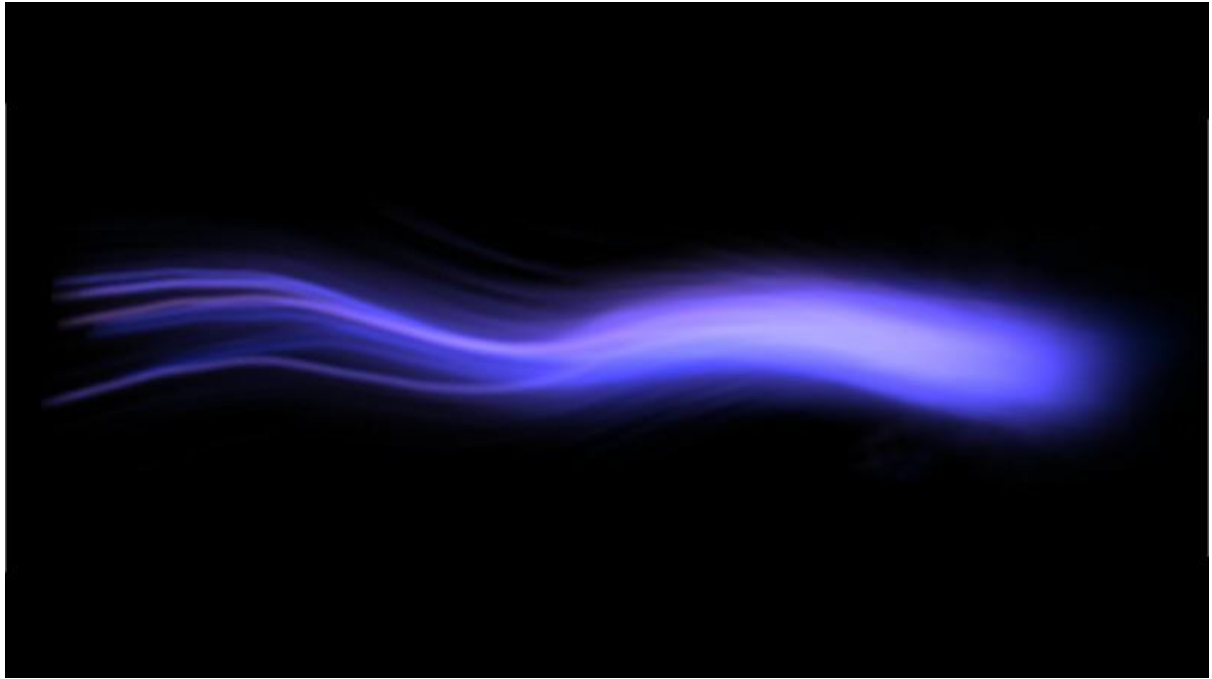
Animation/video/motion capture: Lisa Roberts, William Gladstone (UTS Science), Jason Benedek (UTS Design, Architecture & Building), Interactive design: Cat Kutay (UTS Engineering), Michael Lynch (UTS IT)

5.8.5.1 Phase 1

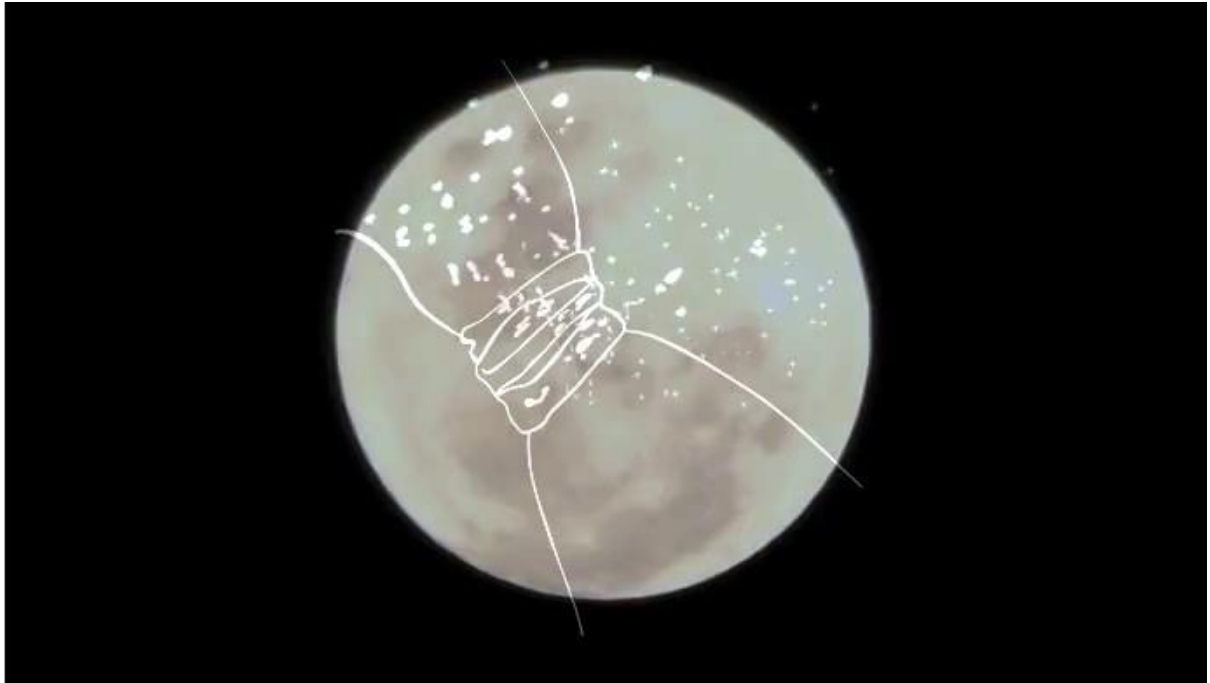
In the beginning, when everything was being made, the spirits formed the universe — its planets, the stars and its sun — and it was perfect.



Our story lines come from this evolution of creation. Uriarra, the first being, made the rivers and the languages.

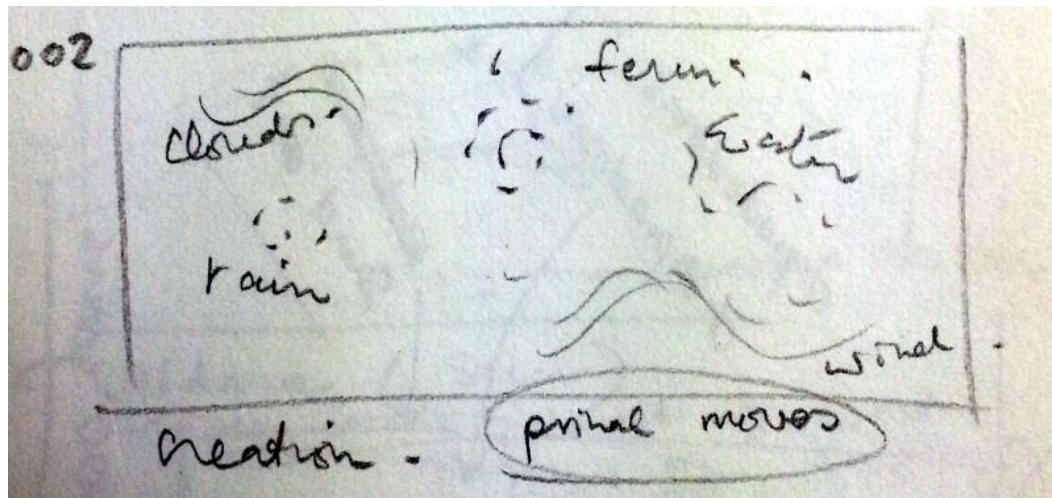


Giidan, the moon man, assisted Yuludarla the creator in moving the oceans and rivers, our tides which dictate our cultural flow and life cycles. Giidan Mirrial is a healer and he works with ferns and our totem the ocean to heal us.

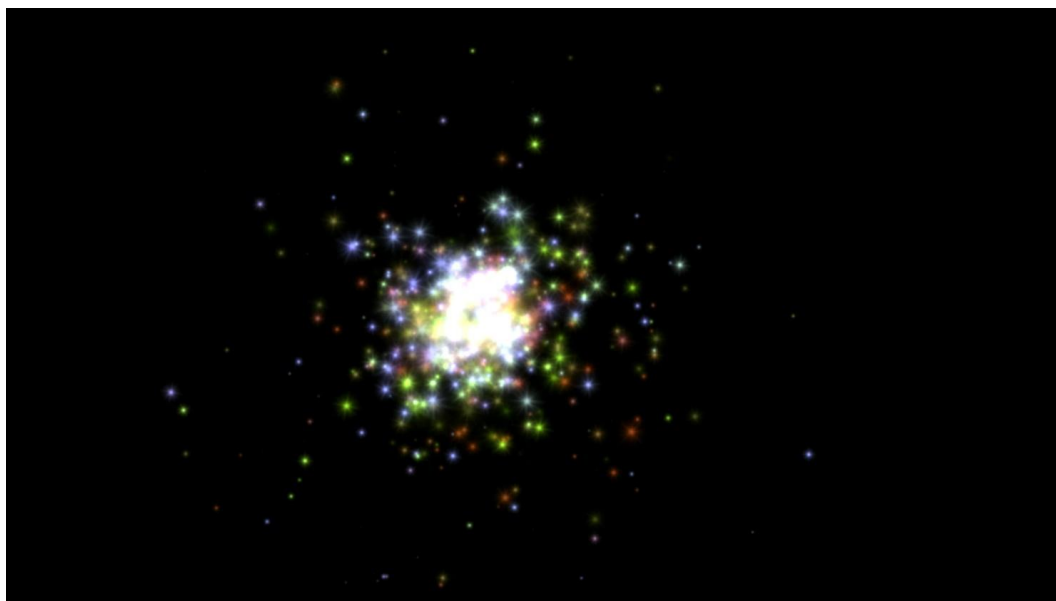


Nyayan — sun, the giver of life, moves over and under the earth. A key component of Gumbayngirr cultural origins. It is represented by Yuludarla the creator of all life. He comes from the east and rests in the west. He is essentially the sun. Gumbayngirr origin stories are very much elemental in nature, the next 8 images shows the transition and blending of this story.



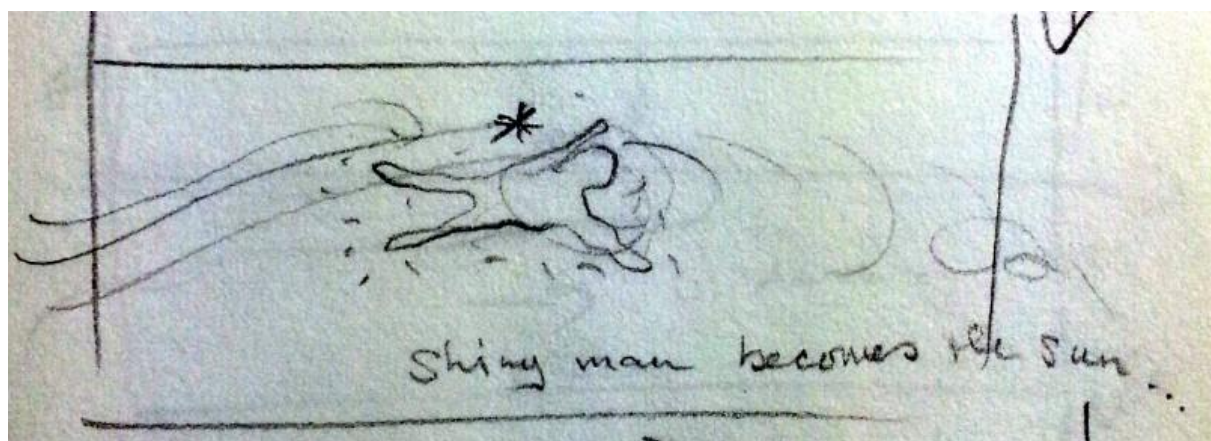
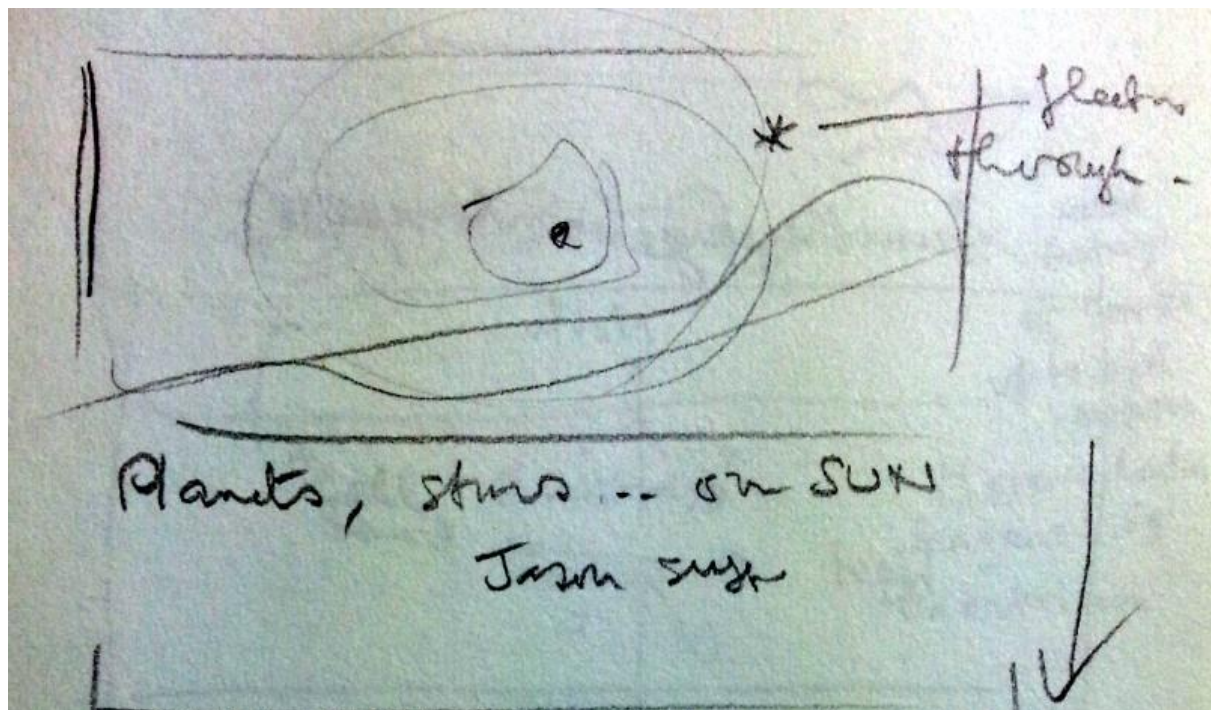


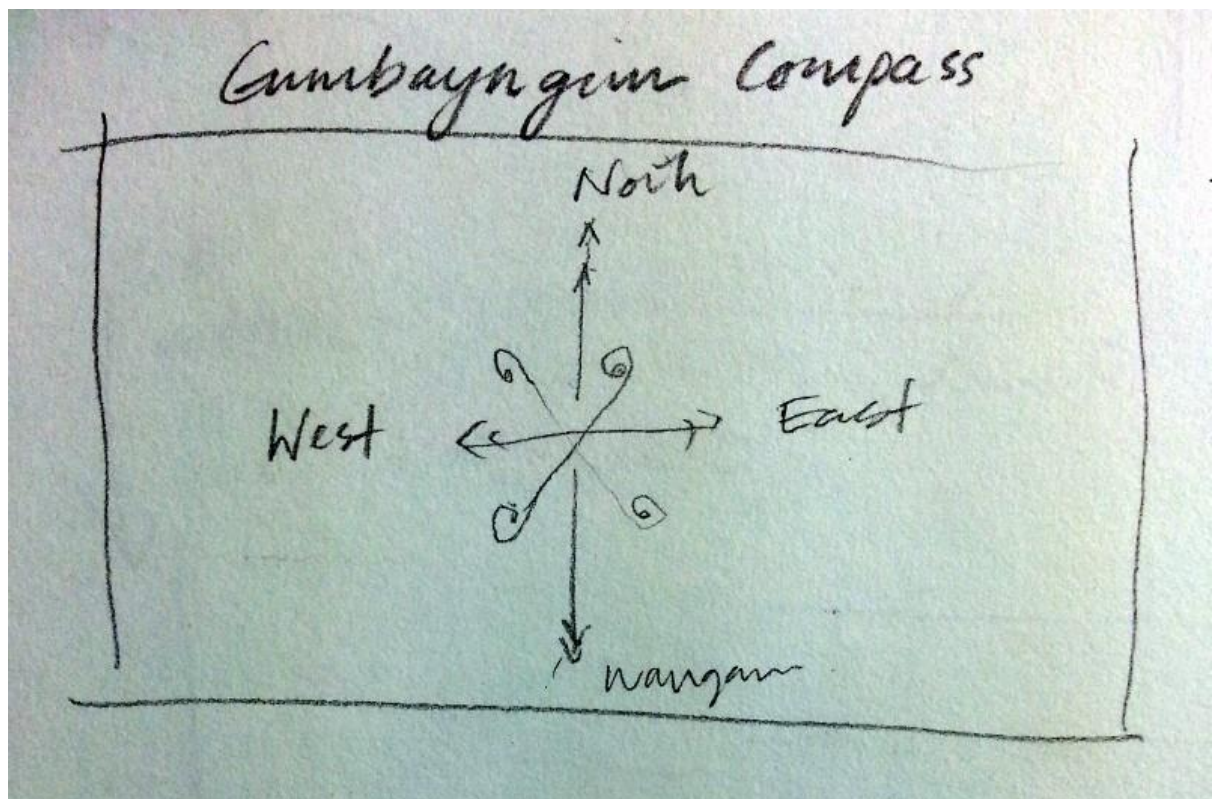
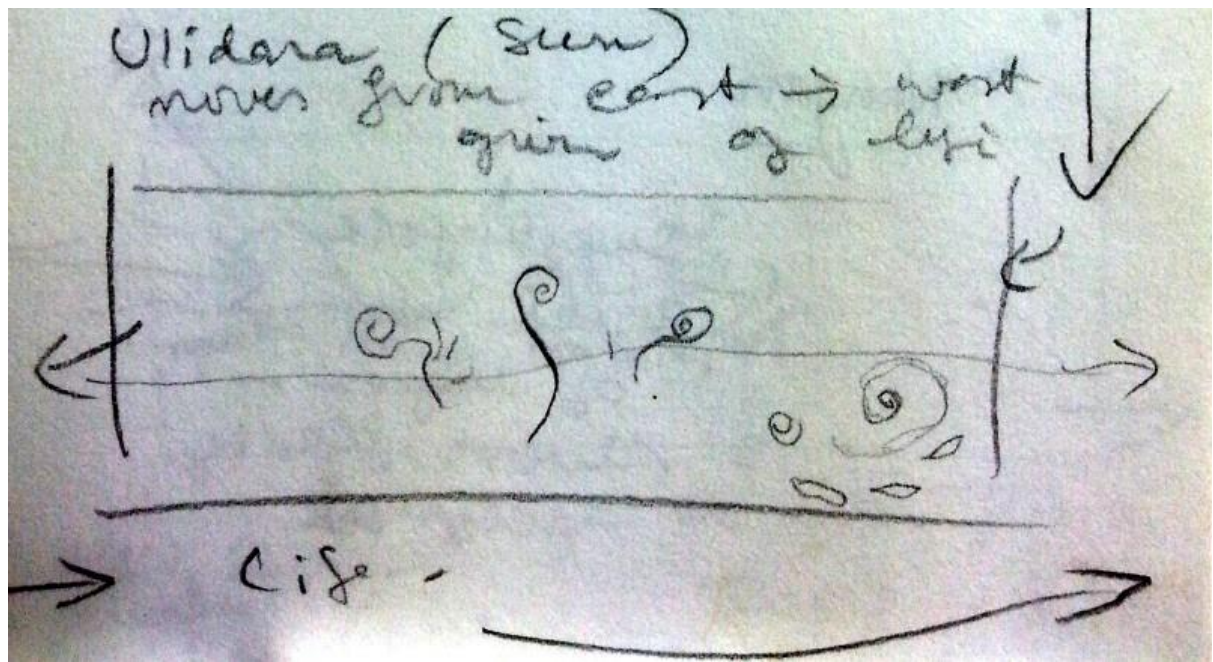
Birrigan, our great warrior, lived among us and helped us to survive and manage our resources. He sits up in the night sky as the Southern Cross, our guide and protector.



The Goanna Sisters gave us our totem and made the coastline and sea. Women are our creators, our teachers and nurturers. These women sit in the sky as the last two stars in the Seven Sisters constellation. They also come to us as the north and south winds.

water earth
 fire wind/air
 SPIRIT (5th element)
 elements





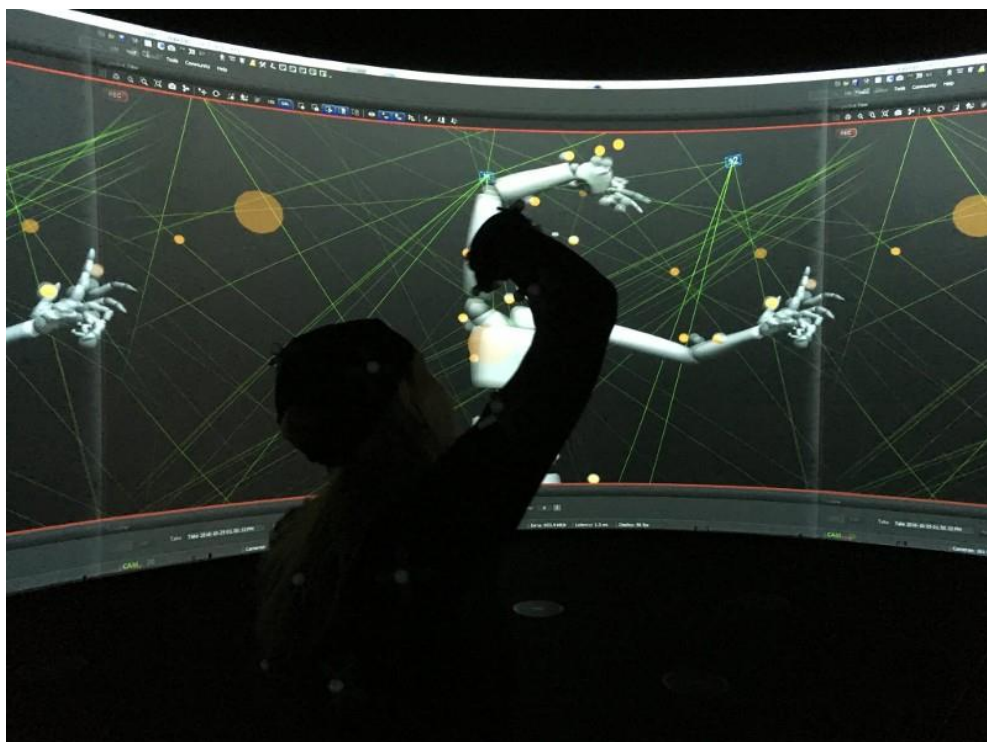


Figure 32: Motion capture in the UTS Data Arena. This process was used to get movement through the water to represent spiritual intangible effects. Source: Jason Benedek, William Gladstone and Lisa Roberts (UTS).

The intent of the animation was to express the connections of elements and people's (Gumabynggiir women's) spirituality and connections through ceremony to the ocean. This animation was specifically aimed at the scientific audience. It can be viewed at the following address:

www.livingdata.net.au/content/presentations/2018presentations/2018GumbayngirrStory.php

The next section outlines how far and wide the animated Gumbaynggirr Story has been viewed, set against a discussion of how people have experienced the paradigm of Aboriginal spiritual artform within western science formats.

5.8.5.2 8 May 2018

The animator and myself were invited to present at the 2018 Boden Research Conference — Ecological Surprises and Rapid Collapse of Ecosystems in a Changing World, Shine Dome, Canberra, Australia. This was presented as a collaboration of ocean knowledge stories from western science with Indigenous knowledge. It was presented at the launch of the conference on 8 May 2018.

The organisers of the conference were impressed by the content and approach to explaining the

intangible concepts of Aboriginal connection. The Australian Antarctic Division (AAD) delegates from Hobart were offered the option of watching the Gumbaynggirr Story or leaving for lunch. Everyone stayed, and many said afterwards that they were spellbound by it.

5.8.5.3 9 August 2018

The Gumbaynggirr Story featured in the UTS Data Arena Living Data National Science Week event Lens on Health.

Feedback from event participants can be found here:

www.livingdata.net.au/content/impacts/2018impacts/2018-impacts.php

5.8.5.4 28 November 2018

The animator, Lisa Roberts, presented elements of the Gumbaynggirr Story at the Healing Our Spirit Worldwide conference hosted by the University of Sydney at the International Conference Centre, Darling Harbour in Lens on Health: Reading Mother Country:

www.livingdata.net.au/content/presentations/2018presentations/2018LensOnHealthHOSW.php

5.8.5.5 25 January 2019

The Gumbaynggirr Story is included in a Living Data workshop facilitated by the University of Technology Sydney (UTS) to explore what key messages to present at the Antarctic Connections at the End of the World: Understanding the Past and Shaping the Future conference:

www.livingdata.net.au/content/presentations/2018presentations/2018PedestrianJourneyDataArena.php

5.9 Case study 3: *Gangaagundi guunuwaygan* (future life)

5.9.1 Introduction

I am constantly challenged by the processes and life in the sea, enticed by the patterns and textures of the ocean and fascinated by the unusual elements within it. Mother nature is my teacher and expressing visually how I see things represents the questions of space and the ocean, kinship and responsibilities, along with the arrangements in my mindfulness. It is my way of giving back to the ocean, by showing its living moods and inviting thought about its future. To Gumbaynggirr people it is life. It is the nexus of culture and it is part of us. It is the living entity that makes and influences who

we are, how we feel and our identity of saltwater people. It is our responsibility to care, respect and foster its appreciation.

This work pulls together the thoughts that flow through my mind as an Aboriginal person, a cultural marine ecologist and a scientist. The *gaagal* (ocean) is my people's totem. It is the carrier of breath and the giver of life, it is a living entity with emotions and moods. The images represent forms of totemism and kinship with creatures of the ocean, the mixing of human and animal (shapeshifting) forms, the spirituality of reincarnation and relationships of humans to the ocean. It challenges the identity of species and the ideology of how extreme we go when it comes to marine biotechnology. It provokes thought about the Indigenous kinship and species relationships and how altering components of species can affect kinship processes. An example is the use of marine fish-derived collagen in cosmetic formulations. For me, this is the use of my totemic family. It also raises questions around sustainability, as the beauty industry increasingly turns to the sea in search of new ingredients. High demand for marine ingredients is increasing the number of raw material suppliers specialising in products such as coastal plants, fish, seaweeds, algae and sea minerals (*Global Cosmetic Industry* 2012; Lee 2008; Martins et al. 2014:1066–1101).

Indigenous partnerships in scientific research and cross-cultural method development are critical to establishing conservation and management solutions that build scientific capacity and sustain both ecological and cultural diversity within marine environments. It also provides forms and pathways for equity sharing and culturally appropriate material exploitation. Most cosmetic brands only label 'ethically responsible' as it relates to laboratory animal use. There are also ethically sourced products relating to the making of the product, the standards for the workers, the sustainability of the product and responsible sourcing. These ethical standards do not move into the intangible, such as the ethics around cultural species that have religious or sacred attributes.

This scientific, artistic and cultural educational work explores the values and attitudes towards the use of oceanic entities in marine biotechnology components and features. Aboriginal involvement in the use and management of biodiversity is fundamental to the maintenance of Aboriginal culture and identity in the marine environment.

Marine biotechnology is described as 'the application of marine science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services' (Australia New Zealand Marine Biotechnology Society 2018). The aim of the photographic works was to provoke thought into the future of marine biotechnology and to engage with people about the potential consequences of our manipulation of

the environment. It was also to engage with unusual creatures and morphed elements of marine animals. This was meant to activate people's comprehension of animism and the use of totems in the Gumbaynggirr worldview. Many Gumbaynggirr traditional knowledge stories involve spirit beings and people who are portrayed as animals or vice versa, with both people and animals portrayed as components of geographical or celestial features.

5.9.2 Animism

Anthropologist Sir E.B. Tylor's theory on religion proposed animism as a 'primitive and essential form of religion deriving from people's self-conscious experiences of the intangible', such as dreams or visions. (The chief source for details of Tylor's life is Robert R. Marett's *Tylor* (1936), and the best critical accounts of his work and influence are in Edward E. Evans-Pritchard, *Theories of Primitive Religion* (1965), and John W. Burrow, *Evolution and Society: A Study in Victorian Social Theory* (1966)). This interpretation and the use of 'primitive' is quite negative, but the term was used commonly by first-contact Europeans. It was generally applied to represent cultures with non-Judeo-Christian-Islamic traditions and implies they are less sophisticated (Lambek 2002).

Animism can be described as a belief in personalised, supernatural beings (or spirits) that inhabit animals and objects, essentially governing their existence. In discussing animism, the complexity of religion and the philosophy and metaphysics of 'beliefs' and belief systems can be daunting. What can be examined is an openness to consider that humans are neither separate from the natural world nor distinct from other kinds of lifeforms in most significant ways. Totemism is a perspective where humans are not only closely related to other humans but also to particular animals, plants, or elements. These fundamental principles can be seen as the key to understanding the relationship between natural elements and humans' place within the environment, including the associated belief values and their links to the natural environment, including knowledge systems.

The documentation of Gumbaynggirr people's belief systems, and the associated creation stories with influences of higher liminal beings and life forces, exhibit tangible and intangible objects infused with life forces of individual spirits that inhabit natural objects. Emile Durkheim (1912, tr. 1965) proposed that 'the roots of religion lay in totemism, where certain objects or animals are treated as sacred objects'.

5.9.3 Totems

The basis of totemism is founded by specific relationships between humans and nature, a relationship connection that serves as the conceptual device for the foundation for a classificatory scheme (Lambek 2002). Therefore, totemism can be interpreted as a conceptual device for sorting out social groups by means of natural emblems. Collectively, the theory involves the concept of objects, animals or plants having some form of sacredness to members of a particular social group. Elements of Gumbaynggirr totemism are outlined in Table 8, including totem clans or kin/family group's managed areas. This class or social group provided social order.

Lambeck (ibid.) explains totems as a guardian spirit of a particular unit of kinship or social organisation. The symbol of the totem can be tattooed on the body, engraved on weapons, pictured in masks or (among Native Americans of the Pacific Northwest) carved on totem poles. In some cultures, males have one totem and females another, but generally speaking, totemism is associated with clans or blood relatives (ibid.). As documented in table 8, the tribes of the Gumbaynggirr also use animals and plants as symbols to designate a family or individual (Morelli 2008). Marriage between members of the same totemic group is commonly prohibited (ibid.). The totem, or rather the spirit it embodies, represents the bond of unity within a tribe, a clan or some similar group. A totem may be a species of plant, insect, animal, bird or even a mythical entity (Lambek 2002). Table 8, gives description of the many applications of totemic attributes in social construct, that essentially was an ingenious way to regulate natural resources, enable social construct and provide identity (or forms of passage similar to passports and cultural authority) . Totemic variables are embodied into all facets of social, emotional and psychological understandings.

In most cases, the totemic animal or plant is the object of taboo: it may be forbidden to kill or eat the sacred animal. Furthermore, some scholars propose that as well as provision of identity and association, the taboo associated with harming one's totem can act as a conservation device, assisting in the adaptation to the natural environmental surroundings. This would then give meaning to ecological significance and play a vital role in development, governance structure and survival of these societies. The religious systems and social political systems revolved heavily around the Gumbaynggirr seasonal cycles. The species and physical environment provided indicators and pre-emptive indications of change.

Cultural Elements	Gumbaynggirr Culture
Exogamy (the custom in some societies of marrying outside their people's own social group)	Totem Clans or kin/family groups - Class or social group, social order.
Totemic names	All totem clans and gender
Taboo	Totemic and non totemic
Decent from Totem	Totem clans Paternal
Magical Ceremonies	Associated with totemism
Reincarnation	Associated with totemism
Guardian spirits	Associated with totemism
Art	Expressive totemism
Rank	Passively associated with totemism

Table 8: Totemism in Gumbaynggirr culture. Adapted from Durkheim 1965; Frazer 1910; Freud 1946; Goldenweiser 1933; Lévi-Strauss 1963.

5.9.4 Marine biotechnology and Indigenous ideology

The representation of the depth and breadth of Indigenous interaction with the environment carries profound implications for better management of marine resources through Indigenous management principles and Indigenous empowerment within management regimes that facilitate equity and benefit sharing. The current bio-marine economy market is estimated at over US\$176 billion per year (Biomarine 2014). Multidisciplinary research and innovation and technology underpin the application and market of marine biotechnology. It is another realm of claimed economic sustainability from exploitation and wealth capital from our oceans, the largest jurisdiction in the Southern Hemisphere, Australia and New Zealand, accounting for the third and fourth exclusive economic zones globally. Marine nutraceuticals constitute 32 per cent of the total nutraceuticals market, predicted to expand to 50 per cent by 2020.

The global consumption of fin fish is rapidly increasing, with 47 per cent of global fish production currently being produced in aquaculture ventures, these are valued at more than US\$232 billion (FAO 2018). Both Australia and New Zealand have signalled a priority need to enhance the sustainability of marine resource development (Australia New Zealand Marine Biotechnology Society 2018). The blue economy would then become 'a sustainable ocean economy [that] emerges when economic activity is in balance with the long-term capacity of ocean ecosystems to support this activity and remain resilient and healthy' (Australia New Zealand Marine Biotechnology Society 2018).

There is potential to get the sustainability of the blue economy as it relates to marine bio-resources more ethically aligned with Indigenous perspectives. This could include, for example, the extraction

of physiological, genetic and genomic elements to guide genetic resource management; molecular and cellular research into new bioproducts; and sustainable building solutions for developers and managers for enhancing marine infrastructure, marine food production, and medicines.

Until recently, Aboriginal communities have not had a meaningful role in present-day fisheries, biotechnology and marine management (Smyth, L., Egan, H. and Kennett, R., 2018; Schnierer, et al 2018). As more user groups are now competing for the fisheries resource, both government and private industry are seeking greater input and collaboration with Aboriginal communities to ensure our knowledge and interests are heard and recognised in relation to sustainable marine industry development and management issues. There is still much work and process to be undertaken to provide an equitable and culturally sustainable blue industry. It starts with issues around sustainability perspectives of the resources and acknowledgement of Indigenous people's rights to these resources. Indigenous use of traditional coastal resources is not only important on economic and social levels, but also on cultural and spiritual levels (Egan 2010; Lloyd 1996; McNiven 2003; Schnierer 2009; Sharp 2002).

The dominating western worldview and historical approach to marine exploitation holds the world's oceans as merely an exploitable resource (Sharp 2002). Due to stock depletion resulting from current fisheries' management models, this western view is now being questioned (Egan 2010). Recent initiatives, including the US National Ocean Policy and EU maritime strategy, have begun to acknowledge ecosystem services and aim to incorporate comprehensive ecosystem-based management to develop the needs of both humans and natural systems (Halpern et al. 2013).

Indigenous rights to practice and obtain a living from the use of our natural biological resources is protected explicitly and implicitly by a range of international environmental and developmental agreements. These include the United Nations Convention on Biological Diversity (CBD); the UN Declaration on the Rights of Indigenous Peoples (UNDRIP); International Labour Organization Convention No. 169; the International Covenant on Civil and Political Rights and the International Convention for the Elimination of All Forms of Racial Discrimination, to name but a few.

The CBD, particularly through Articles 8(j) and 10(c), provides guidance for signatory states such as Australia on the need to protect Indigenous rights to our biological resources, of which fisheries resources are a subset. Articles 25 to 29 of the UNDRIP also seek to protect Indigenous rights to use and management our traditional biological resources. The Food and Agriculture Organisation (FAO), of which Australia is an active member, is also currently strengthening support of small-scale fisheries,

which includes Indigenous cultural fisheries as a recognised subset. This is being achieved through the development of a set of Voluntary Guidelines on Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (VGSSF), which will complement the Code of Conduct for Responsible Fisheries. The VGSSF guidelines are intended to support national, regional and international initiatives for poverty alleviation and equitable social and economic development, and for improving governance of fisheries and promoting sustainable resource utilisation. They are complementary to other international instruments with similar purposes, in particular those related to human rights, sustainable development and responsible fisheries (Schnierer et al. 2018).

The process of alignment of Indigenous knowledge and biophysical science, as well as the development of frameworks to assist decision-making, monitoring and planning, provides a pathway of empowering Indigenous communities to engage meaningfully in culturally relevant biotechnology and marine research.

The CBD (United Nations 1992), clearly and unambiguously places decision-making powers (and processes) in the hands of Aboriginal peoples for anything that may affect their culture and estates:

Subject to National legislation, respect, preserve and maintain knowledge, innovations and practices of Indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilisation of such knowledge, innovations and practices.

Then, in Article 19 of the UNDRIP, Aboriginal peoples must have a central role in the development, implementation and evaluation of policy and legislative or administrative measures that may affect us concerning our estate.

In accordance with Articles 26 and 32 of the UNDRIP as they relate to marine wildlife management:

- Indigenous peoples have the right to the lands, territories and resources which they have traditionally owned, occupied or otherwise used

- Indigenous peoples, have the right to own, use, develop and control the lands, territories and resources that they possess by reason of traditional ownership or other traditional occupation or use, as well as those which we have otherwise acquired
- states shall give legal recognition and protection to these lands, territories and resources. Such recognition shall be conducted with due respect to the customs, tradition and land tenure systems of the Indigenous peoples concerned
- Indigenous people have the right to determine and develop priorities and strategies for the development and use of our lands or territories and any other resources
- states shall consult through our representative institutions in order to obtain our free and informed consent prior to the approval and any project affecting our lands or territories and other resources, particularly in connection with the development, utilisation or exploitation of mineral, water or other resources and
- states shall provide effective mechanism for just and fair redress for such activities, and appropriate measures shall be taken to mitigate adverse environment, economic, social, cultural or spiritual impact.

Another noteworthy article is 10, Sustainable Use of Components of Biological Diversity, in particular Article 10(c), which states, 'Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements' (United Nations 1992).

As much as the articles and their meanings look awe-inspiring, uptake of these rights and obligations is somewhat slow or even non-existent. This drives a business-as-usual procedure for many Australian Government departments, institutions and industries. This unchanging variable is not conducive, moral or beneficial to active adaptive management. The emphasis on dealing with existing stresses and disturbances under a changing climate are fixated on western solutions such as collaboration and investment in technology, whereas the simple process of according Indigenous people's rights can provide innovative governance systems to include Indigenous ideology and ways that promote real sustainable ideology and outcomes.

A comparative example comes from New Zealand, where the colonial conducts were an accomplished contrast to that of Australia. Like in Australia, the initial invasion brought threat to the rights of land and sea culture. James Busby, the appointed British Government's official in New Zealand, called a meeting between northern Māori chiefs at Waitangi in October 1835 to sign a Declaration of the

Independence of New Zealand, whereby New Zealand was recognised as an independent and sovereign state (Orange 2004). This led to the signing of the Treaty of Waitangi, a document that acknowledged *terra nullius* (land belonging to no one) as invalid (Bonyhady 2000; Frawley 1999; McGrath 1995).

In Australia, the British deemed the original people of Australia and our culture worthless and that the British had nothing to learn or gain from us. This led to the arrogant declaration of Australia being declared *terra nullius*, a country owned by no one and capable of being claimed by anyone wanting to utilise it for farming and agriculture (Bonyhady 2000; Howitt 2001; McGrath 1995; Sharp 1996). This egocentric, self-declared assumption of *terra nullius* has shaped the occupation attitudes, land and laws in Australia for the last 231 years.

The following images were constructed to show the cultural dimensions and potential implications of biotechnology and marine management into the future. It is meant to conjures the intangible through animism (transforming from animal to human spirit) and the consideration that need to be given. The images show marine creatures with human elements and vice-versa it enables a visual reality of how each species contains a spirit and in many cases the spirit of deceased family or loved ones.



ie: Film Strip 1
 e: 59.99x183cm
 1



File name: Film Strip 2
 Print size: 59.99x183cm
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Film strip 1:

1. Seasons — *Baarany Yaalgirr* (Butterfly Flathead)
2. Tree Fern Fish Eggs — *Jambarrga Yamaarr Mirubay*
3. Flathead Spirit Man — *Yaalgirr Jaanybarr*

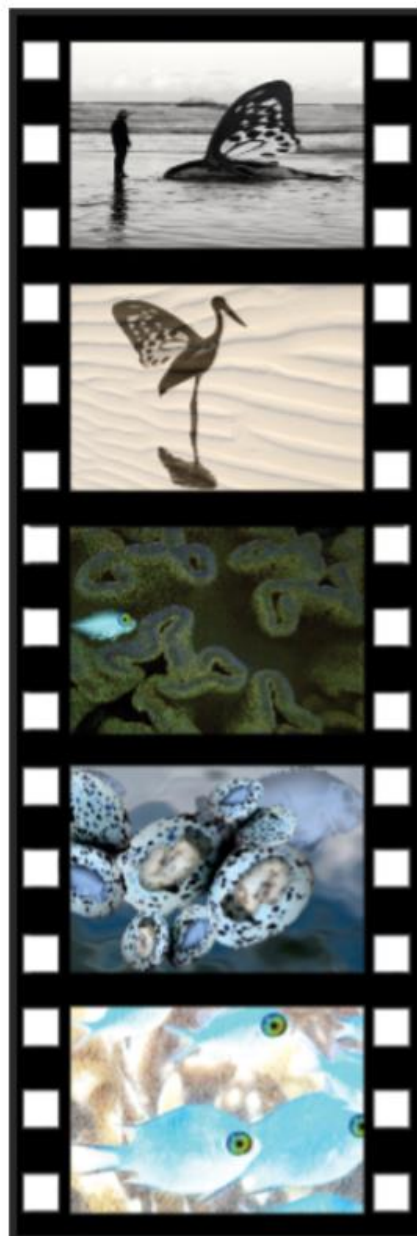
4. Nautilus Baby — *Guungguway Damaan Juunuy* (Sleeping Shell Baby)
5. Protection — *Gunulgin Junuybin Mayal-guunu Guuray Bugany* (Move Life Flower-like)

Film strip 2:

1. Maiden Fern Leaf Fish Baby Eggs — *Juluga Janguurr Yamaarr Buwaarr Mirubay*
2. Bark Spirits — *Baagu Gumburr*
3. Incubation — *Gurulaw Mirubay* (Tomorrow Eggs)
4. Cephalopods Echo — *Numuru Manno Manno*
5. Morphis — Squid butterflies - *Baarany Manno Manno*



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size: 59.99x183cm
1



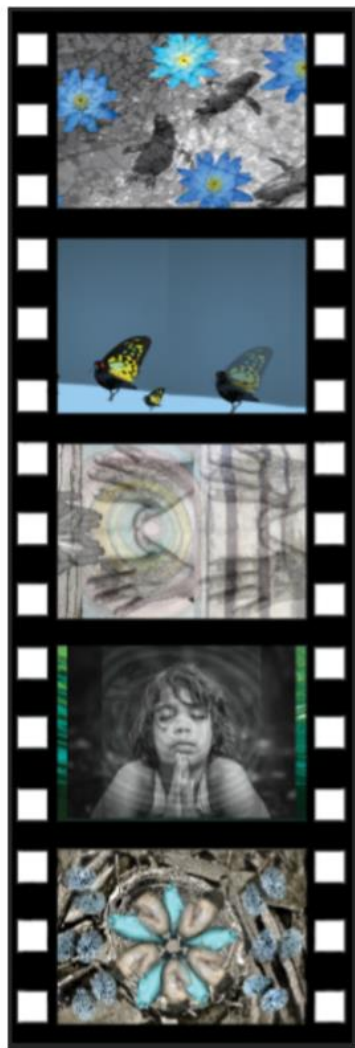
File name: Film Strip 4
Print size: 59.99x183cm
QTY: 1

Film strip 3:

1. Change — *Minyaalu* (What's Caused That) *Dawaar Waanyji Bigaa* (Wild Dog Snails)
2. Strange Crab — *Ngaduun Garruuga*
3. Schooling — *Guul Yamaarr Junuybin* (Little Fish School)
4. Butterfly Fish — *Yamaarr Baarany*
5. I Found It — *Biiway Nganyu Mayal* (Not My Fault)

Film strip 4:

1. Whale — *Gurruuja Wurruun* (Wing Whale) *Naara* (Sad)
2. Stork Butterfly — *Jiibiny Baarany*
3. Fish in Alcyonacea Soft Corals — *Yamaarr Mayal-guunu Guuray Bugany*
4. Human Eggs Sleep — *Mirubay Guunggu*
5. Blue Crommis Friend — *Ngandaalgan Jiling Gunganbu*



name: Film Strip 5
it size: 59.99x183cm
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Film strip 5:

1. Penguin Lotus — Water Lily Play, *Ngaarri Gundarang*
2. Bird Wing Birds — *Jiibiny Wurruun Jiibiny*
3. Generational Hands
4. Spirit (Angel) Girl — *Gawnggan Nyamiganam*
5. Spinning Wheel



Figure 33: The opening of the *Gangaagundi Guunuwaygan* (Future Life) exhibition at the University of New South Wales with speaker Dr Fabri Blacklock (Scientia Research Fellow, UNSW) introducing the photographic works. Source: C. Marshall.

Chapter 6: The Examination of Monitoring Methods Used by Indigenous People in Environmental Observation, Astronomy, Seasons and Sailing

Toitu he whenua, whatungarongaro he tangata (the land is permanent, man disappears).

Whakatauki (Māori proverb)

6.1 Introduction: Aotearoa — landforms and ecology

The 50,000-kilometre arc of volcanic and seismic activity in the Pacific Ocean, the Ring of Fire, is the most seismically and volcanically active zone in the world (Howells 1973: Stewart and Lynch 2007). New Zealand's diverse and rugged island landscapes, including snow-capped mountainous altitudes and estuarine coastal plains, are the result of this dominant feature, the evolving two islands which are surrounded by many smaller islands. This fragment, called Zealandia, was once part of the super continent of Gondwana. Over the last 76 million years, it stretched, thinned, sank and then once again, through tectonic compression, plate collision and subduction, the Southern Alps began to uplift through the western area of the South Island (National Geographic 2011). At 3,754 metres, Aoraki (Mt Cook) is the highest point. Over 350 glaciers are located here. Aotearoa has continued to rise slowly out of the sea. The much greater proportion of Zealandia is still spread under the ocean (National Geographic 2011). Aotearoa has retained many animals from the Gondwana period and many old-world species, but has also evolved and created unique ecological habitats and species associated with island continents (World Atlas 2019).

John McNeill's 1994 publication *Of Rats and Men* provides some of the first comprehensive work on the environmental and human settlement history in the Pacific Islands. McNeill divides this history into eras based on the type of technology that allowed the introduction of exotic flora and fauna and the pervasive economic approach to resource management, from Indigenous tenure and sustainable harvest practices to plantation agriculture to modern day conservation and sustainable growth paradigms.

In general, most Pacific Island history has focused on intercultural relations between Pacific Islanders and Europeans over the last two and a half centuries (Munro and Lal 2006). These studies focus on the influence of western products, peoples and ideas on Pacific Islanders. General environmental overviews have been published by scientists that focus on natural processes more than human–environment interactions (D'Arcy 2012).

Few works exist from Indigenous perspectives or by Pacific Islanders, though one exception is the nascent four-volume *Science of Pacific Island Peoples* published by the University of the South Pacific. The limited integration of Indigenous perspectives into wider literature is a neglected niche I seek to explore.

Given that the majority of Pacific Islanders' history was recorded and conveyed orally, a multidisciplinary approach is required to incorporate non-literate sources such as oral traditions, linguistic patterns and material remains. D'Arcy (2012), for this reason, contends that Pacific history cannot be viewed in isolation, but must be seen as part of a larger body of work produced by Pacific-focused researchers in anthropology, archaeology, linguistics, ecology and geography, further stating that this holistic approach enhances rather than dilutes the nature of Pacific history. However, this cultural and multidisciplinary approach is muted within the environmental community because there are relatively few Pacific historians focused on environmental history (D'Arcy 2012).

6.2 Unearthing Aotearoa

It was quite remarkable that by some hand of the Aotearoa gods I ended up at Whakatāne. I initially set out here to visit friends but became involved in a student marine education *hui* (meeting) to *tamariki* (children) at the Te Whare Wānanga o Awanuiāraangi, having in mind that I wanted to look at the intergenerational knowledge transfer programs and processes. It was here that I initially met some awesome *wahine* (women) who were also involved in *waka* (canoes), sailing knowledge and intergenerational knowledge transfer. This location in the Eastern Bay of Plenty on the North Island felt spiritually good. I took my daughter, who is a bit of a spiritual entity, and she also felt that this location had many stories (pretty spot on for an eight year old).

I then started to feel things in the landscape and was drawn to certain areas. I discussed this with the *wahine* and was introduced to the area and the paddlers of the *waka*. It was like I then understood what was happening. With no intent in the flow, we were all meant to meet, the sacred spaces and places that bind us all, our *atua* (gods and spirits) brought us there.

As it turns out, the area has remains of Māori *pa* (Māori fortified village) sites that date back to the first Polynesian settlements, estimated from around 1200 CE (McLintock 1966b). Māori tradition tells of Toi te Huatahi, later known as Toi Kairakau, who landed at Whakatāne, c. AD 1150 searching for his

grandson, Whatonga. In failing this task, he decided to settle. Two hundred years later, the Mataatua, one of the *waka* from the great migration, landed at Whakatāne.

The Māori name Whakatāne derives its meaning from an incident of the Ngati Awa tribe from Hawaiki after the landing of the Mataatua 600 years ago. The men had left the *wahine* and *tamariki* to relax on the *waka* and set off shore. The canoe had started to drift with the tide further off the beach, Wairaka, a chieftainess (daughter of Toroa), pronounced, 'Kia Whakatāne au I ahau' (I will act like a man). With this, she took up a *hoe* (paddle), defying a *tapu* (forbidden taboo), and began to paddle. With the help of the other women, the *waka* was saved. It was Wairaka's cry that gave Whakatāne its name (Taonui 2005c). It is also said that without Wairaka's bravery Whakatāne ancestry would be completely different.

A bronze statue of Wairaka was placed on the Turuturu-Roimata Rock at Whakatāne heads by Sir William Sullivan, who commissioned the sculpture in memory of his deceased wife and as a symbol of Waiaka bravery and Whakatāne's history. It was erected in 1965.



Figure 34: Photographic interpretation of The Irakewa Rock with star constellation by Pauline Harris. This image merged the sky and star maps to the location. Photograph by C. Marshall 2017.

Toroa, the captain of the Mataatua canoe, was instructed by his father Irakewa to look for three landmarks in his search for Kakahoroa (the original name for Whakatāne): the *Te Wairere* (waterfall), *Te Ana o Muriwai* (cave) and *Te Toka o Irakewa* (Irakewa Rock). The Te Wairere Waterfall was not only a sacred landmark to all Mataatua, but was also a vital source of freshwater. This area is also associated with Ngahue, who visited before the arrival of Mataatua. It is said that he found moa, which he preserved in calabashes and took back to Hawaiki (Taonui 2005b).

6.3 Case study 4: Three hundred and sixty degrees — star maps, waves, sky, ocean and traditional sailing in the Pacific

Sailing and voyaging have long been integral components of life and tradition within the Pacific. For the New Zealand Māori, particularly the emphasis on the long sailing voyages that their ancestors made from Micronesia to the South Pacific and beyond (including knowledge that they sailed to Antarctica). These voyages are integral to the origin and foundations of these ocean-faring people. The knowledge of star maps and the skill contained in traversing long distances on the ocean with the sky as a navigational tool, both by using it as a compass, and by using it as a mnemonic to recall previous journeys, is something every envious sailor respects. This skill is enhanced even further when it is derived from traditional cultural knowledge, local ecological knowledge and continuous Indigenous knowledge systems.

This photo essay brings together the complex and varied components of intellect in the traditions and elements of people in this cycle. The philosophies of holism deriving from one's understanding of the self and the relationship to community, other living things, the earth, the ocean and the divine.

Figure 34: is my photographic interpretation of the mind map from verbal instruction and spiritual guidance the Irakewa Rock was found, this significant rock was then overlayed with with star constellation by Pauline Harris. This image merged the sky and star maps to the location.

Figure 35: Photographic interpretation of the traditional sails of the *waka* with sky fishhook creation story under from the star dome. I was embraced and merged into the intergenerational transfer project on sailing, re teaching the techniques of navigation the ecological ques and shapes and shades of the ocean.

Figure 36: One of the sailing trips, introducing me to the waka and crew. This trip was spent yarning and talking about the waka and the guides.

Figure 39 and 40: this was two female crew who taught me the female side of the waka. This was very interesting given the generalisation that sailing is for men only. Also the transfer of knowledge and

interpretation from both male and female perspectives, a realisation that this is a very important part of knowledge in Indigenous Pacific cultures.



Figure 35: Photographic interpretation of the traditional sails of the *waka* with sky fishhook creation story under from the star dome. Photograph by C. Marshall 2017.



Figure 36: Photographic interpretation of the roles and functions on the waka involving knowledge of all workings on the vessel Haunui. Photograph by C. Marshall 2017.

6.3.1 We sailed here — ecological knowledge and components of sailing (the stars, the swells, the winds, the birds)

Approximately 1200 years ago, the impressive pioneer and discoverer of Aotearoa Kupe marked the arrival of Māori to New Zealand (Reed and Calman 2006:20–35). Māori then endured many journeys back and forth across the Pacific Ocean using the celestial bodies to navigate (Nelson 2005). Sailing and voyaging have long been integral components of life and tradition within the Pacific. For the New Zealand Māori, particularly the emphasis on the long sailing voyages that their ancestors made from Micronesia to the South Pacific and beyond. The Māori of Aotearoa have stories that talk about

voyages to Antarctica. Oral history communicates that a great explorer Hui-te-Rangiora sailed further south of New Zealand around 650 AD and encountered a 'white land'. According to traditional narratives, Chief Hui-Te-Rangiora was the first to discover Antarctica (McFarlane 2008). From the Cook Islands, he was given directions to Aotearoa but missed it and kept sailing until they saw 'a white land that was floating' (ibid.). Māori oral tradition also articulates the journey of the Polynesian explorer Tamarereti, who also ventured south to understand the origins of the Aurora. It is universally accepted in the Māori world that on the return of Tamarereti's canoe the Te Rua o Mahu brought back certain understanding of the physicality of the Antarctic region (Hongi 1925; McFarlane 2008).

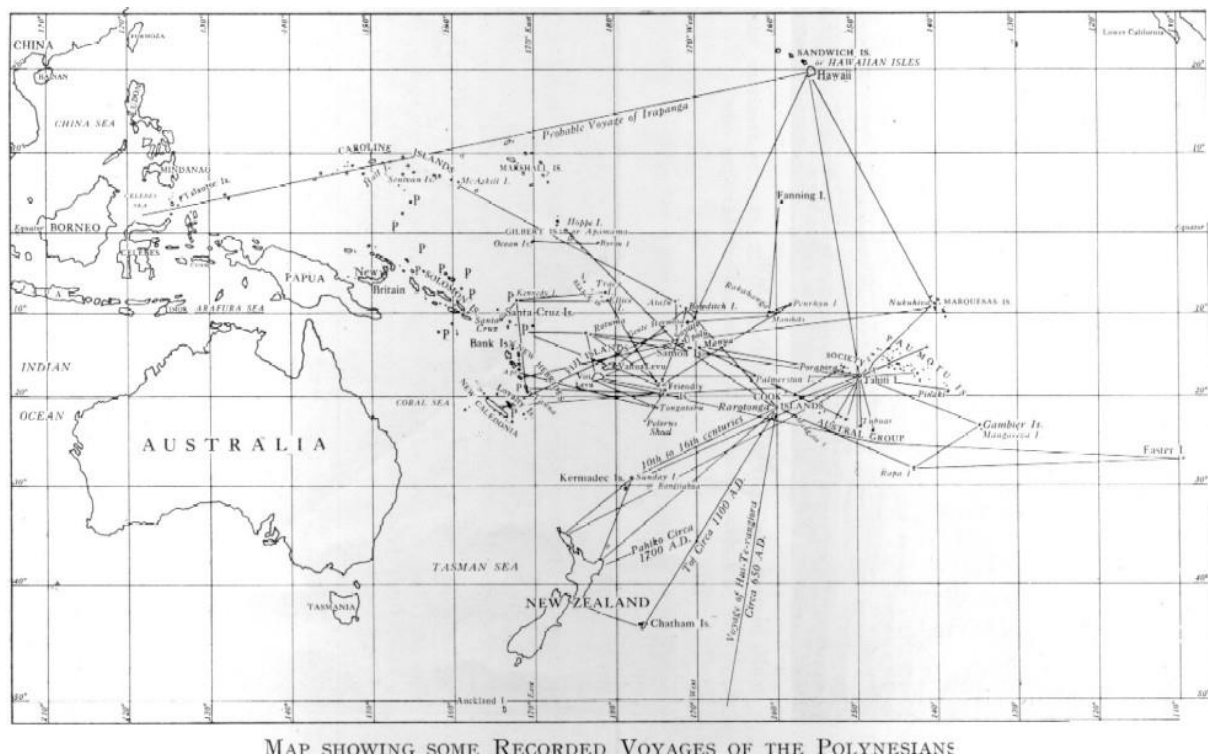


Figure 37: Map showing some recorded voyages of the Polynesians. Unknown: Circa 1917. Source: National Museum of New Zealand 2019.

6.3.2 Star maps and ocean knowledge

Māori knowledge systems are integral to the origin and foundations of these ocean-faring people. The knowledge of star maps and the skill contained in traversing long distances on the ocean with the sky as a navigational tool, both by using it as a compass, and by using it as a mnemonic to document previous journeys, is something every envious sailor respect. This skill is enhanced even further when it is derived from traditional cultural knowledge, ecological knowledge and continuous Indigenous knowledge systems.

Many ancient civilisations used atmospheric and astrological features to guide in time, space and environmental variability and conditions. The cyclic motions of celestial bodies (sun, moon, stars, planets, comets) were incorporated in bodies of knowledge including, songs, dance, art and tools. These astral bodies were also incorporated into rituals, ceremony, festivals and music (Roberts et al. 2006). The first cycle event was centred on the sun's annual motion across the horizon, from northern to southern solstice points. The second cycle involved to movement of the stars across the sky during the year and included the phases of the moon (Harris et al. 2013)

The Māori calendrical system is primarily based on traditional astronomical and ecological knowledge elements. All of these time cycles were based on a combination of celestial, biological and environmental indicators, including floristics of plants, animal behaviour, environmental patterns of the ocean, and behaviours and airstream configurations. These were essential indicators of environmentally based decision-making processes for the successful ecological farming and harvesting of natural/cultural resources. These indicators were also used for time and scheduling social rituals such as festivals and meetings.

Indigenous people from the Pacific made careful observations of the sky through the measurements of celestial bodies, incorporating astronomical events into complex oral traditions. Time keeping through the use of celestial bodies such as the rising and setting stars was used to indicate special events, environmental periods for food production and monitoring of biological attributes in resources. The recorded observations of stars and comets, the solar cycle and lunar phases (including ocean tides and eclipses), as well as astronomical measurements of the equinox, solstice and cardinal points, were embedded in oral tradition (Harris et al. 2013; Roberts et al. 2006).

This knowledge included an understanding that celestial phenomena correlated to terrestrial events, such as the passage of time, the changing of seasons, the emergence of particular food sources, the timing of ocean tides and the nature of transient celestial phenomena such as comets, eclipses, meteors and cosmic impacts (e.g. Hamacher and Frew 2010; Norris and Hamacher 2009, 2011).

The voyages of the Māori to Aotearoa on double-hulled canoes or *wakas* brought waves of people, a diversity of skillsets, innovation and technology. A thousand years of local knowledge prospered until the foreboding arrival of the first Europeans. European impingement and colonisation began in 1642 with Dutch explorer Able Tasman, followed by James Cook in 1769 (Dally and McLean 2005:63–68). The arrival of Cook and the British over the next 200 years would see the spread of diseases, land

alienation, war, displacement and undeniably a dedicated policy of assimilation. The loss in Māori population and European dominance caused complete imbalances in the environment, social structure and cultural integrity.

This photo essay brings together the complex and varied components of intellect in the traditions and elements of people in this cycle. The philosophies of holism deriving from ones understanding of the self and the relationship to community, other living things, the earth, the ocean and the divine.



Figure 38: Māori war canoe approaching Taranaki, 1879 by Nicholas Chevalier. Purchased 1973 with special government grant. Te Papa (1973-0015-1) courtesy of the Museum of Auckland.

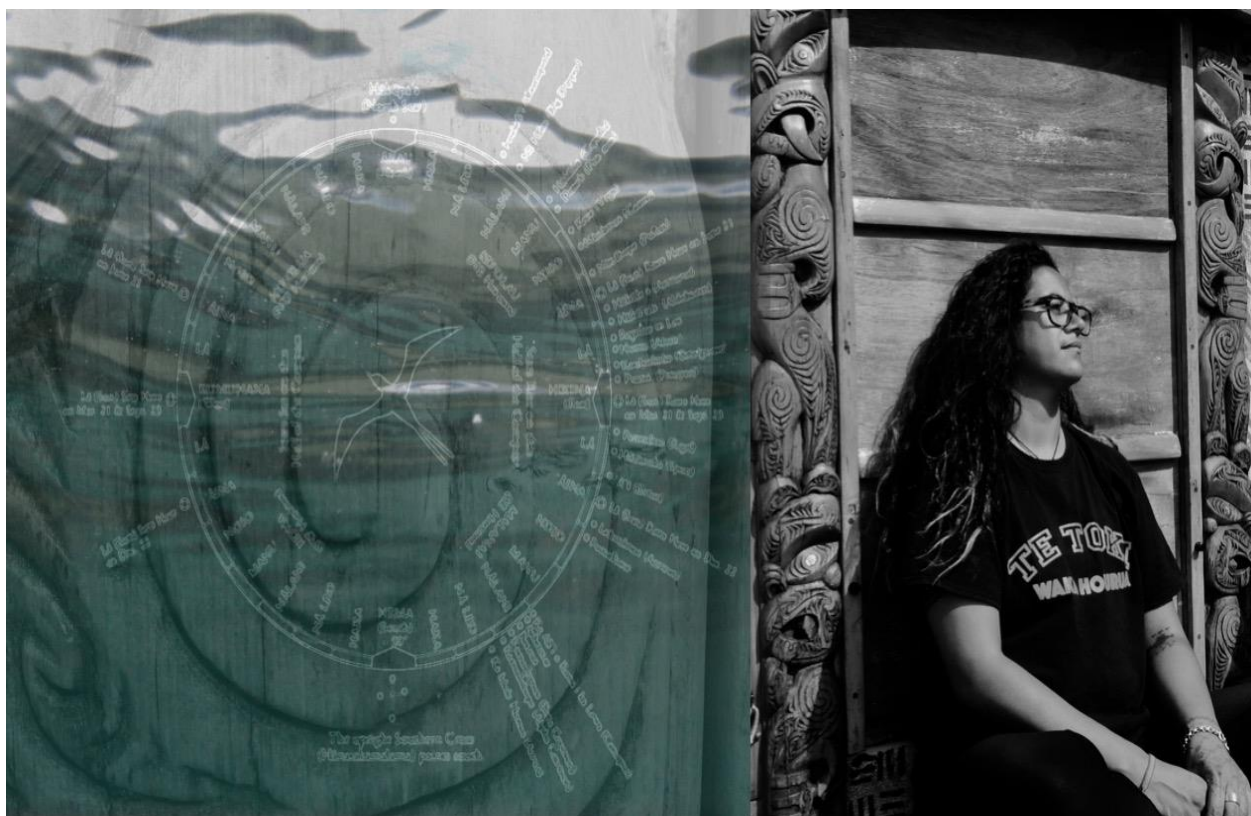


Figure 39: Bonni. Luafutu Tamati. Photographic interpretation of the sailing thoughts of a woman. An image taken after an explanation and discussion of the *waka* and its construction and spiritual meanings. Photo by C. Marshall 2019.

6.3.3 *Te kāpehu whetū* (Māori star compass)

A complex compilation of numerous variables including wave crests, illumination, celestial positions, wind directions and temperatures, wave direction and water temperatures all assisted the navigator. *Te kāpehu whetū* (Māori star compass) divides the 360 degrees around the *waka* into different *whare* (houses). These are usually marked on the *waka* railings. The navigator's objective was to keep the *waka* on a course proportional to these areas. The location of the houses correlated with the position of the sun, moon and stars setting and rising. Navigators would be familiar with the arcs of the sun and stars across the sky at different heights depending on the time of year or season (Taonui 2005a). Master celestial navigator Nainoa Thompson created this star compass. The sky being subdivided into corresponding quadrants shows when stars rising in one quadrant set in the opposite. So when the sun rises in *hikina* (east), this sets the direction of east. Alternatively, the sun will then set in *komohana* (west).

6.3.4 Woman and the sea — the female womb is like the ocean

Much of the same assumptions or interpretations of Australian Aboriginal women and our roles and responsibilities in everyday and seasonal cycles persisted in the descriptions of maritime roles of women in the Pacific Islands. It is noted that New Zealand was one of the first places in the world to give women the right to vote. Fortunately, during the rise of women generally, and the rise of Indigenous women during the 1980s and beyond, many of these conjectures were rectified within the academic domain. Starting in the 1980s, a succession of books, articles and special journal issues revealed the extent to which the values and roles Pacific women made and contributed to the community influenced the shaping of community dynamics, cohesion and resilience. In addition to their responsibilities as mothers, daughters, aunts and grandmothers, women's functions as decisionmakers, resource managers, manufacturers and knowledge holders elicited respect from male relatives and conferred a great deal of influence on women over them, particularly among chiefly families (Ralston 1992; Ralston and Thomas 1987). Women were voyagers who often initiated their own explorations, connecting stories with other Pacific peoples. (Huffer 2008; Wilson-Hokowhitu 2008).

Examples of this include evaluations that showed that the quantity of seafoods collected by women often matching or exceeding that contributed by men in some communities (Chapman 1987; Linnekin 1997). Similarly, Katherine Luomala (1977) describes that many of the valued items exchanged between communities were manufactured by women or involved the exchange of items associated with males for items associated with females.

However, D'Arcy notes that old assumptions about the role of women have persisted in Pacific maritime studies (D'Arcy 2008a). This is supported by book reviews undertaken on Pacific maritime history, such as of Darcy's *The People of the Sea* (2006a) in *The Journal of Pacific History* (2008b:111–24, especially, 113, 116) and in *The International Journal of Maritime History* (D'Arcy 2006b:371–428, especially 395).

The commonly held belief is that women were not voyagers and navigators of the Pacific. Wilson argues that this is a common case of a lack of historical context due to colonisation and misinterpreted anthropology, or a case of assimilation, colonisation and Eurocentric perspectives holding Pacific epistemologies as inferior and irrelevant (Wilson-Hokowhitu 2010). In the Carolines, navigators without male offspring would teach their daughters to sail and navigate so this knowledge could be

passed on to new generations. (Cunningham et al. 2006). 'Through a seafaring lineage and primary cultural continuity, Indigenous Pacific Island peoples have developed and maintain a long held genealogical relationship with the sea' (ibid.).

'The Hawaiian Renaissance in the nineteen seventies lead to contemporary voyages of women from the canoe' (Wilson-Hokowhitu 2010). This resurgence has seen many women of the Pacific involved in navigation, sailing and sailing knowledge transfer. Wilson (ibid.) sums up the narrative inequality of the colonist perceptive in her statement of equity as 'grounded in the Indigenous worldviews from which they originate. Indigenous men and women standing side by side in our struggle for equity in our island homelands.' The current context of traditional knowledge and sailing in the Pacific is being renewed and transferred by both women and men. The intergenerational knowledge sailing programs facilitated by the Te Toki Voyaging Trust and Curious Minds and the men and women involved in the continuation of this knowledge give homage to this statement.

6.3.5 Intergenerational knowledge transfer — sailing into hope for future adaptation

This case study was undertaken from a cultural integration approach and process, which involved more so immersion and involvement, value adding of my skills and interest area and contributing to the program. Rather than study this process of intergenerational knowledge transfer, this cultural protocol lead to process and project involvement. The project involved the Te Toki Voyaging Trust, Waka Hourua, on the He Waka He Tangata Coastal Tour 2017. It included the planning and programming a full production schedule of seven school days on tour and running the traditional sailing workshops, including Māori knowledge in celestial navigation, the use of traditional navigation, traditional knowledge in reading oceans, species and atmosphere and the introduction to traditional knowledge of stars through modern mapping and the star dome. I participated in the planning processes and the logistics of educational days. My role was to provide information to students on the indicators, seasons, clouds and species and also chat about the seasonal calendars of Australia. I think the main point here is that I went to "look and study" but because of my heritage background it turned into a cross cultural exchange (traditional trade) in this case it was knowledge exchanged.

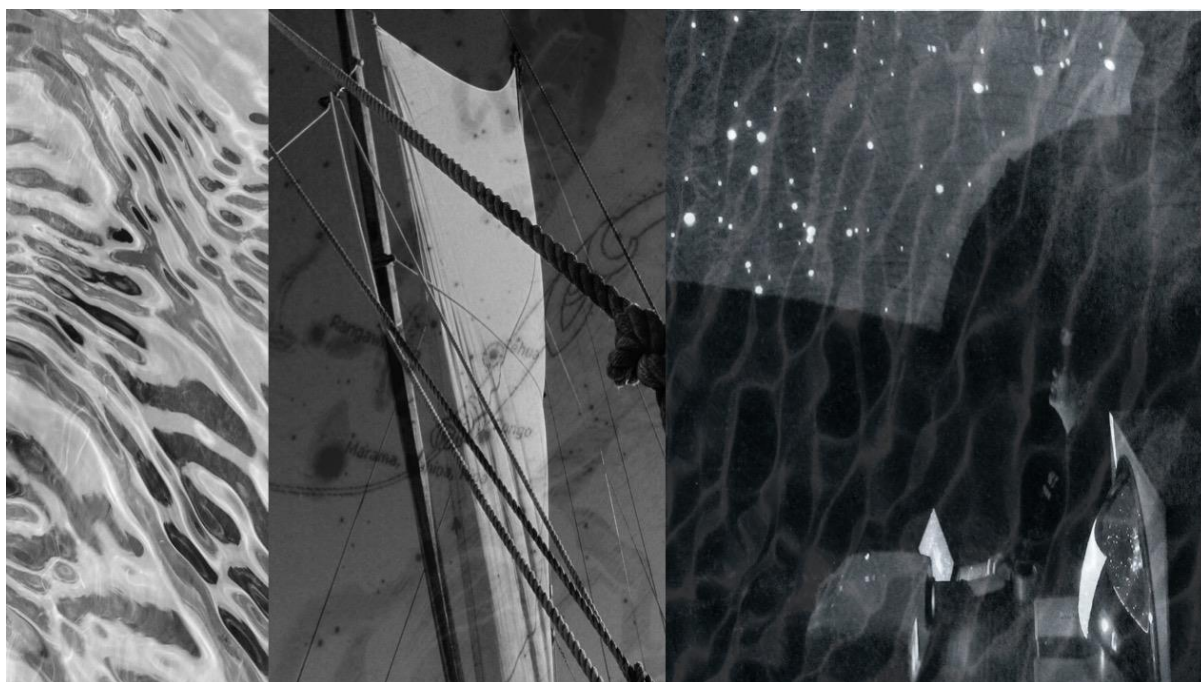


Figure 40: Photographic interpretation of star knowledge and transfer in contemporary mediums with Dr Pauline Harris in the star dome. Photograph by C. Marshall 2017.

The first voyage of the modern replica of a Hawaiian voyaging canoe, the *Hōkūleʻa*, in the 1970s coincided with a more general cultural revival. Relearning lost seafaring arts, *Kanaka Maoli* (native Hawaiians) then inspired the rest of Oceania with the voyages of the *Hōkūleʻa*.

Contemporary Indigenous Pacific navigators such as Mau Pialug, Nainoa Thompson, Shantell Ching and many others share a knowledge base conceptualising the ocean as a pathway, an extension of the land, that offers food, recreation and transport. The ocean is not a barrier that divides the islands and limits our movement; rather, it is our source of expansion and connection.

Indigenous Pacific Islanders have come to know and understand the land and ocean as extensions of ourselves nurtured by acknowledgement of our genealogy. From this worldview, the Pacific region was/is not made up of islands in the far sea; it is ‘our sea of islands’ (Wilson 2005:35–36).

Many ancient civilisations used the heavenly bodies to track the passage of time. The regular motions of the sun, moon and stars were used as clocks for agriculture, rituals, festivities and other activities (Aveni 1980:297; Urton 1981:98).

The Māori used similar methods for their calendrical systems, which were governed by more than one time cycle (Harris et al. 2012). The first cycle was based on the sun’s annual motion across the

horizon from its northern to southern solstice points. The second cycle was based on the movement of the sky during the year, in particular the movement of the stars. The third was based on the phases of the moon (ibid.). These cycles in conjunction with environmental and biological indicators were used to track time.



Figure 41: Georgia Bell on the Haunui talks about the spiritual components of sailing. The Mauri rocks have place and meaning on the vessel. Photograph by C. Marshall 2017.

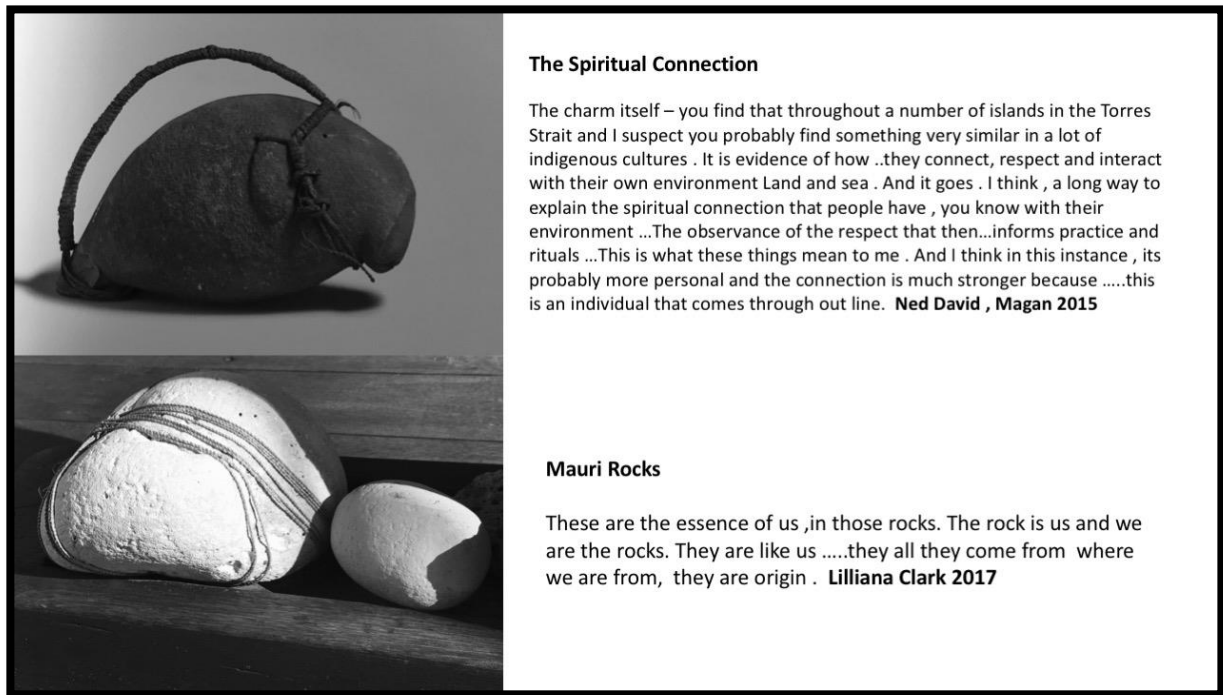


Figure 42: Photographic interpretation. This extract of charms comes from the Torres Strait. It is part of a collection from the British Museum. It was displayed as part of the Encounters collection at the National Australian Museum. This image is from the Encounters exhibition publication from the National Museum Australia. The Mauri rocks are also taken on vessels to sea. They have very similar spiritual meaning.

6.4 Case study 5: Moon living — cultural astrology (Photo essay: New Zealand and Gumbaynggirr)

6.4.1 Historical introduction

Ecological traditions embedded in astronomy have influenced, innovated and evolved Pacific people's cultures, society, knowledge, technology and religion throughout thousands of years and thousands of generations. Many Indigenous cultures throughout the world have cultural dimensional connections to the moon, either through spiritual ritual, creation connections, time and season observation, organisation of food production or movement for resources (i.e. migratory species). For many, the incorporation of lunar events or phases played a major purpose in culture, time keeping, food production, species knowledge, trade and economics. The moon and its phases also were embedded into with social structure and tradition.

The cultural importance of the moon as an entity and its associated cycles is nowhere better understood and explained than by the societies of the Māori people of New Zealand. Inherent in their culture are many instances of how the moon influences the livelihood and survival of people and

connections of culture to the atmosphere and night sky. The Māori have spent thousands of years studying and understanding the astronomical components of cycles and how these influence existences. An understanding of stars, planets and the moon was woven into language and flowed into culture, tradition and environmental resource management, which in turn influenced the actions of everyday life, time and effort.

The Māori lunar calendar is called the Maramataka, which literally means the turning of the moon. It marks the phases of the moon in a lunar month. Each night, which also typically marks a day, was given a name and over time each day/night was accompanied by information guiding fishing, gardening and other activities in the environment.

During a typical lunar month, some days are noted as being favourable for resource harvesting, whereas other days are known to be unfavourable (Roberts et al. 2006). These lunar months provided valuable information to assist in resource availability and production effort. This knowledge was essential in sustaining food production during seasonal environmental and atmospheric fluctuations. With the ensuing impact of climate change on the environment, various groups are looking to TEK as a source of information on climate change. This document concerns one of the most recent questions that has arisen, that is, if and how traditional calendars can inform climate change policy.

6.4.2 Maramataka — the lunar cycle

The characteristic lunar cycle is 29.53 days. Within the Maramataka, each night contains a name or descriptor. For example, Whiro is the first night of the new moon, Tirea is the second. This continues to the last night, Mutuwhenua (Roberts et al. 2006). The cycle then starts again with the appearance of the next new moon, with Whiro, Tirea, and so forth (see Table 10 below).

The following charts of names for days of the lunar month chart were adapted from the Māori Language Commission, who used the names from the majority of *iwi* (tribes). The Commission notes that differences are only in the sequence of the phases, with many names being similar (Museum of New Zealand 2019).

1. Whiro (<i>kohititanga</i>)	..	..	• —	
2. Tirea	..	..	• —	→ ()
3. Ohoata	..	..	• —	→ ()
4. Oue	..	..	• —	→ ()
5. Okoro	..	..	• —	→ ()
6. Tamatea	..	..	—	
7. Tamatea-ngana	..	..	•	
8. Tamatea-aio	..	..	•)	
9. Tamatea-whakapau	..	..	•)	
10. Huna	..	..	e	
11. Ari	..	..	(	
12. Hotu	..	..	(	
13. Mawharu	..	..	•) (	
14. Atua	..	..	e	
15. Ohua	..	..	x (	
16. Turu	..	..	L x (	
17. Rakau-nui	..	..	L x (	
18. Rakau-matohi	..	..	L x (	
19. Takirau	..	..	•)	
20. Oike	..	..	—	
21. Korekore	..	..	e	
22. Korekore-turua	..	..	e	
23. Korekore whakapiri ki nga Tangaroa			L	
24. Tangaroa-amua	..	..	• —	→ ()
25. Tangaroa-aroto	..	..	• —	→ ()
26. Tangaroa-kiokio	..	..	• —	→ ()
27. Otane	..	..	• —	→ ()
28. Orongonui	..	..	•)	—
29. Maurea	..	..	•)	—
30. Mutu	..	..	•)	—

Figure 43: A Maramataka from *Fishing Methods and Devices of the Māori* (Best 1986). Source: Museum of New Zealand 2019.

	Name of night	Relevant description of the night.
1	Whiro	Bad day; the moon is out of sight.
2	Tirea	Bad day; the moon is slightly seen. (New Moon.)
3	Hoata	Good day for planting and fishing, the moon is well shown.
4	Uenuku	Good day for planting from dawn to mid-day; good night for eels.
5	Okoro	Good day for planting from mid-day to sunset, good night for catching eels.
6	Tamatea-a-hotu	Bad day for planting and fishing; sea is disturbed by ocean currents.
7	Tamatea-a-ngana	Bad day for planting and fishing; sea is disturbed by ocean currents.
8	Tamatea-aio	Good day for planting and fishing. (Quarter Moon.)
9	Tamatea-kai-ariki	Bad day for planting and fishing, sea is disturbed by ocean currents.
10	Huna	Bad day; everything is hidden.
11	Ari	Fairly good for planting and fishing; good night for spearing eels.

12	Maure	Fairly good for planting and fishing; good night for spearing eels.
13	Mawharu	Good day, especially for pot cray-fishing.
14	Ohua	Good for planting, good return for all seeds and seedlings.
15	Turu	Fairly good for planting; tide coming in morning and evening, sun setting and moon rising simultaneously.
16	Rakaunui	Good day for planting, but not for fishing (Full moon).
17	Rakaumatohi	Fairly good day; whitebait is moving. (Moon commencing to wane.)
18	Takirau	Best day of all; plant kumara.
19	Oike	Fairly good day for planting and fishing.
20	Korekore-hahani	Bad day, everything is unobtainable.
21	Korekore-whiwhia	Bad day, everything is unobtainable.
22	Korekore-rawea	Bad day, everything is unobtainable.
23	Korekore-piri-ki-tangaroa	Slightly better day, from mid-day to sunset; night for eels. (Moon last quarter.)
24	Tangaroa-amua	Good day for deep sea fishing; white bait is running.
25	Tangaroa-aroto	Good day for deep sea fishing; white bait is running.
26	Otane	Bad day for all things.
27	Orongonui	Bad day for anything.
28	Omutu	Bad day for anything.
29	Mutuwhenua	Worst day of all. (Moon is dead.)

Table 9: The Māori Maramataka (moon cycle calendar) from the Ngati Kahungunu tribe. Source: Mitira 1972:261–62.

6.4.3 Resource harvesting and lunar cyclic events

Maramataka provided fishing, hunting and planting work schedules, ensuring the effectiveness of scheduling resource allocation and maintenance processes, which was imperative when undertaken in optimum environmental conditions and within optimum species cycles. This understanding, expertise and precision is what sustained and enhanced the Māori for thousands of years and hundreds of generations. This knowledge allowed the seasonal cycles and variations of moon phases to establish the system of self-sustainability and ongoing sustenance to the wider group. The flow on of astronomical knowledge stemmed into seasonal cycles and then preservation technology and techniques resulting in sustenance management. These calendars are still used and referred to today.

My friend Lilliana Clarke was interviewed regarding her students' project at Te Whare Wananga o Awanuiarangi, where they were monitoring the behaviour of fish and the moon. I first met this class whilst at a workshop in NZ. Lilliana explains an interpretation of Maramataka from a Māori perspective:

There was science behind the Maramataka — it was precise and meticulous, based on minute and daily environmental observations, traditions and whakapapa over a long period of time. Observing the ocean swells, knowing when the water table is high — and when ordinary people were sleeping, tohunga (priests) were out observing the stars and the moon (2014).

Lilliana went on to explain how her knowledge and perspective on all things derives from the collective learning and mentoring of generations of her ancestors:

I am because of the growth born from the circles of beautiful *tāngata whenua* (people of the land) who have inspired me in many ways. These *whakapapa* (familial) relationships are the gifts of life, handed down to care for, to tend, and to weave creating the mats we pass down for multitudes of generations ahead. So we never forget that everything we do is for the communities we serve, so the collective thrives, so our families/communities rise up to be strong on all fronts and confident in who we are and where we come from. To create the future we decide on, one we work towards to truly heal our *maunga* (mountains) to *whenua* (land) to *moana* (sea) and to each other. A future of *whanau ora*, *whenua ora*, *moana ora*, *rangi ora*, healthy, productive, and thriving communities. *Tūpuna* (ancestors) who crossed our paths and will continue to unfold the treasures they left for us to re-remember and find our way to rise again (ibid.).

6.4.4 Fishing — Kaimoana

The knowledge of changes and the meaning of the environmental attributes associated with seasonal cycles, along with the variations and fluctuations of these components, were essential elements of adaptation and existence. The changes in seasons denoted the altering weather patterns, food resource availability, ecological cycles of species and hydrological variations. The positions of celestial bodies also provided expanded awareness of weather conditions and species prerequisites, in this case, of fish. The diversity in the topography of Aotearoa provide varied conditions in the landscapes, including alps and large glacial river systems, coastal inlets and fjord lands, rocky coastline fjords, stretching sandy and pebble beaches and volcanic islands that support hard and soft corals. This diversity gives rise to a number of different resource opportunities.

The Māori understood intimate details of fish life cycles and movement, which provided proficiency in fishing. A fishing calendar was created to provide knowledge transfer of this comprehension of fishing effort, time and technique. This also included whether fishing would be more successful during day or night.

The Maramataka was particularly influential for fishing schedules. The obvious factor is the moon as the dictator of tides and tidal events. The other is that many species of fish are dependent on the cyclic system of the moon for spawning and migratory events. The moon is also particularly important for the timing and predictability of fish behaviour. Like other Indigenous cultures of the Pacific, traditional Māori fishing operations were methodical, with different tribes having partitioned fishing zones. These ancestral areas were indicated by landmarks and physical markers. Fishing was often a communal activity, with all tasks being undertaken by the group. It included fish observation, net making, fish catching and processing (Best 1986).

Sustenance collection is an important educational tool for teaching younger generations law through the expression of knowledge and reinforcement of spiritual beliefs (Collins 1996). Caughley et al. (1996) suggest that without collective food gathering, social networks would be disrupted. To this day, the gathering of marine resources is a social event. I have witnessed many conversations and discussions on whether resources are 'right' to eat, and the excitement of when a favourite food is 'coming into season'. The arrangement of meeting up to gather or fish is a perfect example of kinship and social interaction based on cultural values. These processes are a part of culture and are significant in the sustenance of resource teaching.

It was through my interest in cultural resource mapping and traditional food nutrition that I started developing traditional calendars. This then led to an invitation to New Zealand to attend the UNESCO Te Hurihuri o te Ao (Cycles of Change) – Traditional Calendars for Informing Climate Change Policies seminar and workshop. It was here that I met six students of the bachelor of environment studies programme at Awanuiārangī who contributed research through summer internships, conducting interviews and logging data about traditional and contemporary understanding and use of the Maramataka. Their group presentation included a display of *kai* (food) harvested by the students according to the Maramataka, including kūmara, kamokamo, smoked fish, pipi and inanga. The project included interviewing kaumātua and traditional practitioners, as well as people in their 20s and 30s, documenting both traditional and new understandings of the Maramataka and assessing how contemporary social and cultural factors affect its use today. The project set out to identify how contemporary practices may impinge on different species or on resource management restrictions factored into the Maramataka (through, for example, timetabling periods for fixing nets and preparing gardens). The Maramataka was about harvesting for the sustenance of the people. The intricacies of time, species biology and climate are factors that require comprehensive knowledge. The efficient use

of time and enhancing harvest for the *whānau* (extended family) and for the *marae* (meeting grounds) are of great importance.



Figure 44: Photographic interpretation of historic climate change from a newspaper clip from 1920 highlighting the knowledge and consequences of coal and carbon dioxide in the atmosphere. Then the association of climate changes and fate of whitebait in NZ. Photograph by C. Marshall 2018.

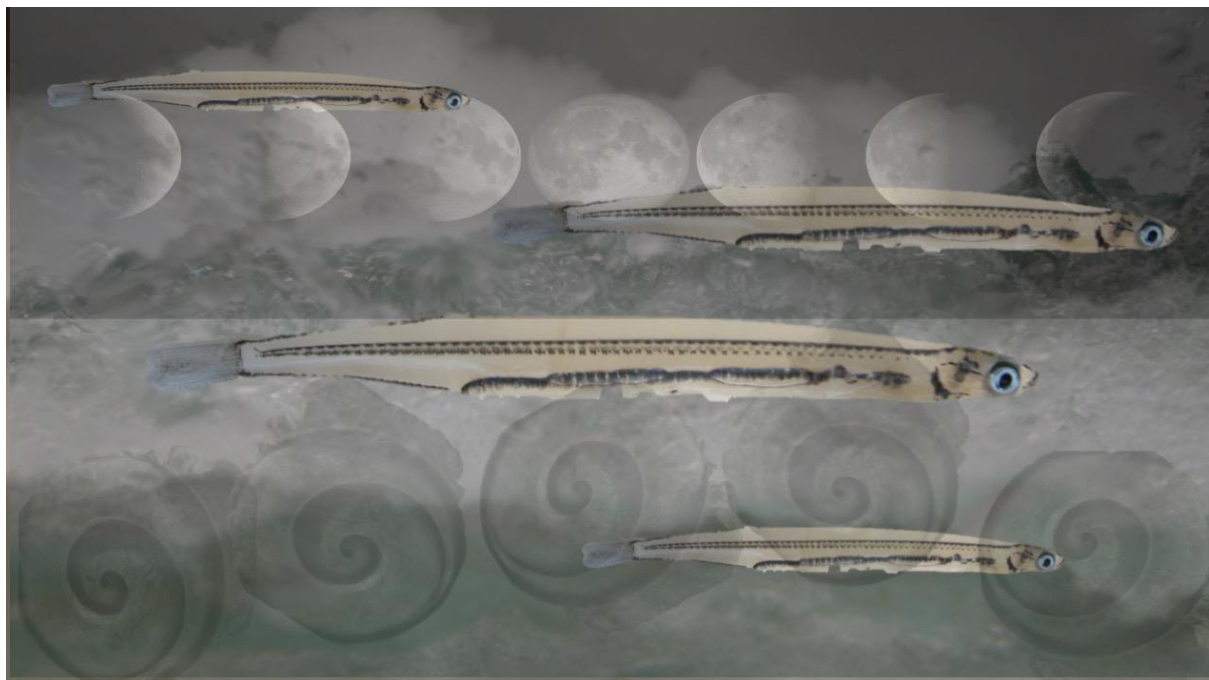


Figure 45: Photographic interpretation of white bait and climate change. The association of moon cycles and increased storm events leading to increased rain and fate of whitebait in NZ. Photograph by C. Marshall 2018.



Figure 46: This is my interpretation of the moon and the fish unity and how each is connected. Photograph compilation by C. Marshall 2018.



Figure 47: The whitebait lay eggs on vegetation upstream. The unknown factors associated to climate change could push this species that has sustained Māori fishing and sustenance for generations into further decline. This is my interpretation, a message from the fish. Photograph by C. Marshall 2017.

6.4.5 Traditional and contemporary understanding and use of the Maramataka

Traditional knowledge about sustainable food production and management practices is an integral part of island living. The knowledge around *kai* (food) relates to traditional and contemporary food, sustainable practices, food production and *kaitiakitanga* (management). There are a number of programs throughout New Zealand aimed to re-insert this knowledge back into *whanau* (extended family), *hapū* (subtribe) and *iwi* (tribe) settings.

This knowledge includes skills in preserving, enhancing, designing and preparing *māra kai* (gardens), as well as intimate knowledge of moon phases and when to plant and harvest according to traditional practice, through *ture tikanga* (customary practices or behaviours) and *ture tangata* (secular movement) principles, Indigenous systems of growing and producing food (*Hua Parakore*) and *kai* as medicine.

Since the incursion of European colonisation in the Pacific, the changes in lifestyles and diet have had various consequences for the people. This is particular true for the nutrition transition, where the increase in external influences and trade agreements for a globalised world have come with inevitable health issues for Indigenous people, characterised by western-dominated foods high in refined sugars, starch and saturated fats. These malevolent ingredients were first introduced as trade products and quickly became everyday sustenance, bringing health issues such as heart disease and diabetes (Caballero and Popkin 2001). In a modern context, these ingredients have become the trademarks of chain stores and their mega-capitalist creep to dominate every landmass on the globe (Hviding 1996). The low-priced foods and marketing make these products very attainable to low socio-economic people and their families, many of whom are Indigenous.

It is highlighted throughout much of the Pacific that these food consumption changes and the reduction of localised food production and preparation, including the cultivation, contributes to the loss of knowledge and heritage (Ross et al. 2011). An example is the replacement of taro with rice products, which is undergoing significant change as Pacific people place increasing reliance on imported foods rather than subsistence gardening to meet their dietary needs (FAO 2018). It has been documented that the integration into a cash economy and increasing involvement in global food markets has affected the traditional Pacific diet (Pacific garden products and fish), which is increasingly

being replenished with nutritionally inferior cheap food imports such as white rice and instant noodles. (FAO 2018; Leon Guerrero et al. 2009; Lawrence et al. 2010; Pitman 2016). In addition to contending with the impacts of climate change, these circumstances unveil concerns regarding a secure and self-determining food future for these small Pacific Island nations (FAO 2018; Lawrence et al. 2010).

6.4.6 The process and store houses



Figure 48: Māori oven, 12 March 1933. Source: Leslie Adkin Te Papa (A.007089) courtesy of the Auckland Museum Collection.

6.5 Conclusions — the revitalisation of traditional knowledge

The dimensions of traditional calendars are moral, ethical and spiritual. They are based on experience and sagacity, unchanging in integrity, rooted in cultural knowledge systems and living through continuing cultural practice and intergenerational knowledge transfer.

Although many purists and romantics would love to keep Indigenous people's knowledge in the past, the knowledge is attached to the people and the evolution of people in time and place. It is with this that the understanding and practice of this knowledge also evolves by practice and utilisation in contemporary settings. In other words, it is fluid and contextual rather than rigid and fixed. The

Maramataka sustained and provided knowledge on fishing, hunting and planting schedules for Māori communities long before the arrival of *Pākehā* (European people) and Maramataka is still used today (Hakaraia 2008).

Indigenous knowledge systems have always been; they may be dormant, they may be resting but they are never lost. The systems of knowledge include the holisticness of the knowledge, including the science, the spirituality, the species associations and the values and principles attached.

Over the last 20 years, through the persistence of Indigenous scholars, community and leaders, the world collectively has realised the importance and value of traditional knowledges. The reawakening and willingness of Māori to reveal this knowledge comes with the protection mechanisms to sustain the cultural integrity that is needed with this information. One must remember that this knowledge has always existed and has always been practiced in some form, but it is the recognition from western institutions that has labelled its surfacing as a resurgence.

The divergent concepts applied to species have also been applied somewhat inappropriately to Pacific Island societies, basically diminishing their cultural achievements and interactions. The Pacific is also home to a diverse and varied compilation of Indigenous people. This blue abode continues to provide sustenance and cultural responsibilities for many island people of the Pacific. Hence, Pacific environmental history is a potential tool for rectifying Eurocentric misrepresentation of Pacific cultures as being isolated and vulnerable to external influences. (D'Arcy 2012).

The intergenerational knowledge transfer of Māori astronomy and astronomical knowledge includes the teaching of the Maramataka (lunar calendar) for planting, harvesting and fishing, ocean navigation and the Matariki (Pleiades) celebrations.

This photo essay focuses on comparisons of Gumbaynggirr and Māori worldviews on astronomical knowledge and how it has influenced and shaped fabricated and generated science, technology, culture, society and belief, which have influenced the adaptation, resilience and evolution of Aboriginal and Māori people. These expansive timeframes of examining, analysing and reviewing had a primary place in everyday life and seasonal cycles. The study of stars has led to the interweaving of findings into language, culture and environment. (Whaanga and Matamua 2016).



Figure 49: One of the youngest of the crew Pera Waka contemplates the waves and learnings through intergenerational knowledge transfer. The image also shows the star constellations and female component of the waka. Photo by C. Marshall 2017.

Chapter 7: Sustaining the Integrity of Indigenous Women's Roles in Generational Knowledge Transfer

7.1 Decolonising methodologies

Much of the historic observations of Pacific women were generally experiences or observations from white men constructed around personal views and assumptions of gender bias within their own European or western-based religion, class or race. This western notion and view of women within society and culture resonated in the colonial layering of New Zealand and Australia. As a result, the documentation of women's role and functions in sea management within the Pacific is somewhat fractured in its presentation and representation. Once again this is a result of utilitarian, egocentric, euro-anthropological, male-dominated study and presentation. In the last 20 years, we have seen community leaders, women scholars and writers emerge with female perspectives on Pacific history. Pacific Islanders have their own way of telling and seeing their past. It is an approach that particularly diverges from western historiography in its emphasis on genealogy and spirituality.

The photo essay contained in this chapter is meant to present a visual of the spiritual and cultural role women have in sailing. It also adds to the larger body of knowledge available about the Pacific region, specifically women's connections, voyagers and roles as knowledge holders and sea managers.

This case study explores the roles of women in ocean knowledge systems and climate change along with genealogical relationships with oceanic realms and oceanic peoples. I will look at the creative dimensions and spiritual components of the Gumbaynggirr women's perspective through cultural story animation. The study will also refer to the history of woman voyagers and the case study of the contribution of women to intergenerational knowledge of sky navigation being delivered by the women of New Zealand. It highlights the ancestral knowledge that is linked to our DNA, genealogical connections and the responsibilities of sharing the knowledge that is part of us.

7.2 Oceanic women — sailing sisters

Indigenous people of the Pacific have long had a significant interdependence with the ocean where they live. These marine systems and environments are vital for our survival, providing a wide array of food, shelter and materials. The sea environment is also significant for our cultural, religious, social and emotional systems. We are custodians and stewards of our cultural land/seascapes and

environmental systems. We have been entrusted by ancestral charters in our bloodlines to care for these through successive generations. I write with such passion and assertion knowing the ocean like a friend, an entity I have intertwined with all my life. From a very young age we learn to respect and operate within it and for it.

The land and sea interface, its features, environments and products, form cultural seascapes, which are given significance by our belief systems. These cultural seascapes are both the result of and provide the focus for ancestral events. Together with our social, political and religious systems, the sea, the land and environments are interwoven into a tightly integrated cultural system of values, meanings, principles and worth.

This is my knowledge: it's like knowing that the salt water is as much a part of you as you are of it, like it runs through your veins, you can feel it. The stories from my grandparents, mother and father, my father's brothers and uncles form this oral transmission of knowledge in accordance with well-understood cultural principles and rules regarding the management of knowledge. This is where I derive from, a family of fish and a totem that is the sea. My whole upbringing revolved around these fundamentals, this is my culture.

Systems of knowledge and their products and expressions are vital to ensuring the continuity and integrity of our culture and are important paths for enabling Indigenous peoples to adapt our societies and cultures to introduced societies, cultures and technologies. A similarity in regional and Pacific context is the role of women in intergenerational knowledge transfer, revival and upkeep of local knowledge systems. This role also moves into wider variations of social and emotional wellbeing and the cohesiveness of family and culture. It also extends to conservation of natural resources.

The Eurocentric and male-dominated perceptions of Indigenous people meant that predominantly male archaeologists, anthropologists and historians focused on the male-orientated components of ritual and culture. This then set in motion the disregard of women's role, function and place within family and tribal groups. As a consequence, their role and purpose and meaning were excluded from colonist worldview. Fortunately, the men within these tribal groups understood women's functions.

I have always believed that maintaining cultural diversity through recognition and protection of Indigenous knowledge can benefit wider environmental conservation, sustainable management and even society generally.

In the past, on cultural landscapes, people seem to have moved seasonally between permanent settlements near the sea and the headwaters of the coastal rivers. The coastal and marine

environment is quite diverse, with many habitats each having their role in resource provision. Many of these are still used today.

Expressions of customary practices such as hunting, fishing and collecting are activities that require knowledge of customary ways of procuring these resources. The exercise by Indigenous peoples of their rights to carry out these activities in accordance with our laws and customs should be regarded as a demonstration of our assertion of rights to our traditional knowledge systems.

7.3 Biological diversity, cultural diversity and Indigenous peoples

The loss of rich biologically diverse environments (such as the Amazonian forests) through activities such as logging, land clearance and mining and development has profound consequences on the culturally diverse groups of Indigenous peoples whose livelihoods depend on these environments. There is, in this sense, a direct relationship between biological diversity and cultural diversity; maintenance of the former can help preserve the latter. The reverse is also true, since Indigenous peoples are often the custodians and stewards of biological diversity, the maintenance of cultural diversity is an important factor in the conservation of biological diversity (Schnierer 2011).

Despite these important links between cultural and biological diversity, the recognition of cultural diversity does not necessarily always exist in harmony with the preservation of biological diversity. The preservation of cultural diversity is taken to include having a respect for and maintaining Indigenous peoples' rights to hunt, fish and gather according to their customary laws and practices. These practices, as shown in the following story of Giidan the moon man, sometimes conflict with the interests of conservation and environmental protection.

7.4 Moon Island, or the *Giidan Mirral*

This Gumbaynggirr area is associated with a celestial figure (moon) who came down from the universe and made his home on what is known as Muttonbird Island. In Gumbaynggirr language, this place is known as *Giidany Miirral*, which means 'Moon Sacred Site'. This giant moon being walked the beach and controlled the sea and tides and could turn the sea to a lethal weapon. No one was allowed to go to the island, although documented information suggests that individuals from certain 'sections', including totemic gender and family structure-based order, were allowed safe access. This formed part of a controlled-access application. The prohibited measures placed on the access to the island vary, from gender restrictions to food resource collection (initiated men/sections) with exclusion

periods (trial periods for those initiated). This site is associated with mutton bird breeding and nesting. It is also associated with lobster Dreaming and resources.

In 1960, G.F. England documented the story of the islands as:

When the moon was full, it appeared to rise out of the sea where a shallow reef (now partly encumbered by the northern breakwater), the reflection of the moon and the breaking waves on the reef gave an illusion of the moon rising over the reef. During the day the moon was known to take rest in the sea just off the eastern point of the island.

The story told by Harry Buchanan to G.F England in 1960 describes the association as:

This man came down from the moon and made his home on the island. He was like any other coloured man, only he was about eight-foot tall and he must have weighed between 25 and 30 stone. His feet must have been three feet long. A lot of people used to see him walking the beach there. No one was allowed to go to the island except the father-in-law and the mother-in-law. You couldn't go on your own for he would run the tide on you. He kept the mutton birds on the island for the people to feed on. He had yams and all. They used to lift up the stones and all the yams would be there and they would put them all in a bag.

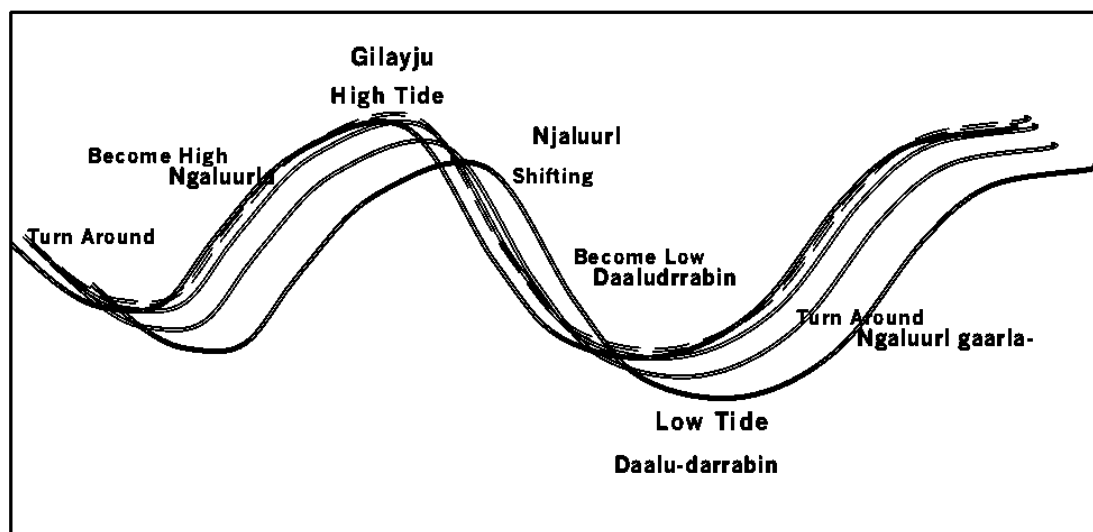


Figure 50: Tidal sequence and Gumbaynggirr interpretation. Graphic by C. Marshall adapted from Morelli 2008.

The story of the making of languages and Yuludarla's journey along the coastline tells of the creation of the tribal language groups along the coastline and the creation of river systems in Gumbaynggirr and adjoining tribal groups. The story of the moon man provides insights into mechanisms of resource management, warnings of tidal currents and ecological reasons for certain plant species, along with an emphasis on spiritual awareness.

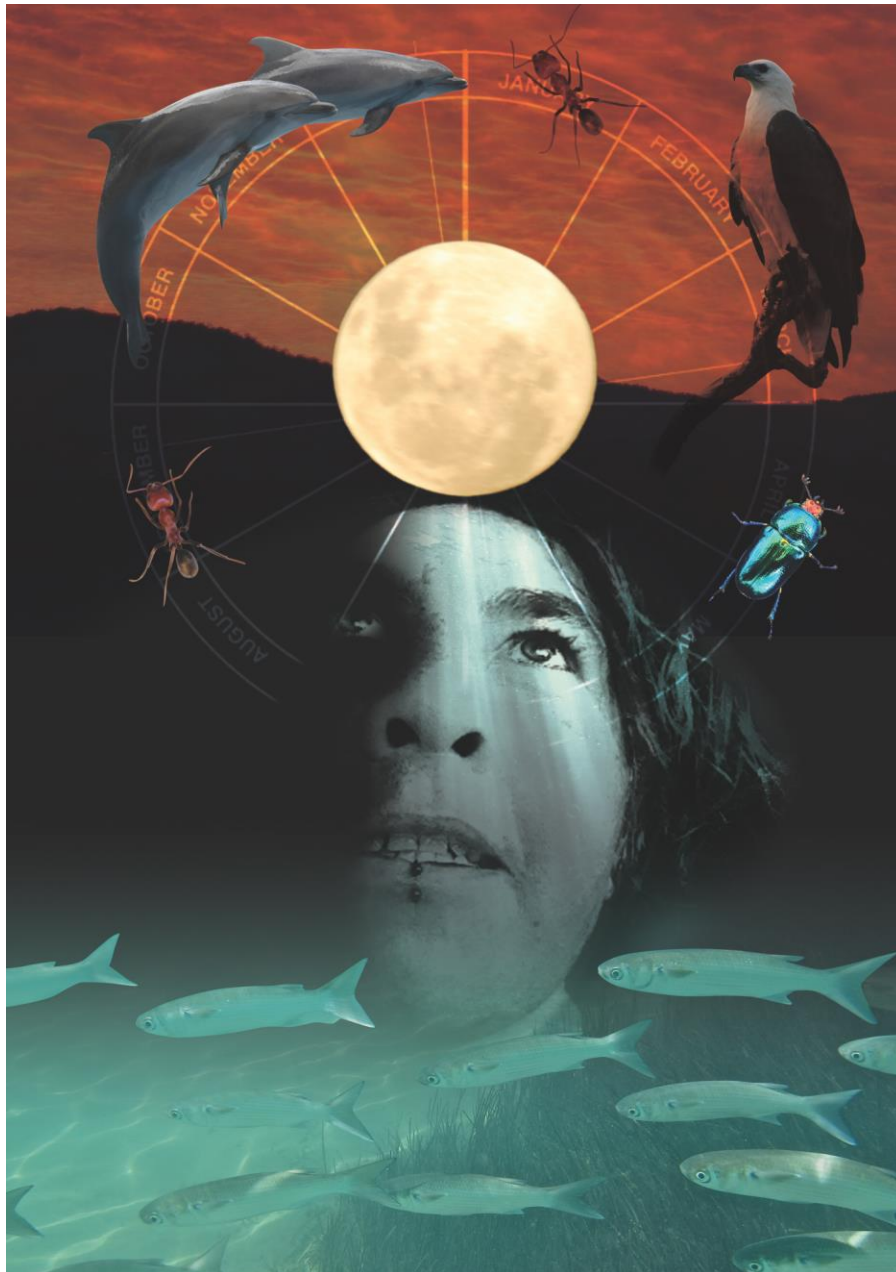


Figure 51: A self-portrait used for promotion at the Australian Museum for the Gumbaynggirr seasonal calendar. Photographic images by C. Marshall, graphic work by Caz Nowaczyk, Exposure Arts & Media 2015.

7.5 Gumbaynggirr women and the sea

Approximately one thousand Gumbaynggirr people lived on the coast of East Australia before the disruption and onslaught of white settlement (Morelli 2008). There were many commonalities between the people, including a language, initiations, section names and creation stories. At the same time, loyalty and commitment to one's own clan and *jagun* (homeland) existed along with our

language dialects and traditions. An example is the Bagabaga (Nambucca) ancestors who belonged to the sea and the rainforest. In each area, different clans (usually family groups) occupied the landscape; the people were as distinct as the landscape itself. Each *jagun* had its sacred paths and areas where rites of passage and lore were passed on by the ancestral heroes and great spiritual beings were remembered and honoured, primarily by those clans who were *guumunbu* (belonged or related to each place). These clans were united by the women of the groups, who were expected to marry outside of their own clan and spatial distribution but inside the Gumbaynggirr tribe (Morelli 2008).

During the 18th and 19th centuries, women were placed in an unusual social space by the male-dominated western society. It was an unfamiliar position for Gumbaynggirr women, to go from a respected specialists with authority to an inferior sub-standard existence through British male egotism (from even those who were convicts and considered inferior back in England). It was described as a man's world. All literature referred to male connotations and all administration and governance were from arduous male approaches and direction. It was also considered that women had no role or function in environmental conservation and promotion (Aditya 2016).

These Eurocentric male perspectives flowed into Australia during the colonisation period, where the interpretive and anthropological narration was highly dominated by male explorers, surveyors, colonist, convict settlers and British Government officials' perspectives. The opinions tended to exclude female perspective or Aboriginal female constituents within the historic writings of not only Australia's cultural history but also much of the Pacific.

This explanatory history was therefore somewhat biased in its informative perception as well as being exclusive in its narration. Alternatively, this could have been a cultural benefit in disguise, allowing grandmothers (*mimmi*) and mothers to continue to uphold oral tradition without the inception of anaemic analyses and allowing Aboriginal women to continue without any interruption of curiosity.

This was to change dramatically, however, as many males were defending country or being obscured by the colonists by the end of the 18th century. The plan of British invasion turned to occupation with dispossession of lands followed by dispossession from family. The 19th and 20th centuries saw a rhetorically benign period of assimilation, where laws initially intended to 'protect' Aboriginal peoples further oppressed and alienated them, with the trend of removing children to advance assimilation becoming systemised nationally (Australian Parliamentary Library 2019).

Of course, to continue the elements of culture transmission and to have knowledge, one needs to practice that culture or the aspects of it. The dispossession and exile from lands and seas by British colonists impacted the way of life for many Pacific people. The colonisation plans in Australia ripped at the heart of Aboriginal women's existence. The mass murdering of women, men and children, along with the ongoing violence toward husbands, uncles, brothers and sons, caused sorrow and sadness that still resonates within communities today. In adding to this distress and suffering, the genocidal governance that killed and removed children added to the pain, discomfort and grief. The ruthless British dominance that felt comfort in methods of discriminatory intent and dispossession also disrupted and continues to disrupt this continuation of cultural practice and full access to traditional cultural resources, especially within the marine environment.

The following image is a staged photographic studio set by J.W. Lindt in Grafton, Gumbaynggirr country. The women's lack of expressions and unwillingness comes through profoundly. Personally, I don't like these images. The reason I included it was to show the noticeably removed first two joints of the little fingers on the left hands of both older women in the photo. This is a tradition that was undertaken on many areas along the east coast of Australia. In Gumbaynggirr country it is described as *malgun*. The tradition was noted along much of the east coast from the south, as far as Victoria, to the north to the Gumbaynggirr (Clarence River).



Figure 52: Two Gumbaynggirr women and children from staged photography. The two women show *malgun*, 1873–74. Source: J.W. Lindt, courtesy of the Grafton Regional Gallery 2019.

Malgun was a curiosity for colonial observers, with many misinterpreting this important custom by creating their own explanations and cultural assumptions for the significant woman's business.

For example, Captain Arthur Phillip of the First Fleet, interpreted fingertip removal as follows:

It was now first observed by the Governor that the women in general had lost two joints from the little finger of the left hand. As these appeared to be all married women, he at first conjectured this privation to be part of the marriage ceremony; but going afterwards into a hut where were several women and children, he saw a girl of five or six years of age whose left hand was thus mutilated; and at the same time an old woman, and another who appeared to have had children, on both of whom all the fingers were perfect. Several instances were afterwards observed of women with child, and of others that were evidently wives, who had

not lost the two joints, and of children from whom they had been cut. Whatever be the occasion of this mutilation, it is performed on females only (DECCW 2010).

Then by the time colonist John Turnbull visited Sydney in 1800, most white settlers realised that *malgun* was related to fishing. Turnbull describes the practice:

Whilst the female child is in its infancy, they deprive it of the two first joints of the little finger of the right hand; the operation being effected by obstructing the circulation by means of a tight ligature; the dismembered part is thrown into the sea, that the child may be hereafter fortunate in fishing (DECCW 2010).

The custom of sacrificing a small portion of the little finger of young girls to identify them as fishers and fishing knowledge holders was also practiced further north in the Port Stephens and was observed into the 1860s (Bennett 2007).

William Scott, who grew up in Port Stephens around the 1860s and counted the 'lads of the tribe' as his 'playfellows', explains how this practice was related to fishing:

An Aboriginal woman, Fanny, who was a servant of our family for many years, was in her girlhood days dedicated to the art of fishing. When quite young, a ligature was tied about the first joint of her left finger very tightly, and being left there for a considerable time, the top portion mortified and, in time, fell off. This was carefully secured, taken out into the bay, and, with great solemnity, committed to the deep. The belief was that the fish would eat this part of the girl's finger, and would ever, thereafter, be attracted to the rest of the hand from which it had come (ibid.).

This tradition was also noted by E. Brough Smyth in his writings *The Aborigines of Victoria* with notes relating to the habits of the natives of other parts of Australia and Tasmania. Smyth noted that:

The practice of mutilating the body prevails in all parts of Australia. In New South Wales, the women, at an early age, are subjected to an uncommon mutilation of the two first joints of the little finger of the left hand. The operation is performed when they are very young and is done under an idea that these joints of the little finger are in the way when they wind their fishing lines over the hand. This amputation is termed *malgun*. The mutilation known as *malgun* is not confined, it is believed, to New South Wales. When the women are fishing they place stones in the canoe and keep a fire burning so they can cook the fish as soon as it is caught (Brough Smyth 1876).

The tradition of *malgun* identified the girls in the clan or family who would become the primary fisherwoman. This role held all authority in the fishing domain. The *malgun* process was associated with many components of fishing and marine ceremony, including these women being defined and dedicated as the knowledge holders of everything fishing, including the making of fishing lines, the instructors in the making of large fishing nets, the authorities on fish biology and those who determined where and when to fish. The *malgun* would be the main person to also make fishing lines

and hooks. She would also hold knowledge on seasonal cycles, biology and movement of fish species. *Malgun* girls and women were the knowledge holders and spiritual mediums for the ocean, rivers and its fish.

This is distinctly a realm where women were primary knowledge holders and largely responsible for fishing in coastal New South Wales. Women were designated as such both symbolically through the absence of two joints of their little fingers and practically, as the absence of this joint was said to aid fishing ability (Roberts and Schilling 2010). The custom of *malgun* involved ceremony to the ocean and wrapping spider web to the second digit (atrophy) on the little finger. Once the digit was released, a ceremony to mark the girl and her role as well as the sacrifice of the finger portion was undertaken. This was dedicated to the ocean, ensuring that fish would be plentiful and forever attracted to her hand.

Malgun was also about the practicalities of fishing. It was noted that the shorter little finger assisted in the ease of winding in fishing lines. The majority of these lines were manufactured by the women from fibres of young kurrajong, stringy bark or hibiscus trees, which were soaked, pounded and worked into a strong thread of rope many metres in length. The end of the line was the important part. The technology and manufacture of hooks was the essential item that determined the attraction of the fish to the women's lines. These hooks were carved from abalone or turban shells (and in other parts of Australia carved hardwood, bird talons and bone). The glimmering shine and alluring rainbows of colours and silvers in the pearlescent shell was the attractant to the fish. These fishing lines were cast over the sides of canoes and from shore then wound in. The strength of the line, the skill in hook manufacturing, the knowledge and ability of the women and the spiritual belief in mutual benefit and giving back ensured a successful catch.

Malgun is not only representative of past traditions, but is symbolic of the role and functions of women and their place as custodians, knowledge holders and authorities on the management of fisheries resources and their associated cultural and ecological variables of management on the eastern coast of Australia.

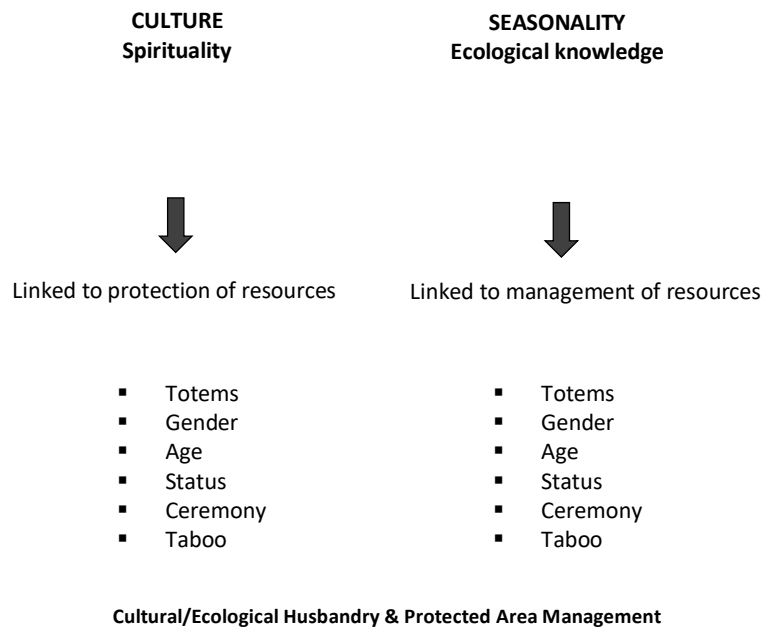


Figure 53: The components of spirituality in culture and ecological knowledge pertaining to management of resources. Source: C. Marshall 2018.

Prior to colonist settlement and landscape alteration through development, dam and road construction associated with population growth within the Gumbaynggirr area, it is documented that marine species (fish) were much more abundant. Historic documentation of early explorers reports pristine waters and large shoals of fish (Hodgkinson 1845). Fish are deemed the most important source of protein, and the main food, of coastal and riverine Aboriginal communities all over Australia (Isaacs 1987).

Sea people's routines were dictated by the physical ocean forces and the flow of moon and tidal regimes. The *Malgun* women, before British contact, had intricate knowledge of all marine ecological dynamics of the ocean and its creatures. The knowledge of where to hunt and what seasons to take in also ruled the interactive dynamics of coastal communities. Women were the managers and caretakers of our traditional fishing industry on the mid-northeast coast. Cultural practices and connection were an interconnected realm. Beliefs systems held regard for every creature having right and place to exist and undertake a role in nature dynamics, the equity in existence.

For Indigenous people, fishing is not only important for food and nutrition, but also for ceremonial occasions, exchange, trade and barter. Fishing is an invaluable component of cultural lifestyle and is

connected to the traditional responsibilities of management and kinship. To take advantage of the plentiful supply, a diversity of collection techniques was employed and various resources were utilised in conjunction with these. In time and space, Gumbaynggirr people living on the coast also faced and survived adversities, primarily natural disasters, climatic changes and sea level rise. These occurrences caused changing environments and landscapes and required careful resource consumption and management. The knowledge of seasonal cycles and the connections of environmental and atmospheric variables assisted in the organisation of productive processes. These seasonal ‘calendars’ were local frameworks for organising seasonal activity with values to people and place and species.

A variety of fish species were consumed by the Gumbaynggirr (Table 10). Common species included mullet (*Mugil cephalus*), blackfish (*Girella elevata*), snapper (*Pagrus auratus*), bream (*Acanthopagrus butcheri*) and groper (*Achoerodus viridis*). The ecological knowledge of the fish and their habitats and fishing skills enhanced the abilities of Aboriginal peoples to manage take, where ecological knowledge was applied according to season, habitat and locality with different fishing methods employed.

Fish	Gumbaynggirr	Latin
Mullet	buluunggal	fam. <i>Mugilidae</i> / <i>Mugil cephalus</i>
Mullet pink eye	guubam	<i>Trachystoma petardi</i>
Blackfish	warraagan	<i>Girella tricuspidata</i>
Bream	gaayi	fam. <i>Sparidae</i> / <i>Acanthopagrus butcheri</i>
Catfish, saltwater	ngambaalam	
Catfish	Wilang, wayin	Eel tailed
Cod (eastern?)	gurruuja	<i>Maccullochella ikei</i>
Drummer	gulaygarr	<i>Kyphosus</i>
Flathead	Yaalgirr, miijan	fam. <i>Platycephalidae fuscus</i> (dusky), <i>arenarius</i> (sand)
		<i>Neoplatycephalus richardsoni</i> (tiger)
Flying fish	balalagan	fam. <i>Exocoetidae</i>
Farfish	Jingamuri	fam. <i>Hemiramphidae</i> / <i>Hyporhamphus australis</i>
Groper	gunulgin	<i>Epinephelus lanceolatus</i>
		<i>Achoerodus viridis</i> (blue)
Jewfish/mulloway	ngaliwal	fam. <i>Sciaenidae</i>
		<i>Argyrosomus japonicas</i> (m)
Long tom	juuman	fam. <i>Belonidae</i>

Leatherjacket		<i>fam. Monacanthidae</i>
Perch	Bagubany, mirriga	<i>Glaucosoma scapulare</i>
		<i>Lutjanus russelli</i> (moses)
Fresh water perch	Bugambal, madu	<i>Macquaria colonorum</i>
Salmon Australasian	Nguulanyi	<i>Arripis trutta</i>
Snapper	Giyangarri	<i>Pagrus auratus</i>
Tailor	Jurruwal	<i>Pomatomus saltatrix</i>
Whiting	Jurruwiny, danggu	<i>fam. Sillaginidae/Sillago ciliata</i>
Eel	Buurrga	<i>Anguilla reinhardtii</i>
Shark	Yanggay	<i>Carcharhinus spp</i>
Stingray	Ngalaany	<i>fam. Dasyatis – fluviorum?</i>

Table 10: Fish commonly eaten by Gumbaynggirr people. Source: C. Marshall 2010.

7.6 Fishing methods used in Gumbaynggirr

The use of spears was undertaken in shallow enclosures, from canoes or around rocky shores primarily by men.

7.6.1 Traps

Traps were utilised to decrease fishing effort. Trapping was also an activity children could participate in. Knowledge exchange progressed through the collection of materials to make the traps, the time of sitting and making the traps, installing and knowing good places to lay the traps and then the checking of the traps. Although all participated in the making of line, nets and traps, Aboriginal women were and still are master weavers.

There were large traps, like that of the Arrawarra, where fish were rounded up into shallow embayments and waited until the tide receded. At full tide, the fish entered the trap through a seaward opening, which was then closed to prevent fish from escaping. This particular trap was used up until 40 years ago (Issacs 2002). The use of poisonous substances was also employed, usually in such habitats as shallow sheltered waters and rock pools.

7.6.2 Helpers, dolphins

The Gumbaynggirr dolphins are embedded in cultural storylines, kinship, place and ceremony. A common practice was ‘singing the dolphins’. There are many stories of the kinship associated with

dolphins and the role they played in Gumbaynggirr people's lives. The women of Gumbaynggirr Jagun were the keepers of ocean knowledge and ocean ceremony. As Uncle Milton Duroux explains, 'The women, they'd go out into the water, wade out to their waists and sing, to sing in the dolphins, and these dolphins would bring in the fish into the traps, and then the men did the fishing using the traps' ([Arrawarra Sharing Culture](#)).

The fish were rounded up into shallow waters where nets were then used to catch them. There are also stories of dolphins assisting in this method of fishing and being rewarded with a meal after the haul. The dolphins of the Nambucca River still undertake this fishing behaviour today, where they forage and chase fish into shallow waters or embayments along the river, breaching themselves in the process. It is suggested that this learnt behaviour originates from assisting the Gumbaynggirr people with fishing.

7.6.3 Nets

The nets for fishing were manufactured using material from the near vicinity of estuarine systems and were highly valued. There are also direct associations to story lines, resource areas and species. An example is the use of native hibiscus plants and the making of spears. Also, the use of species such as acacia/*Livistonia australis*/lawyer cane vine/*juncus* involved curing methods and various styles and techniques of weaving, depending on the specified use of the product. A particular type of weaving style is the coil. This method originated on the east coast of Australia and was taken inland by a white missionary. In 2010, I was part of a project that reintroduced and reinforced the coil method to the north coast of NSW.

7.6.4 Hook and line

Line made from hand-spun fibrous material such as tree bark was a common practice in many areas (Issacs 2002). Hooks were derived from many materials such as shells, bones or carved pieces of wood. Hooks were also made from various bits of steel. Metal hooks soon replaced these original forms. Gold was also known to be used for sinkers (pers. com. Edwards 2009). The habitat and the target species of fish determined the type of baits used. This included other marine species such as small crabs (ghost crab, soldier), yabbies, weeds (lettuce) and freshwater algae. Due to tides and fish cycles, night fishing was also favoured. The technique involved making a torch from driftwood and holding it high as you walked around the rocks and sand flats with a spear (pers. com. Marshall 2009).



Figure 54: Hook made from turbo shell, reproduction. Aboriginal artefact. Source: Willie Feinberg 1987.

The C or J shaped fishhooks are representative of the many types found along the east coast of Australia that appear in the archaeological record around 900 years ago. It is thought that these types of hooks were independently invented on the east coast of Australia or introduced from Polynesia (Cork 2018). This design of hook ranged in size from 13 to 50 millimetres. They were only used by females and were attached to a line formed from flax or stringy bark fibres with a small stone attached as a sinker. No bait was used on the hook as the reflective lustre of the shell acted as the lure. It is also recorded that chewed shellfish was spat out on the surface of the water to attract the fish (ibid.).

7.6.5 Poisons

The use of poisons to stun fish was also a widespread practice all over Australia (Isaacs 1987). This was very much the case for the Gumbaynggirr, where certain plants were crushed then thrown into pools or confined areas (small embayments, rock pools). Fish were stunned by the active properties of poisons in leaves, bark or roots. Fish usually swam to the surface or become disorientated and were then collected. The poisons released did not seem to harm humans upon consumption.

7.6.6 Knowledge of species and their life cycles — eel migration

Many native fish species (more than two-thirds of coastal species) rely on a variety of habitat types to complete a life cycle and undertake migration to do so. Such species include bass, sea and freshwater

mullet, long and short-finned eels and herring. Shortfin eels (*Anguilla australis*) and longfin eels (*A. reinhardtii*) are true freshwater eels.

Eels start their life cycle as larvae, approximately 50–70 millimetres in length, in the Coral Sea. Development is slow as the eel moves south with the East Australian Current, taking one to three years to progress 3000 kilometres down the eastern Australia coastline, where along the way metamorphosis into a tubular shape occurs, but they have no pigmentation (glass eels) (Forteath 1994; Silberschneider 2005). They then enter estuaries at night, where sex is determined. Individuals that swim upstream into upper reaches of riverine systems become females and those who stay in estuarine conditions develop into males (Edgar 2008). They change pigment (brown), become elvers and progress and adjust to freshwater, where they remain for six to 35 years. Once fully mature, the eels develop breeding organs. They stop feeding and their stomach disappears. The eel is then in the final stages of completing its life cycle. The fully grown adult then takes a journey back to the place of progeny where it spawns and then dies (Scott 1986; Silberschneider 2005).

Specific words in Gumbaynggirr dialect also indicate our level of knowledge about marine species and various distinctions between life cycles and stages of development. An example is the words that describe the mullet (*buluunggal*) and eels (*buurrga*), outlined below.

The Life Cycle of *Buurrga* (Eels)

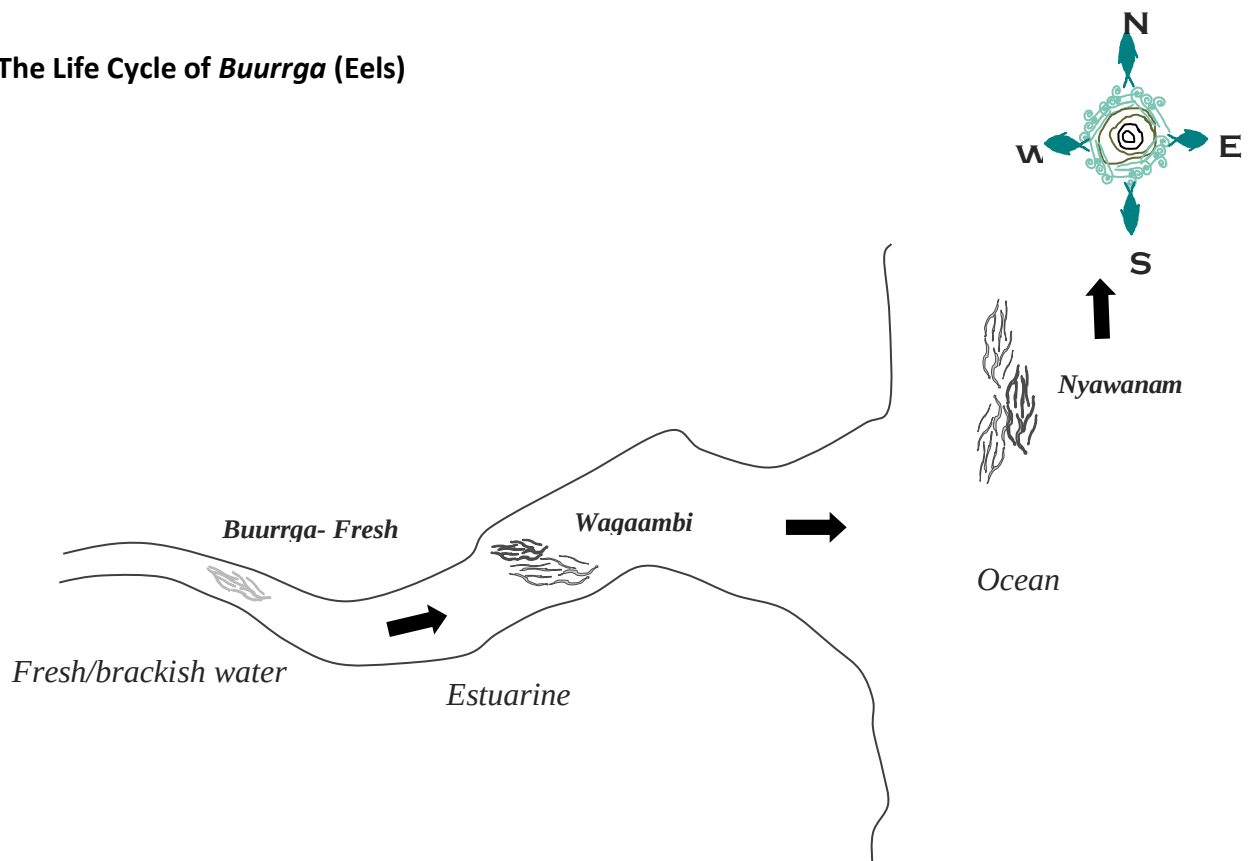


Figure 55: The knowledge of eel biology and migration in Gumbaynggirr country. Graphic by C. Marshall 2017.

7.7 The significance of fishing to Pacific people

The variety of species harvested and used as bait to harvest other species shows the associated species in knowledge, where any alteration of the cultural landscape poses a threat not only to the primary species but also the components of cultural association to other relevant and necessary species. In combination, these species make up the components of the holistic cultural system of practicing knowledge and culture, but also of obtaining resource species associated to the activity and process of obtaining.

Fishing is important to a healthy diet and lifestyle for Indigenous people of the Pacific and allows communities and families to retain their independence. The importance of fishery resources for some coastal communities of Australia is revealed in large measure by the dietary patterns of these communities and numerous middens found along the shores of our rivers and bays. Fish are deemed the most important source of protein and the main food of coastal and riverine Aboriginal communities all over Australia (Isaacs 1987). Seafoods have been shown to contribute between 30 and 40 per cent of the calorific intake in a coastal outstation community in the Northern Territory (Meehan 1982), and seafood consumption by Torres Strait Islanders has been ranked among the highest in the world (Johannes and MacFarlane 1991).

Many Indigenous people express a strong and continuing sense of belonging to, and responsibility for, geographic regions and their resources, which they consider to be their traditional estates (Resource Assessment Commission 1993). Anthropological research shows that distinct maritime cultures continue to exist among some Indigenous communities (Chase and Sutton 1981) and records dating back to early this century describe instances of a system of Indigenous property rights relating to reefs and seas (Cordell 1991). This sense of custodianship extends to fishery resources within the sea as well as land and many groups of Indigenous people consider areas in the sea as integral parts of their traditional country.

Social networks are reinforced through the customary sharing of gathered food (Caughley et al. 1996). The value of food collecting, hunting and fishing is seen as important in maintaining the social cohesion of Indigenous communities (Walsh 1992). Hunting is also used as an important educational tool for teaching younger people Aboriginal law through the expression of knowledge and reinforcement of spiritual beliefs (Collins 1996). Caughley et al. (1996) suggests that without food gathering social

networks would be disrupted, for example, some resources are harvested for community celebrations.

An example is the midden located at the 'Golden Hole' within Ngambaa *jagun* (country), just south of Stuarts Point, New South Wales (NSW). The site contains a series of extensive and well-preserved midden deposits that are amongst the largest in NSW and the Southern Hemisphere. The main midden deposit is a linear feature that extends for almost 3.5 kilometres. This consists of a band of midden deposits that lie parallel to an inlet and which appear to be a single, albeit discontinuous feature. On the surface, oysters (*Cassogstrea commercialis*) are the dominant species, with smaller proportions of cockles (*Anadara trapezia*) and whelks (*Pyrazus ebeninus*) also present. However, excavations have revealed that oysters are only common in the upper midden layers, with cockles being dominant in the lower layers. The Clybucca middens are part of a larger complex that includes the Stuarts Point shell middens located immediately to the north. It has been estimated that the Clybucca-Stuarts Point midden complex has a total volume of between 150,000 and 200,000 cubic metres. Archaeological evidence and radiocarbon dates from the Clybucca-Stuarts Point middens indicate that exploitation of the estuarine resources of the western margin of the lower Macleay River valley began around 5000 years ago and continued for about 3000 years. Hughes and Sullivan (2002) have linked the cessation of midden formation at this location around 2000 years ago and changes in the species of shellfish exploited to environmental change.

The Clybucca-Stuarts Point midden complex is the largest of its type (estuarine midden) in temperate Australia (Hughes and Sullivan 2002). It is almost continuous for a distance of 14 kilometres. Archaeological examination of the middens has revealed the shells of 16 species of mollusc and the bones of six fish species, three species of sea bird, six species of land mammal and three species of sea mammal (Knuckley 1999). Most of the larger middens in tropical Australia consist almost entirely of one species of cockle (*Anadara granosa*) (Hughes and Sullivan 2002). The Clybucca midden composition is not uniform; this reflects the changing availability of foods through time (Knuckley 1999).

7.8 Conclusion

The purpose of these case studies was to investigate and visually display through photography the knowledge systems of Pacific peoples' relationships with the ocean, atmosphere and coastal landscape environment. By exploring the connections between traditional cultural practices and creation knowledge relating to climate and seasonal change in the Pacific, along with marine habitats

and species as they relate to seasonal variation connection, a voice is given to the culture and practices of knowledge from Indigenous people's perspectives. As an Aboriginal woman, I felt it necessary to rewrite and interpret *malgun* from a female perspective. It is also an ancestry obligation.

What is clear is that Aboriginal women along the east coast of NSW had inherent responsibilities, capacity and specialisation in fishing business. Retrospectively, the ideological position of viewing women as less in European society eventually skewed perceptions of Indigenous women. This oppressive processing specialism deprived women from taking their congenital roles as specialists, environmental caretakers and authoritative figures in their cultural roles. The narration of creation and the associated interpretations of events determined social laws and behaviours. They also emphasise the significance of the ocean and important associated factors, dictating behavioural mannerisms in marine species fishing and gathering.

Moser (1991) details the roles of women in environmental protection and ecological preservation as:

- managers or maintainers of the natural environment
- rehabilitators of the natural environment in the sense of sustainable development and
- innovators in the use of appropriate technology in the creation of new environments.

Women as the biological controllers of Earth's human species have a responsibility. It is time for women to stand up from taking a backseat in society and it is time for men to acknowledge and shift this past ideology of male dominance. It is evident from indigenous perspective that ideology is one of the key factors letting our Earth mother and our fellow sisters suffer and struggle to retain this primary role within societal structures, all at the hands of greed and capitalism. The question is how we adapt on a damaged planet devoid of female influence in the dominant decision-making processes. It is also very clear that women like Wairaka, the chieftainess, and the women on the *waka* who have taken up the roles of saviours had ongoing support and encouragement from men, with all responsible for ensuring life was preserved.

At a local scale, recent amendments to the NSW Fisheries Management Act recognise the spiritual, social and customary significance of fisheries resources to Aboriginal communities. There is, however, still a way to go yet in ensuring culturally appropriate management strategies are implemented that address the inequity of female representation in decision-making and the cultural appropriateness of female cultural obligations. Figure 56 is one of my favourite images from my tribe, a man proud of his

partner catching the epic fish (that extends from her waist to her knee) and her smiling because she is the authority on all things fishing in this area and knows she has the support and respect through cultural rights in this role and function.

Why should Indigenous people, especially women, be more concerned or have primacy in the discussions and future design of climate adaptation and mitigation? Because climate change includes a holistic meld of issues. Indigenous peoples are peoples of the land and sea, many live and survive off the resources. Many Indigenous peoples are also the main stewards of biological and cultural diversity. Rights, cultures, livelihoods, traditional knowledge and identities are founded on the intricate relationships and associations established with the environment. When these things change or disappear we suffer the worst impacts (Tebtebba Foundation 2008).

Fish and fishing play an important role in culture, tradition and cultural obligation. To ensure Indigenous people of the Pacific's fishing rights, connection and voice are expressed within the climate change policies. More needs to be known about the dimensions of cultural protocols, seasonal knowledge and issues affecting Indigenous communities with traditional marine food resources in the face of climate change. Doing this in partnership with Indigenous communities and ensuring female involvement will help an exchange of ideas with researchers and managers about how to sustain fish stocks while at the same time building Indigenous capacity to play a more effective and proactive role in marine food management.

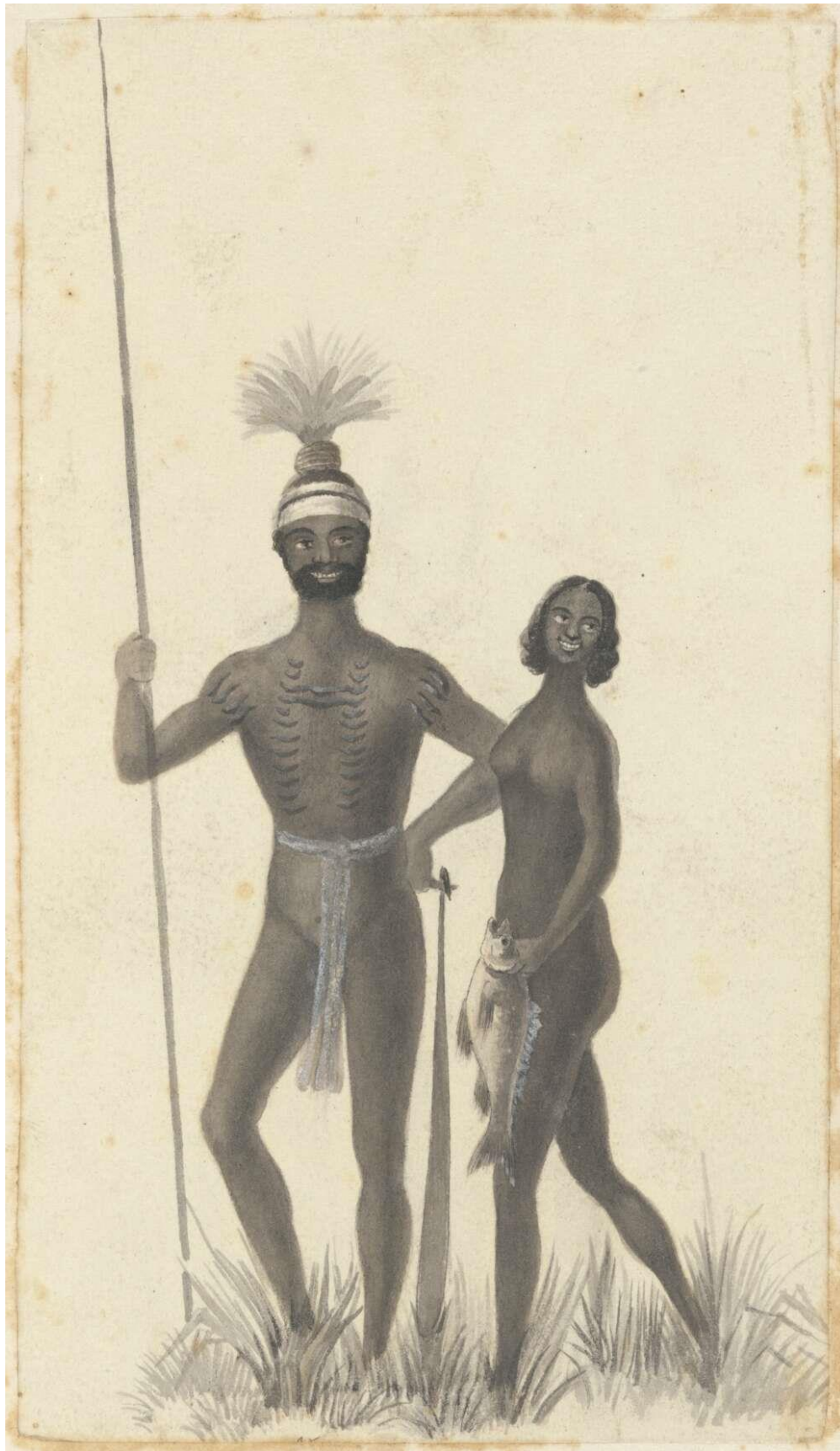


Figure 56: Gumbaynggirr warrior Crankey Tom and master *malgun* fisherwoman Dilberree, 1818.

Title from engraving bound with the original in *Australia from Port Macquarie to Moreton Bay*.

Source: Clement Hodgkinson 1845.

Chapter 8: Understanding the Implications of Climate Change for Indigenous Peoples of the Pacific

8.1 Introduction: Climate change, species movement and cultural adaptation

Seasonal change has a significant role in cultural existence and the means by which people relate to, utilise and adapt to their environment. Scientific research has been intensively advising Australian Governments on climate change over the last 25 years. I can remember my first years in university discussing the topic of carbon emissions from dirty energy (coal, motor vehicles), methane from intensive agriculture and industrial pollution being the drivers causing unavoidable changes in our ozone layer and climate. This was 27 years ago. We discussed the amount of carbon emissions and the fact that reduction and change were needed immediately, as these emissions would inevitably exacerbate consequences such as the greenhouse effect and global warming. This would inevitably mean more frequent and extreme heatwaves, cyclones, storms and bushfires. This was human-induced climate change (Flannery 2009; Flannery 2015).

There were also secondary impacts of climate change, including decline in rainfall and increases in temperature leading to declines in water supplies and the subsequent effects on native species. It was at this point that not only action in reduction and elimination was needed, but adequate education of society on what the consequences of doing so would be for daily life. The changes required would entail conscious water use, altering the way buildings and infrastructure are designed, including the use of materials, rethinking how and why we develop vulnerable areas such as coastal fringes and increasing natural biobanks or protected areas. It would also mean addressing the white elephant in Australian agriculture of changing from water thirsty crops to drought tolerant crops and being mindful of our population growth and use of resources.

Cultural ecology is the science of interactions among plants, animals, microorganisms, humans and their environment. Organisms do not live in isolation, but as functioning communities that are inseparable from the environment. These environment–community complexes are ecosystems that range in size from minute algal cells in water to the universe itself. Humans are an integral part of natural ecosystems and the earth ecosystem as a whole. Modern human activities have modified and exceeded the balance of these cycles, creating human-induced systems or artificial processes. This human-centric process has placed humans as dominate forces in this complex systems operation. Knowing that this ecological system has limitations and interconnectivity, we continue to exceed them

with an egocentric drive that is leading to the disappearance and breakdown of sensitive systems (Armitage et al. 2012; Bruno et al. 2016).

As time passes, instead of curbing our insatiable, ignorant human ways, humanity continues with the justification of sustainable planning and small personal efforts to make us feel like we are changing and doing something that curtails the inevitable. Given the enormity of changing global mindset, education and awareness from future generations is essential to develop adaptation and flexibility in solutions and new ways of thinking. Our governments and business leaders now look to adaptation mechanisms and risk management processes in areas such as water, health, emergency and primary industries.

In 2010, a position paper entitled *Adapting to Climate Change in Australia* (Australian Department of Climate Change) was released. It set out the Australian Government's vision for adapting to impacts of climate change, building resilience and establishing the right conditions for people to adapt. The paper identified six national priority areas: water, coasts, infrastructure, natural ecosystems, natural disaster management and agriculture.

Another document was released by the Department of Climate Change and Energy Efficiency (DCCEE 2015) to the Productivity Commission's inquiry entitled *The Barriers to Effective Climate Change Adaptation*. This document highlighted regulatory barriers to the climate change adaptation framework. Then there was the *National Framework for Climate Change Science* (Department of Environment and Energy 2015), which set out research priorities, identifying the people and infrastructure needed to meet future science requirements (Department of Environment and Energy 2015). Then the *Climate Change Adaptation Program* aimed to help Australians 'better understand and manage risks'. In December 2015, the Australian Government released a National Climate Resilience and Adaptation Strategy. The strategy sets out how Australia proposes to manage climate risks for the benefit of community, economy and environment. It identifies a set of principles to guide effective adaptation practices and resilience building and the government's vision for the future. The Australian Climate Change Science Programme (ACCSP) was the Australian Government's flagship climate change science programme, from 1989 to 2016.

Australia's national climate resilience strategy has three elements: global action to reduce emissions; effective adaptation research, planning and action at the national and sub-national levels; and programmes to limit or remove other human pressures on systems affected by climate change (Commonwealth of Australia 2015).

The Australian Government's broad suite of climate change policies is designed to:

- reduce emissions while improving productivity
- reduce and manage the risks of extreme weather events and climate change
- reduce costs and the regulatory burden
- create jobs and boost innovation and competitiveness and
- deliver positive environmental outcomes.

Whilst trying to remain positive and having faith in our government, the above policies and strategies look very much like business as usual. It is noted in the strategy, however, that climate change can be exacerbated by other threats and human interventions such as land clearing and urban development, the introduction of pests and weeds, pollution and land-based runoff, as well as overfishing (Commonwealth of Australia 2015).

In building resilience, it is noted that in order to help ecosystems and ecological communities adjust to the expected climate change and its effects, consideration must be given to strategies such as setting aside and protecting habitat, undertaking rehabilitation and revegetation activities, applying Indigenous knowledge and stewardship approaches and enhancing monitoring activities.

However, there does not seem to be substantial thought given to applying Indigenous knowledge and stewardship approaches. At present, the Commonwealth Government provides Indigenous ranger projects that were first funded in 2007 through the former Working on Country Program. These projects create employment, training and career pathways for Aboriginal and Torres Strait Islander people in land and sea management. The Indigenous ranger projects support Indigenous people to combine traditional knowledge with conservation training to protect and manage their land, sea and culture. Indigenous ranger groups also develop partnerships with research, education, philanthropic and commercial organisations to share skills and knowledge, engage with schools, and generate additional income and jobs in the environmental, biosecurity, heritage and other sectors (Australian Government, Department of Prime Minister and Cabinet 2018). These programs are specifically applied on Aboriginal owned and managed country, almost isolating the role and application of Indigenous knowledge to protecting habitat, undertaking rehabilitation and revegetation activities, applying stewardship approaches and enhancing biological monitoring activities.

There seems to be no initiative to extend this knowledge base into other threats and human interventions such as effective adaptation research, planning and action or programmes to limit or remove other human pressures on systems effected by climate change such as land clearing and urban development, pollution and land-based runoff and overfishing. I am hoping the last chapters of this thesis provide some insight as to why and how adaptation, resilience, research and planning need to include Indigenous knowledge and the paradigms associated.

Extensive modelling and monitoring from research over the last 20 years provides considerable evidence that human-induced climate change is already affecting many ecosystems and their species. The future looks grim, with further significant declines and fragmentation of diversity leading to localised extinctions of many species, the detriment being interruptions to ecosystem functions (Dunlop and Brown 2008; Sih et al. 2011; Steffen et al. 2009). Additional pressures, such as 220 years of European settlement (increasing fragmentation of all habitats through land clearing, weeds and feral animals) and the heavily industrial and economic mindset of humans, intensify the net impacts on our biodiversity (Steffen et al. 2009). However, it is not yet fully understood how the interacting nature of biological and ecological systems and species will respond.

8.2 How seasonal change has a significant role in cultural existence and the means by which people relate to, utilise and adapt to their environment

During the historic events of global climate fluctuation, many species faced physical challenges and psychological ordeals. Many could not adapt quickly enough to survive. This situation changed around 10,000 years ago, when climate dramatically improved and stabilised. The fluctuations during the last ice age defined the development, technology and dispersal of modern humans across the earth, thus defining our physiology, intellectual development, technology and social behaviour, as these factors are heavily influenced by climatic factors. Diet, resource availability, health and our relationship with nature are all products of the climate in which we evolved (Burroughs 2005:124–26, 160–61).

These components of climatic adaptations have not been experienced in our lifetime. One insight, however, is the oral tradition and information transmitted in Indigenous culture and language. Many Aboriginal story lines of Australia tell and physically show in the landscape about experiences of climate and atmospheric fluctuations. One Gumbaynggirr story tells of the time of the sea level rise and the movement of animals. Underlying these ‘stories’, or as I like to refer to them, insightful layered knowledges, is a psychological component about behaviour and how to live. The lack of

acknowledgement of Aboriginal issues as they relate to climate change adaptation and resilience strategies stifles investigation of Aboriginal solutions to wider climatic problems.

Throughout nearly all of the government adaptation and resilience documents, there are minimal to no references to impacts on Aboriginal cultural integrity and access to traditional resources. They primarily focus on providing information on economic, environmental and social decision-making by government and industry. There is an inhibited position of recognising that Aboriginal culture and environment are intrinsically linked and facilitate each other. This oversight can have consequences for Aboriginal health and wellbeing. According to the Productivity Commission, total spending on Aborigines and Torres Strait Islanders in 2016 was AU\$33.4 billion, including AU\$6 billion on programs exclusively available to Indigenous Australians (*The Australian* 2019), though how much of this actually reached communities is to be questioned.

This position imparts a gap in conveying adaptation mechanisms and requirements, especially in the areas of health and wellbeing of Aboriginal peoples, many of whom already live in below-standard living conditions akin to developing countries and rely on traditional resources as substance. The primary and concerning issue in Australia is the lack of water and water resources. This also includes questions around knowledge and knowledge transfer. The ever-changing or rapidly changing biodiversity, including species movement, species decline, extinction, biological cycles and totemic relations, needs immediate consideration. There is minimal to no facilitation of assisting Aboriginal communities and the cultural component to become resilient and adaptable in a climatic cultural context.

8.3 Case Study 6: Climate Change: Adapting Language to Landscape and Species Movement

8.3 1 Microclimatic patterns and regional scale — Gumbaynggirr case study

Gumbaynggirr relations with their environment exemplify the successful nurturing of ecosystems for sustainability that was advocated in the previous chapter as a vital necessity in the era of climate change. Plants are the fundamental nexus for providing food and habitat to other species. Plant growth determinants include solar radiation, temperature and rainfall and their associated variation from season to season; all determine the distribution and density of the various species across the landscape. Each species has individual requirements for growth, pollination and reproduction and achieve this balance between climatic factors and environmental determinants such as soil

characteristics (Billings in Lange et al. 1983). Plant existence, life cycle and lifespan, along with their dependant organisms including animals and human beings have adapted to and been influenced by climatic factors such as solar radiation, temperature and water. Within Australia and much of the Pacific, they have also been influenced by the cultural practices of Indigenous peoples. This includes such activities as firestick farming or cultural landscape burning and native crop production. In his publication *Aboriginal Man*, R.L. Kirk (1983), identified the geographical position, latitude, topography and wide-microclimatic patterns of Australia as being major factors in vegetation zones, therefore influencing adaptation, technology and existence.

Atmosphere, hydrosphere, cryosphere, lithosphere and biosphere are also the major components within Indigenous knowledge (De Blij et al. 2005). They are identified and interpreted through chronicles and narratives of landscape formations, cloud and wind movement, sun and planet movements and seasonality in an oral manner. Descriptive and leading animal or elemental characters are embedded in repetitive, haunting dialogue, influencing, modelling and guiding social structure and livelihood from generation to generation for hundreds, even thousands of years.

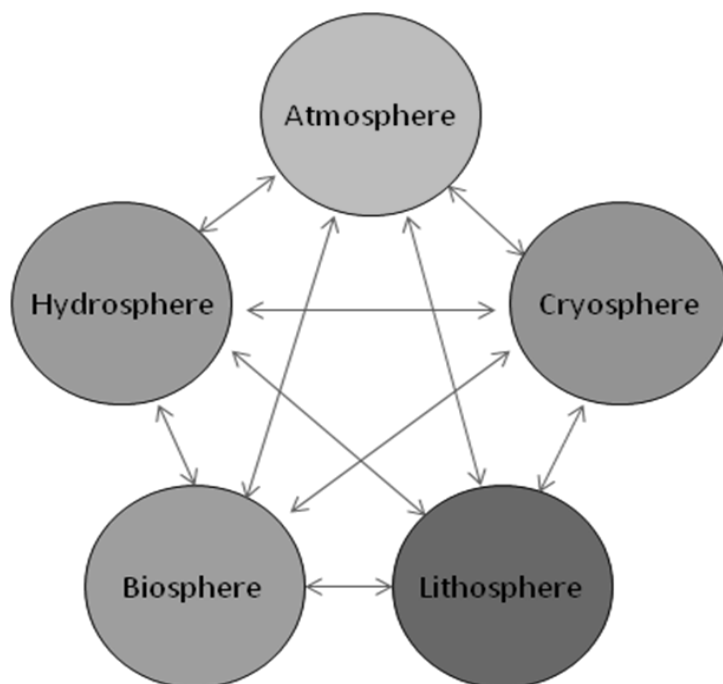


Figure 56: The five spheres of the earth system. Source: De Blij et al. 2005.

Kirk (1983) identified the dominating microclimatic factors as the seasonal northward and southward movements of the pressure systems that move from west to east across the continent and the position of the Eastern Uplands, which deflect much of the moisture in the onshore winds from the Pacific

Ocean onto the narrow coastal belt along the east coast, causing rain shadow on the western side of the ranges.

The southward movement of the pressure system during summer months produces monsoonal conditions for four to five months along the north coast, which also influences areas to the south. During monsoonal periods, rainfall is heavy and subtropical and tropical conditions prevail. In winter, conditions are reversed with dry, warm weather dominating. Flooded plains and low-lying areas that had water during the wet are now dried and the rivers are reduced in volume and flow, with many smaller tributaries having no flow. In contrast, the coastal areas south of the tropic receive their maximum rainfall during winter months (Kirk 1983).

8.3.2 Being aware, attuned and influencing

Indigenous cultures throughout the world lived as one with nature and the environment through sheer force of necessity. This inescapable immersion progressed insight and intellect, then dictated and derived cultural behaviours and belief systems that facilitated the earth's environmental functions as precedence. Thousands of investigators, observers, authors, ecologists, inventors, makers, and designers contributed to engineering the foundations of earth-based cultural religions, beliefs, technology and practices. A fundamental continuum and reoccurring theme is the belief in equity and that all living entities are of equal value in the natural world, that all living and non-living entities have a place and a role and that nature (represented as mother) is the superior in dictating existence, disaster, nourishment, success, life or death.

So, what does climate change mean for contemporary Aboriginal society? What does it mean for individuals? What are the impacts of climate change on Aboriginal peoples and their landscapes and seascapes, and their cultural practices with each? How do Aboriginal peoples continue to function and implement cultural identity and cultural practices in landscapes that are predicted to transform not only for species but in every cycle that occurs, including modification of the time and dates of seed germination, flowering, egg laying and hatching. For example, it is predicted that biological occurrences that happen in spring will occur earlier in the year and things that happen in autumn will happen later (Steffen et al. 2009). This will also change the behaviours of animals and how species interact with each other, including pollination, seed dispersal, competition, predation and diseases. These changes will, in turn, result in direct and indirect impacts on connective species. These

transitions also have implications for cultural knowledge transmission, especially when it comes to seasonal knowledge transfer.

8.3.3 Latin to Lingo: Sustaining and renewing Gumbaynggirr language

This section documents the current and historical aspects of marine resource utilisation by Gumbaynggirr. It describes the regional landscape and its climate and marine habitats and documents Aboriginal marine usage, including seasonality, locations used, fishing and marine hunting equipment.

The climate in the study region is subtropical with warm to very warm and wet summers and cool to mild, dry winters. The main factor controlling the climate of the region is the transitional zone between the steady trade winds to the north and the anticyclone belt to the south, which oscillates northwards and southwards over the region annually. Strong wind gusts affect the region from time to time, which tends to be in association with meteorological phenomena such as the passage of cold fronts, severe local storms or ex-tropical cyclones (Bureau of Meteorology 2007).

8.3.4 Knowledge of resources

Sustenance was accessed in all areas of coastal marine ecosystems and habitat types, except for those that were managed culturally under a type of regime. Marine hunting and fishing practices for food and material resources would have probably dominated the lifestyle. The effects and changes of tides, seasons and moon cycles played significant roles in the hunting and gathering processes of the coastal marine people.

The Gumbaynggirr species list is not comprehensive. It contains species associated with language, which indicates knowledge or use of the species. I also recognise that language is living and, although some species may not have been represented traditionally, it does not mean that they are not utilised or valued in contemporary times. Traditional fisheries include all primary species documented in language, which equates to approximately 30 primary fish species, nine mollusks, two annelids and four crustaceans. These species have sustained Gumbaynggirr people and their visitors for thousands of years and were harvested and managed according to Gumbaynggirr traditions and laws. There are seven documented methods of harvest, including spear fishing, spear fishing at night, poison, hand line fishing, hand collection, fishhook (jagging) and fishing netting. In a contemporary context, coastal families continue to rely on the availability and abundance of these species for food, health and connection to Gumbaynggirr totem (the ocean).

The complex and multi-dimensional nature of environmental and species change in terms of spatial scale and rapidity or evolutionary novelty is a form of human-induced rapid environmental change (Sih et al. 2011). This puts species in rapid change scenarios that have not been experienced in their evolutionary history (Palumbi 2001). As climate change intensifies, it is predicted that species will either adapt, move or diminish (Steffen et al. 2009). These predicted species movements will inherently impact cultural components of knowledge and land/seascape management. With the transitions of landscapes and species comes the transition of language.

8.3.5 Cultural marine species of the Gumbaynggirr

Fish are deemed the most important source of protein and the main food of coastal and riverine Aboriginal communities all over Australia (Isaacs 1987). Sea people's routines are dictated by the physical ocean forces and the flow of moon and tidal regimes. The saltwater people before British contact had intimate and intricate knowledge of all ecological dynamics of the ocean and its creatures. The knowledge of where to capture and what seasons to take in also ruled the interactive dynamics of coastal communities.

The religious background of the Gumbaynggirr derives from one god — Yuludarra. First recorded by A.C. McDougall (1900) in *Science of Man*, this story was also documented by Laves in 1929. The origins of this creator are derived from the first man who came from the east, or the sea, the land of the sunrise, and the land of the sunset in the west. Yuludarra is described as living on mountain tops and when death comes to the people of the land Yuludarra will go with them to the other side of the sea (McDougall 1900). Yuludarra is also the creator of several waterholes and features that have associations with other ancestor heroes. Many *miirral* (sacred places) are attributed to these ancestor creators (Ryan 1964).

Creation stories give explanations to the origins and systems of life and the surrounding landscapes and environments. Many either reflect historical events in time and space or provide guidance on how to live with meanings of fundamental issues of life. There can be many versions based on gender, status or group, but all contain the core essence of origins and systems of life. The laws, values and customs form parts of religious systems.

The narration of creation and the associated interpretations of events determined social laws and behaviours. They also emphasised the significance of the ocean and important associated factors and

dictated behavioural mannerisms in marine species and fishing/gathering. The story of the making of languages and Yuludara's journey along the coastline tells of the creation of the tribal language groups along the coastline and the creation of river systems in Gumbaynggirr and adjoining tribal groups.

The story of the moon man (Giidany), which was told to me by my Grandmother and Uncle as a teenager, provides insights into mechanisms of resource management, warnings of tidal currents and ecological reasons for certain plant species, along with an emphasis on spiritual awareness and female associated landscapes.

Prior to increased settlement by colonists and the mind frames of landscape alteration such as large-scale development and dam and road construction associated with population growth within the Gumbaynggirr area, it is documented that marine species (fish) were much more abundant. Historic documentation of early explorers reports pristine waters and large shoals of fish (Hodgkinson 1845). My father talked of landscapes filled with sounds of countless animals and skies full of birds, some flocks so thick they blocked out the sun. To take advantage of the plentiful supply, a diversity of collection techniques were employed and used in conjunction with various resources. In time and space, Gumbaynggirr people living on the coast also faced and survived adversities, primarily natural disasters, climatic changes and sea level rise. These occurrences provoked changing environments and landscapes and required the need to be careful in resource consumption and management.

Throughout these climatic changes, various marine species were consumed by the Gumbaynggirr. The ecological knowledge of the species, their habitats and ecological cycles enhanced the abilities of Gumbaynggirr people to catch and gather marine sustenance, where knowledge was applied according to habitat and locality with different fishing methods employed.

FAMILY	SPECIES	GUMBAYGGIRR	HABITAT
<i>BIVALVES</i>	Oysters	Barliin.gurr	Oysters occur in a selection of habitats, attached to rocks in lower reaches of estuaries close to river mouth openings. They also occur in mangrove estuary systems attached to the mangrove roots or logs. In oceanic systems they are found on rocky shorelines. Stone tools were used to remove from rocks, some were gathered to put on fire.
	Pipies	Garlaany	Sandy shorelines with intermediate beaches host the pipie. A family gathering task, women and kids primarily gathered on the intertidal transgressive beaches.
<i>GASTROPODS</i>	Turbo	Gugumbul	Gugumbul are found on rocky shores around the headland/ shelf zone and in rock pools at low tide
<i>MOLLUSKS</i>	Gugur	Gugur	The wood worm is found in mid to upper reaches of estuarine systems and are dependent on fallen submerged timber for their survival in a planktonic form these molluscs attach and then burrow making the internal heartwood their domicile, they are biotrophic where they rely on their host for survival, Biotrophic parasitism is an extremely successful mode of life. They also assist in the decomposition and nutrient recycling of nutrients in the estuary system. Collection

			needed endurance, as it included diving to secure rope and pulling logs out for extraction.
CRUSTATIONS	Mud Crabs	Ngaduun nguulany	Mud crab habitat consists of estuarine systems in depositional coastal environments with fine sediments forming muddy siltated areas protected from high energy wave action. Conditions range from saline to brackish waters. A number of methods were employed, from hand catching, hooking, digging, scoop netting and spearing.

Table 11: Commonly eaten marine species in Gumbaynggirr. Source C. Marshall 2012.

8.3.6 Species movement impacts on cultural components

Many species of fish such as buluunggal (mullet *Mugil cephalus*), Jurruwal (*Pomatomus saltatrix* tailor) flow annually through a particular area of the ocean. Some are true migrants, travelling regularly over great distances. Young fish usually leave the spawning grounds for areas where they develop into juveniles before joining the adult stock at the feeding grounds. Adults move to the spawning grounds then return to the feeding grounds. Migratory patterns of fish are related to oceanographic factors and currents. Eggs, larvae, and young drift passively with the current, though the migration of adult fish toward breeding grounds is usually against the current. Thus, adult movements are directional rather than passive and the fish respond to environmental conditions such as climate.

It is apparent that homing animals use familiar landmarks, both random and oriented searches have been observed in birds and fish (Baker 1980). Homing experiments with gannets observed from aircrafts have demonstrated that after release the birds explore the region and hesitate as they apparently look for landmarks (Baker 1980). Landmarks vary from topographical (for example, mountain systems, river systems and coastlines) to ecological (such as vegetation zones) to climatic (e.g. air masses differing in temperature and humidity, prevailing winds). Fish may orient themselves by using similar clues (ibid). Passive drifting is an important factor in the movements of larvae and young fish, such as those of the eel, cod, herring and plaice, and adult fish that are passive after spawning, such as herring and cod. As a result of drifting with the current, the movements of such fish are similar from year to year. Familiar landmarks and exploration do not, however, explain how migrants find their way along routes covering many hundreds or thousands of miles, nor do the results of most homing experiments (ibid).

8.3.7 With the transitions of landscapes and species come the transition of language

Language is a predominant part of cultural connection. Language is the nexus of all holistic components of culture (Marshall 2012). Identity, holistic cultural values and issue-based cultural dimensions of Sea Country are all related to language of the landscapes and seascapes. With the imminent transitions of landscapes, seascapes and species comes the transition of languages.

In 2016, the minister for Aboriginal affairs, Leslie Williams, announced a bill to recognise Indigenous Australians as the owners of their traditional languages and give higher priority to government efforts to support their revival and preservation. Williams said, 'Aboriginal people have told us language is indivisible from their identity. Aboriginal people who speak their language are healthier. Aboriginal children learning an Aboriginal language do better at school and that language renewal strengthens (Deluxe Café Moree 2016). This would be the first act of its kind in Australia.

In another context, it was noted by Indigenous resource management consultant Dermot Smyth (2012) that, for coastal clans, their country always included the adjoining estuaries, beaches, coastal waters and ocean. Groups of clans speaking a common language formed a wider social group, sharing ceremonies, belief systems, technologies and subsistence strategies. The ocean, or saltwater country, was not additional to a clan estate on land, it was inseparable from it (ibid.).

Because of the central importance of language for preservation of cultural knowledge, Latin to Lingo workshops were undertaken by the Gumma Indigenous Protected Area (GIPA) under my supervision as Manager of the GIPA. Latin to Lingo is a program developed by the GIPA to facilitate ongoing commitments to protecting and managing the cultural integrity of our landscapes and seascapes.

Gumma IPA was gazetted under the Indigenous Protected Areas program and the National Reserve System program by the National Heritage Trust in November 2011. Gumma IPA represents an area of Indigenous-owned land or sea where Traditional Owners have entered into an agreement with the Australian Government to promote biodiversity and cultural resource conservation (Hill et al. 2011). The Australian Government supports Indigenous communities to manage Indigenous Protected Areas for conservation as part of Australia's network of protected areas, in line with the International Union for Conservation of Nature's (IUCN) protected area management categories. There are now over 100 declared Indigenous Protected Areas across Australia covering over 84 million hectares. The largest declared Indigenous Protected Area is the Southern Tanami in the Northern Territory at 10.16 million hectares. The smallest is Pulu Islet in the Torres Strait at around 15 hectares (Australian Government 2016).

IPAs contribute to Australia's obligation to the 1992 Convention of Biological Diversity by forming a significant portion of the National Reserve System (Commonwealth of Australia 2014). In 2011, IPAs accounted for 36 per cent of the National Reserve System (48 million hectares) (Hill et al. 2011). IPAs in Australia now account for 84 per cent of protected areas. IPAs compliment the concept of country by:

- integrating land and sea management in some cases
- facilitating cultural obligations for Traditional Owners to manage country and
- providing a mechanism for cultural development.

Unlike most other IPAs in NSW, Gumma is unusual in that it includes estuarine and marine waters. The Gumma IPA progressed this position primarily as part of the process of cultural obligation to protect and sustain important landscapes and seascapes (NLALC 2011). It is also categorised as such under the IUCN protected areas categories. Additionally, a key objective of the long-term management of the IPA is to generate baseline data on the living resources of the marine and estuarine habitats to ensure our lands and water, along with their species, especially cultural sustenance species, are healthy so we can continue sustainable resource collection practices with intergenerational knowledge transfer.

Gumma IPA, like most IPAs in Australia, has developed many partnerships with government and non-government organisations. The GIPA supports Indigenous interests to develop cooperative management arrangements with these agencies in managing not only protected areas but other biological connections in the region. The main difference between IPAs (apart from being Aboriginal owned and managed) and standard protected areas in Australia is the integration of Indigenous ecological and cultural knowledge with contemporary protected area management practices. The management of many IPAs is based on traditional customary land management principles. Many are organically managed and outcomes are focused on traditional or lineal management structures. There is also cultural autonomy and authority.

I had the opportunity to establish management structures and objectives, operations and day to day management of Gumma IPA. Being a Traditional owner this was a unique position to apply cultural knowledge and law, TEK, western science and modern management legislations and techniques.

8.4 Looking after *gaagal* (ocean): Biodiversity and debris surveys in Gumma Indigenous Protected Area Stages 1, 2 & 3

The objectives of this project and associated marine biodiversity and Indigenous resource use surveys were to undertake a photographic inventory of species occurring in the lower estuary of the Nambucca River and adjacent rocky ocean shores and nearshore reef system. This was also correlated with previous inventory of near shore temperate reef. The inventory provides baseline photographic documentation of species taxa to monitor changes in species movement, abundance as it pertains to

species inhabiting new and larger areas or species decreasing or declining (Smith et al. 2014). It also allows us to monitor changes in the places where species are found, with climate changes predicted to alter temperature and rainfall patterns, encouraging some species to move to new areas.

Additional information was also collected, including common, scientific and Gumbaynggirr names. Workshops were also run to provide instruction on the identification of marine species and underwater photography to key personnel associated with the management of Sea Country in the Nambucca Region. By the second stage of the inventory, we realised that many of the species being photographed were vagrant or new to Gumbaynggirr language, with many of the species in current and previous language documentation being that of resource (food) or cultural significance.

A Gumbaynggirr language workshop was then undertaken with language speakers, the Gumbaynggirr Language Hub and Muurrbay Aboriginal Language and Culture Co-operative to develop and prescribe Gumbaynggirr names to common fish species that inhabit the near shore reef at Nambucca Heads. The methodology included integrating already-existing traditional knowledge (i.e. female species relations or species attached to cultural context) and then, for those species not occurring within this area, examining the Latin or scientific language meaning and applying Gumbaynggirr interpretation. The following table shows the addition of 84 new words to the Gumbaynggirr language for 58 marine species.

Common name	Gumbaynggirr name	Direct translation
Seaweed	Nyayi-nyayi	
Brown seaweeds	nyayi-nyayi jumbaal	seaweed brown
Red seaweeds	nyayi-nyayi mulurr-mulurr	seaweed red
Green seaweeds	nyayi-nyayi guunuga	seaweed green
Red leather weed	nyayi-nyayi bilarr mulurr-mulurr	seaweed leather red
Common kelp	nyayi-nyayi muruy-bugany jumbaal	seaweed forest-like brown
Green feather weed	nyayi-nyayi wurruun guunuga	seaweed feather green
Green necklace weed	nyayi-nyayi guunuga	seaweed green
Sponges	derived from another Aboriginal language	
Cnidarians	mayal-guunu guuray-bugany	move-life flower-like
Red and gold sea	yal-yalay-gam gaagalgundi	wave-something that ocean belongs to

fan		
Orange solitary coral	mayal-guuna daari	move-life hard
Lobed pancake soft coral	mayal-guunu guuray-bugany bambuurr	move-life flower-like soft
Bryozoa	mayal-guunu guuray-ganam	move-life flower-small
Worms	gugumbal	
Yellow featherduster worm	gugumbal gaalgundi wurrun.garri duna	worm ocean-belongs feathers-carrying yellow
Orange chiton	dabangganay-ganam janya	shell-let eight
Abalone	Yambaa	
Military turban snail	gugumbal dunda-garri	worm cover-having
Australian tent snail	gugumbal nguurabugany	worm hut-like
Cowry	Gawarri	(English borrowing)
Egg cowry	gawari mirubay-bugany daagan	cowry egg-like white
<i>Prosimnia semperi</i>	gawari mirubay-bugany	Cowry (English borrowing) egg-like
Spindle cowry	gawari buuduny	cowry spindle
Jonas's dog whelk	jundi	periwinkle
Sea slugs	bigaa ninginy gaalgundi	snail naked sea-belong
Hairy mussel	Waluurlay mara-mara	mussel hairy
Wing oyster	barliin.gurr wurruun.garri	oyster feather-with
Honeycomb oyster	barliin.gurr maawa-bugany	oyster honeycomb like
Common Sydney octopus	Janyaany	octopus
Cuttlefish	manno-manno (Yinikurtira), yayardloo (Barngarla)	
Lobsters	gulaarrgan	
Crabs	ngaduun	
Blue swimmer crab	ngaduun jiling	crab blue
Mud crab	ngaduun nguulanygundi	crab mud-belong
Star fish	Gaagal-winda	sea star
Urchin	to be found in another Aboriginal language	
Sea squirts	waluurlay	
Banded carpet shark	yanggaay nguubigarri	shark beard having

Common stingray	ngalaany	other stingrays will be distinguished as different from common stingray
Green moray	nyawanam guunuga	sea-eel green
Eastern frogfish	yamaarr jaraan-bugany	fish frog-like
Eastern red scorpion fish	bigaawi-bugany mulurr-mulurr	scorpion-like red
Common hionfish	gun wurruun-garri	cod feather-carrying
Eastern hulafish	yamaarr-ganam yiiliwiyaygirr	fish-small dancing
Sydney cardinalfish	jambaan-juun	spot tail
Silver trevally	jambaan-duna gurrubal	stripe-yellow fast
Southern roughy	gunyju-gunyju miil-gany	rough big-eye
Snapper	giyangarri	
Yellowfin bream	[removed word] gaayi	
Drummer	gulaygarr	
Mado	mado	possibly from QLD Aboriginal language
Red morwong	warraan.ganam mulurr-mulurr	horn little red
Australian damsel	ngandaalgan jiling	damsel blue
Girdled scalyfin	gawgan daagan	shield-white
Eastern blue groper	gunulgin	
Gunthers wrasse	giiguy-garri gaalgundi	rainbow-carrier sea-belongs
Crimsonbanded wrasse	giiguy-garri gawgan-mulurr-mulurr	rainbow-carrier shield red

Table 12: New species names for Gumbaynggirr marine environments. Source: Smith et al. 2014.

The management of the Gumma Indigenous Protected Area then created a strategy for educational resources, including a poster with photos of 20 fish species and their common, scientific and Gumbaynggirr names. This was to promote awareness of species movement and get the community to participate in monitoring the presence or observation of these species. In addition to constructing a framework for Gumbaynggirr language formation and interpretation for marine species, this initiative contributed to sustaining and adapting Gumbaynggirr language and culture. This project secures a baseline of cultural species in the Gumbaynggirr marine environment and provides a mechanism of language adaptation in the face of climate change. It has established a framework for evolving cultural language due to species changes and movement.

Chapter 9: Indigenous Paradigms in Marine Protected Area Planning

9.1 Introduction

Australia has one of the largest marine jurisdictions in the world, containing a vast array of diverse and unique biological and physical features (Director of National Parks 2013). There are an array of different types and terminologies to describe marine conservation. The commonly used international term is marine protected area (MPA), which is defined as any area of intertidal or subtidal terrain, together with its waters and associated flora, fauna, historical and cultural features, that has been declared under the IUCN protected areas categories. Further definition states:

A protected area is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (Day et al. 2012).

Further examination of the IUCN conditions and prerequisites of declaration for cultural values reveals that the cultural values should not interfere with the conservation outcomes. All cultural values in a protected area should meet this criterion, including in particular:

- those that contribute to conservation outcomes (e.g. traditional management practices on which key species have become reliant) and
- those that are themselves under threat.

The IUCN 2012 guidelines also heavily stipulate that there must be alignment with the IUCN definition of a protected area. The 2008 definition states that for a site to be a protected area, priority must be given to nature conservation; other values present may be of similar importance but in the event of conflict between values, nature conservation must be considered the most important (Day et al. 2012).

Phrase	Explanation provided in the 2008 Guidelines	Discussion and example of application in the marine realm
Conservation	<i>In the context of this definition conservation refers to the in situ maintenance of ecosystems and natural and semi-natural habitats and of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties</i>	Examples: - Ecological Reserves in the Florida Keys National Marine Sanctuary in the United States are designed to provide natural spawning and nursery areas for the replenishment and genetic protection of marine life and aim to protect and preserve all habitats and species found throughout the Sanctuary. - The inclusion of a minimum of 20% of all 70 bioregions within Australia's Great Barrier Reef Marine Park is designed to provide in situ protection of representative examples of all species and ecosystem processes.
Nature	<i>In this context nature always refers to biodiversity, at genetic, species and ecosystem level, and often also refers to geodiversity, landform and broader natural values.</i>	All protected areas, whether terrestrial or marine should aim to protect all the features of conservation importance within their boundaries. Example: The overall objective of the Great Barrier Reef Marine Park is to provide for the long term protection and conservation of the environment, biodiversity and heritage values of the Great Barrier Reef Region.
Associated ecosystem services	<i>Means here ecosystem services that are related to but do not interfere with the aim of nature conservation. These can include provisioning services such as food and water; regulating services such as regulation of floods, drought, land degradation, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other nonmaterial benefits.</i>	MPAs provide a wide range of ecosystem services: Examples: - Ecosystem services: The MPA network in Belize has been estimated to contribute nearly US\$20 million annually in reef-related visitor expenditure. - Regulating ecosystem services, for example seagrass meadows, mangroves and kelp forests as carbon sinks: The four MPAs designated by the Malta Environment and Planning Authority to protect Malta's <i>Posidonia</i> (seagrass) beds together protect over 80% of this habitat in Malta. Areas set up for wave/wind power are generally NOT MPAs (see section 2.3).
Cultural values	<i>Includes those that do not interfere with the conservation outcome (all cultural values in a protected area should meet this criterion), including in particular:</i> <i>Those that contribute to conservation outcomes (e.g., traditional management practices on which key species have become reliant)</i> <i>Those that are themselves under threat.</i>	Areas set aside for cultural values are only protected areas under the IUCN definition, if they have nature conservation as a primary aim. However, many MPAs contain sacred sites or have significant cultural and heritage value and understanding of this is important. Examples: Nosy Ve, an island in southern Madagascar protected under a local 'dina' agreement is both a sacred site and an area important for corals and as a tropic bird nesting colony. Papahānaumokuākea Marine National Monument in the North West Hawaiian Islands is important for Native Hawaiians at genealogical, cultural, and spiritual levels.

Table 13: Guidelines for applying the IUCN protected area management categories to marine protected areas 2012. Source: IUCN 2012.

There are many Aboriginal individuals and groups who continue to identify themselves as Traditional Owners of these maritime estates who are keen to have their traditional rights to ownership and management of marine estates recognised. This traditional or customary right among maritime Aboriginal peoples includes the development of processes that enable them to be more directly involved in marine estate establishment, its management and decision-making processes. At present, Aboriginal peoples' involvement in decision-making and management of marine reserves and marine spaces in Australia falls well short of what they desire, and, as will be discussed, well short of what is in the best interests of marine ecosystems as they relate to cultural and national interests.

Many Australian Indigenous communities have profound reliance on, attachment to and responsibility for their customary marine tenure. It provides spiritual, cultural, social and livelihood benefits to both Aboriginal and non-Aboriginal communities. Why is it that Aboriginal peoples do not have more involvement and authority in marine estate, particularly protected areas? This section explores some of the potential prospects and dissuasions of this marginalisation in marine conservation. In understanding how marine protected areas evolve, I will first go back to examining the original development of marine reserves in Australia and their functions, establishment and construction processes with an aim to examine the framework and understand how Aboriginal values and interests are inserted and applied. I will also endeavour to pinpoint where the obstructions lie from an Indigenous perspective and propose a process on how to move forward.

The protected area co-management arrangements in Australia are still evolving. However, there is still disparity in the ratio of co-management and ownership between terrestrial areas and the marine domain. There are informal and formal local and regional agreements and memorandums of understanding that apply to site-specific areas or use agreements under Native Title legislation. This chapter therefore does not claim to be comprehensive but focuses on accessible examples that reflect current trends in frameworks for a number of jurisdictions. It aims to detail formal arrangements as they appear in agreements and legislation related to marine protected areas.

After 78 years of marine park existence in Australia, there are no existing models of marine planning that allow for culturally identified marine protection or joint management of marine ecosystems. A key issue facing marine conservation today is how to develop and implement governance approaches that are both effective in achieving conservation objectives and equitable in fairly sharing associated benefits with the Aboriginal owners of Australia.

9. 2 Functions, establishment and construction processes

Australia has a federal system of government in which legislative power is divided among the Commonwealth (Federal) Government, six state and two territory governments. The limited topics on which the Commonwealth parliament has power to enact legislation are set out in the Australian constitution. Most marine tenure located in the states are state waters covering the Economic Exclusion Zone (EEZ) and each formulates legislative structures to authorise state marine protected area systems. Commonwealth waters start at the outer edge of state waters, generally three nautical

miles (5.5 kilometres) from the shore (territorial sea baseline), and extend to the outer boundary of Australia's exclusive economic zone, 200 nautical miles from the territorial sea baseline. The Commonwealth parliament has the power to enact legislation in relation to Australia's marine territories. The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) provides the provisions of this current Commonwealth legislation (Commonwealth of Australia 1999).

Within the many planning systems of Commonwealth, state and territory governments, the marine reserve management planning documents identify Aboriginal heritage as a component of significance and value. The criteria applied aims at addressing the objectives of the EPBC Act, which recommends that administering authorities:

- recognise the role of Indigenous peoples in the conservation and ecologically sustainable use of Australia's biodiversity
- promote the use of Indigenous people's knowledge and biodiversity with the involvement of, and in co-operation with, the owners of the knowledge (ibid.).

The Marine Reserves Network forms part of Australia's National Representative System of Marine Protected Areas (NRSMPA). The establishment of the NRSMPA has been ongoing since 1998 when the Australian, state and Northern Territory governments agreed to its creation. The states and the Northern Territory are establishing marine protected areas in their coastal waters, while the Australian Government has established marine protected areas in Commonwealth waters around Australia. The NRSMPA also aims to meet Australia's international commitments as a signatory to the Convention on Biological Diversity to establish a representative system of marine protected areas within Australia's exclusive economic zone. (Director of National Parks 2013).

The creation and management of marine reserves is an important strategy for the conservation and ecologically sustainable use of the marine environment. Marine reserves, when well designed and managed effectively, make an important contribution to maintaining the overall health and resilience of our oceans in the face of climate change. The primary goal of the NRSMPA is to establish and manage a comprehensive, adequate and representative system of marine protected areas to contribute to the long-term ecological viability of marine and estuarine systems, to maintain ecological processes and systems and to protect Australia's biological diversity at all levels. (Director of National Parks 2013).

9.3 Aboriginal rights, interests and obligations in the marine environment

Making real progress in Indigenous rights and management in the marine environment requires interpretation and evaluation of what Indigenous rights in the marine environment are and how these are applied and integrated into framework and planning establishment, then transferred to management and policy within Australia's MPAs. It also requires a perspective of progress and the actual advancement in Indigenous entitlements in the control of marine jurisdiction.

Over the past 78 years, the work and applications of traditional mechanisms, commitment and successes of Aboriginal and Torres Strait Islander peoples and their current approaches to and management of Sea Country, including research, monitoring and sustainable use of biological resources, have contributed to the success of marine protection and the biological functioning of marine habitats in Australia (NAILSMA 2012).

The lack of application of Aboriginal cultural laws and protocols totally misses the concepts of ecosystem management in a cultural seascape context. In other words, western tenure structures created by various government agencies impose a regulatory structure that acknowledges Aboriginal use rights in one domain but not in another. An example is the terrestrial Commonwealth Booderee National Park that adjoins the Jervis Bay Marine Park. While co-management occurs on terrestrial land, it is not extended to the marine estate, thus ignoring the traditional territories. This arrangement inherently fails to fully protect Aboriginal cultural integrity of the land/seascape, as highlighted by Farrier and Adams' 2011 publication *Indigenous–Government Co-Management of Protected Areas: Booderee National Park and the National Framework in Australia*. An inherent concern in Australia is the constitutional division of powers and legislation not only in different states but also the many government agencies within. This impacts the integrity not only of cultural practices and sustenance, but increases economic, social, cultural and spiritual impact along with the long-term ecological viability of the area. It could be argued that the historic and constant Aboriginal practices have contributed to the evolution of the ecosystem processes and habitat complexes.

Supporting the development of a framework for Indigenous governance that would set out the appropriate institutional and legislative platform for Aboriginal processes that detail Aboriginal interests, rights, values, significance and associations with contextual integration to MPA strategic planning processes would provide rational and equitable tools in the establishment and

acknowledgement of Indigenous rights and values in Sea Country adjoining already Aboriginal owned lands.

The following looks at the progress and advancement from an Indigenous perspective and draws on the discussion and outcomes from a Sea Country meeting held in 2012, where land and sea managers from around Australia met at Mary River in the Northern Territory to discuss issues affecting Aboriginal Sea Country management in Australia. The workshop provided an opportunity for Aboriginal and Torres Strait Islander people from all around Australia to discuss current issues, aspirations and cultural obligations as Sea Country owners and managers. It also aimed to explore options for increased Indigenous engagement in Sea Country management and to develop and articulate the views of delegates on an appropriate national Indigenous Sea Country management framework. The consistent theme was Indigenous people's desire to increase their participation in the management of marine estates, from increased opportunities to own and control inputs into policy and legislative processes to increasing resources, capacity and powers for individual groups directly involved in management on country (NAILSMA 2012).

At the National Indigenous Sea Country Workshop held in 2012, the delegates wrote a statement to the Australian, state and territory governments outlining that as Traditional Owners they have inherent and pre-existing rights to make decisions about cultural landscapes and the management of biological resources in Australia. The statement emphasised the holistic cultural approach to management, including of land, Sea Country, fresh water, spiritual aspects, cultural aspects and intellectual property; where Aboriginal and Torres Strait Islander Peoples are intrinsically entwined. This statement also outlined to governments the need to review current legislation, policies and practices and shift toward new and emerging initiatives to identify obstacles and remove impediments with the view of fully involving Aboriginal and Torres Strait Islander people in the control and management of the marine environment and associated biological resources and systems. (NAILSMA 2012)

9.4 Where do the obstructions lie?

A critical component missing in the marine estate and marine management of the coastal zone of Australia is appropriate and meaningful recognition of Aboriginal peoples and their historical and ongoing role in ownership and management of these marine zones.

Deficiencies in representation and participation by Aboriginal peoples in decision-making, along with

the inadequate protection and management of Indigenous cultural heritage in marine estates along with resourcing, access to appropriate equipment (boats etc) and specialist training to meet marine operational safety requirements result in misrepresentation, diminished opportunities to own and control inputs into policy and legislative processes and inconsistencies in legislation and policy across the country. The consequential outcomes generate lost opportunities and constraints between regions that often disadvantage Indigenous people (Australian Government 2013). Innes and Ross 2004 provide reference to some examples and consequences of not including or the lack of Indigenous representation on decision making bodies in their report ; *Managing sea country together : key issues for developing co-operative management for the Great Barrier Reef World Heritage Area*.

Underpinning the desire for improved, holistic Sea Country management is the development of models of governance, which provide scope for the management of intra- and inter-group relationships. The strongest and most basic desire is recognition of the Indigenous view of holistic land and sea management that includes people and culture; in other words, Sea Country is more than just 'sea'. The inherent absence of cultural laws and protocols when dealing with Aboriginal maritime estates and the lack of government expertise on processes and recognition of cultural laws and protocols then extends to a lack of consideration in planning and management of marine resources. These deficiencies then bias Indigenous communities to be proactive and adequate in marine protected area decision-making structures and deny equitable sharing of the benefits.

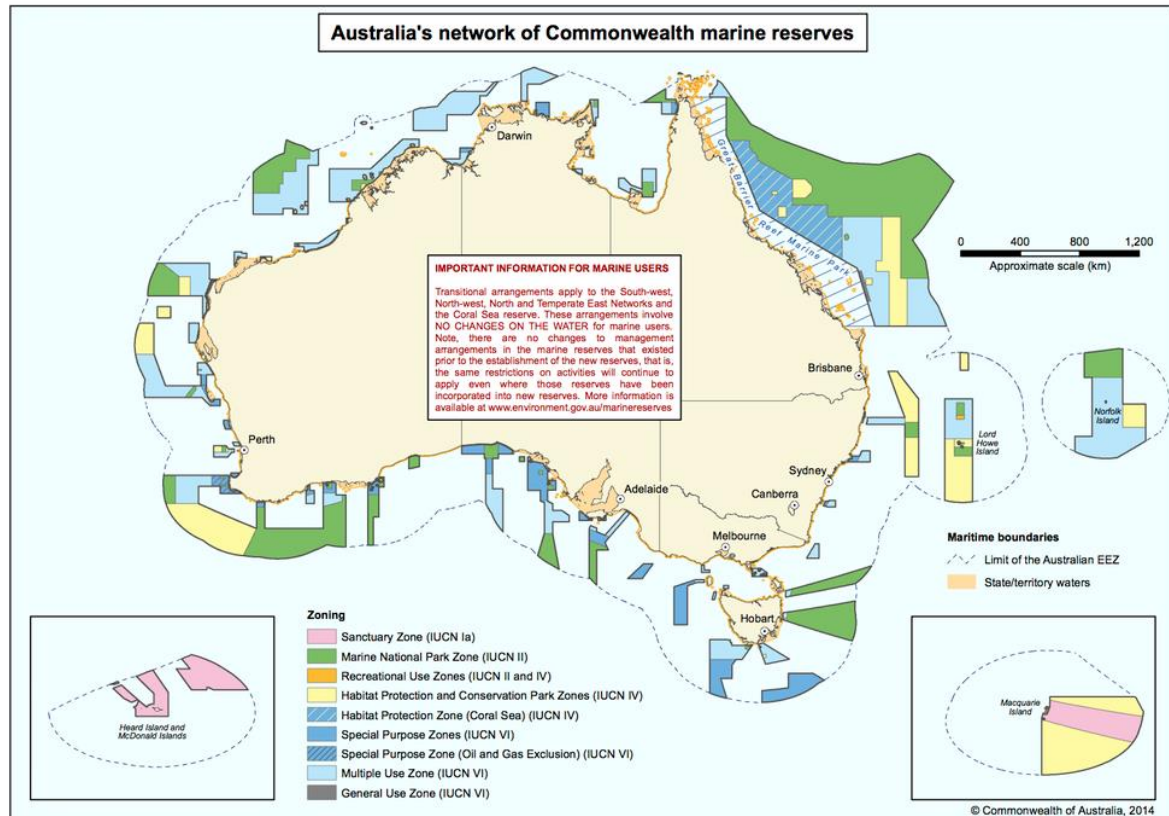


Figure 57: Australia's network of marine protected areas. Source: Commonwealth of Australia 2014.

Many reports and publications from government departments state their desire to better recognise and support culturally significant marine and coastal areas, especially those already being managed by Indigenous communities (IUCN/SSC 2013). An inherent issue arises when there is no inclusion of Aboriginal values when ecological values assessments are being undertaken as scientific methodologies are applied at the forefront of planning.

A prototypical example of this process is the Teahupo'o, where a hybridised system based on an old Polynesian custom of *rahui* (prohibition against a particular area or activity to protect a resource) was initiated to enhance both social and ecological resilience along with ecological connectivity for the first time in French Polynesia. With the recognition of the legitimacy of traditional experts and their role in the management of resources and territories, this simple shift in hegemony has reversed post-colonial inequities, this simple action of giving traditional knowledge and the traditional experts that represent it (through facilitated local community consensual recognition and election) a place in the formulation of the establishment framework and the ability to legitimise the development of cultural maps. This then allowed exploration of IUCN categories by the inhabitants of Teahupo'o as a

way to legitimise the *rahui* and apply it to cultural patterns regarding resource management and decision capacity (Bambridge 2012).

Another issue is that the smaller number of MPAs compared to terrestrial means there is less experience and understanding of applying categories to MPAs. Application of the IUCN categories to MPAs has often been inaccurate and inconsistent (IUCN/SSC 2013). Traditional Owner groups consider developing and implementing Sea Country plans as an Indigenous-led mechanism to engage in the planning and management of Victoria's MPAs — including consideration of collaborative frameworks such as Traditional Use of Marine Resources Agreements (TUMRAs) in Queensland and Indigenous Protected Areas nationally (Smyth 2009).

9.5 Aboriginal cultural marine mapping: Recognising governance complexity and diversity

Indigenous cultures throughout the world have used different forms of mapping, whether drawn on skin, wood or paper (De Hutorowicz 1911). Gladwin (1970) note that Micronesians created stick charts that showed complex representations of ocean tides and currents. In more expressive cultures, movements are carried out which serve to embody experiences and events, such as the Hawaiian *hula* (Wood 1992). The traditional *hula* steps express the creation and codes of culture.

In Australia, Aboriginal peoples have developed song lines to sing our land and sea into existence. These song lines also draw mental maps of historical events, significant places and claims to territory (Chatwin 1987). Another particular type of mapping applicable to Aboriginal culture is oral mapping. This type of map explained people's worldview of how the land and seascapes were organised and utilised. The kinship to the natural environment is often based on strong spiritual connection with ancestors and the land/water where ancestors were buried as well as on sustenance needs. This intimate connection with nature is very hard to digitise. Calamia (1999) found when reflecting on Pacific Islanders' oral maps presented by contemporary local peoples that they may be seen as an Indigenous ethnographic model of their cultural code. The maps may reflect social behaviour and aspects of marine resources use and conservation (ibid.). One interesting point is that the oral culture utilised spatial references or landmarks such as waterways, headlands and mountains, which are typical cartography attributes. Cultural mapping goes beyond strict cartography to include other cultural resources than land, including 'anthropological, sociological, archaeological, genealogical, linguistic, topographical, musicological and ecological and botanical' (Poole 2003).

9.6 The most effective strategies for realising the benefits of Indigenous approaches to sustainable resource use in the era of climate change

More recently, spatial information has been used for understanding interrelationships between traditional human societies and ecological processes (Calamia 1999). The application of geographic information systems (GIS) technology in marine cultural resource documentation provides opportunity to assemble information regarding species, habitats, seasonal patterns and cultural values in a spatial manner. The application of cultural mapping alongside ecological mapping allows:

- development of a predictive model of spatial Indigenous cultural use and associated resource products in shallow-water marine environments
- identification of key environmental variables as indicators of cultural resource use and management, producing habitat maps with Indigenously defined habitat classes and connected cultural associations, providing cultural perspectives on resource management
- highlighting of the intimate and intricate knowledge of ecosystems, species and the physical fundamentals of place
- identification of species and point locations (tangible and intangible) of cultural significance.

The mapping of Indigenous attachment and significance is a relatively new approach to secure tenure, manage natural resources and strengthen culture, with origins in Canada and Alaska during the 1960s and in other regions in the last two decades. Each mapping objective has a variety of methodologies that usually range from highly participatory approaches with village sketch maps to highly technical methods of spatial and technological equipment and use of GIS and remote sensing (Chapin et al. 2005). Such tools can complement Indigenous knowledge systems traditionally used to store and transfer knowledge and information (Harmsworth 1998).

These data systems of cultural knowledge also require a framework for application, management and access, including values that are attached to traditional and contemporary knowledge as well as the relationships with ocean attributes such as habitat, ecosystems and species, cultural elements such as totems, connections in spirituality and belief systems and how these elements are integral to the sustenance of local resources, use, access and responsibilities of territories/homelands.

Understanding and documenting customary resources, systems and processes operating in the marine environments and traditional coastal landscapes is not an easy task. The multi-layered cultural

systems of the many language groups and the interconnectedness between cultural biodiversity social and cultural values and social systems is a multi-dimensional assessment. However, the information obtained provides a basic introduction to Indigenous governance systems in marine environments. Information compiled would be of both qualitative and quantitative data sets. Examples include areas of ecological knowledge, areas of significance and connection and known resource information with examples of connection in traditional estates and associated knowledge systems of country and creation. The spatial mapping of resource information in two and three-dimensional cultural connection can provide a resource tool that incorporates cultural connection attributes into current management systems in the coastal and marine environment. It also provides insight into the analysis or theories of cultural restrictions as harvest principle mechanisms as they relate to species biology, ecology and ecological sustenance management (cultural biodiversity).

In understanding the context in which Aboriginal peoples utilised the landscape, one must recognise the distinct cultural groups (own stories/language/songs, etc). The alternate process of knowledge is not meant to enhance science or add to a data set of how cultural data analysis can aid in determining fish abundance in nearshore reef habitats, but is a separate data set of TEK, IEK, or Indigenous knowledge with its own values and attributes that establish equity in knowledge.

This is why the proposal for a generic framework for application, management and access would be necessary. As such, the further detail and the data analysis would primarily aim to link the concept of interconnectedness between cultural biodiversity, social and cultural values and the relationship of the changing variables of the coastal marine environment within each group's 'country'. The connections between ecological knowledge, cultural use, known-resource information and ecological habitat communities are mapped in terms of spatial, multi-dimensional data for spatial application and representations. These are then applied as commonly used spatial resource information tools, incorporating cultural knowledge and values into a management system tool with data manipulation to show Aboriginal cultural associations, including existing marine and coastal environmental data and site-specific information with examination of the potential to produce an indicative model that evaluates the significance of Indigenous cultural landscapes (marine) with a series of cultural attributes. This data and its application is relevant and needed in the current uncertainties of climate change, with species movement and species adaptation. Traditional knowledge on this and other biological components is information of great value.

The framework or process is similar to that of the ecological assessments. Lauer and Shankar in 2008 undertook an assessment of the practical application of Indigenous ecological knowledge along with remote sensing analysis to construct marine habitat maps. Outcomes from this study showed that remote sensing techniques can produce culturally defined marine habitats, which can be useful in socio-ecological processes and management decision-making and planning.

The physical aspects of the ocean, land, atmosphere and their associated environments, products and features are cultural landscapes given significance by Indigenous doctrinal systems (Elkin 1994). This intimate connection with nature is very hard to digitise. Calamia (1999) found when reflecting on Pacific Islanders' oral maps presented by contemporary local peoples that they may be seen as an Indigenous ethnographic model of their cultural code. The maps may reflect social behaviour and aspects of marine resources use and conservation (ibid.). One interesting point is that the oral culture utilised spatial references or landmarks such as waterways, headlands and mountains, which are typical cartography attributes.

These cultural landscapes are both the result of and provide the focus for ancestral events, together with Indigenous peoples' social, political and religious systems. Lands and environments are interwoven into a tightly integrated cultural system. This integrated cultural system forms the basis for Indigenous knowledge. This then leads to how marine resources were managed and knowledge of species biology, ecology, habitat and eco-morphology, influencing such things as seasonal indicators, harvest times (based on abundance and potentially high nutrition and protein yield) and interrelated ecosystem dynamics, therefore providing abundant resources.

Given the limitations of available data, sensitivities of cultural information and inadequate culturally appropriate software, along with the cultural difference of how Indigenous people map country against the traditional western concepts of mapping, mapping provides an array of challenges. It evolves primarily around multi-dimensional and multi-spatial geographies.

It is possible to make maps that show various forms of marine cultural associations and values, including but not limited to: cultural connections, marine systems habitats and cultural resource associations. However, given the available software and resources, the comprehensive attributes and variables are not capable of representation. The inherent issue lies in the limits of mapping cultural connections of spiritual origin, an attribute that cannot be easily delineated, represented and displayed. The application of cultural spatial data systems does, however, highlight the complexity of associations (in time and space) and, most importantly, the layers of resource management and

protection mechanisms. Such a resource would complement education in revealing a different psychology, perception and perspective on the marine environment, one that highlights holistic values and inter-related connections and complexities of cultural principles.

The scale of mapping and the area being assessed are important initial factors in the development of any cultural marine methodologies. As it details the cultural context and relationships (Language boundaries / ownership etc) and relevance of information that primarily leads to the focus of elements and variables such as tangible and intangible information. The secondary component is allowing this scale to be used in values assessment, developing a system to translate oral data into a spatial format by extracting explicit details of resources, habitat and associated linkages or secondary variables into feature point locations or polygon areas. The mapping consolidates research undertaken on associations of traditional and cultural uses of coastal and marine resources and illustrates it in a two and three-dimensional visual record.

Many scholars emphasise the practical and ethical importance of retaining and applying Indigenous ecological knowledge. The IUCN program on traditional knowledge for conservation (1986) summarises five practical and tangible benefits of TEK:

- It may be useful for new biological and ecological insights.
- Resource management, in particular rules and rote procedures, is often just as good as western scientific prescriptions.
- Protected areas and conservation education.
- In development planning where traditional knowledge can provide more realistic evaluations of environment, natural resources and production systems.
- Environmental assessment. Those dependant on local resources for livelihood are in better positions to assess true costs and benefits of development.

There is increasing awareness, indicated in the international Convention of Biodiversity, of the critical need for Indigenous knowledges to achieve environmental sustainability. Although recognised as important, effective application remains elusive (IPBES 2011). Calamia (1999) states that Indigenous peoples have an enormous contribution to make, however he continues that traditional knowledge is complementary to western science and not a replacement (Knudtson and Suzuki 1992). This is evident in the technological systems used to evaluate or include Indigenous knowledge. Current geospatial techniques and technologies have limited potential to represent Indigenous cultural knowledge and may have detrimental effects because they de-emphasise, ignore or devalue concepts that are of

central importance to Indigenous cultures, including the ubiquity of relatedness, the value of non-empirical experience and access and value of ambiguity over binary thought (Hi'iaka Working Group 2011).

Indigenous ways of knowing are holistic, acknowledging the 'interconnectedness of physical, mental, emotional and spiritual aspects of individuals with all living things and with Earth, the star world, and the universe' (Lavallee 2009). The conventionally framed resource management approaches are able to contend with factual observations, past and current land uses and some traditional land management systems, but they do not effectively grapple with issues of cosmology (Houde 2007).

Indigenous cultural values place emphasis on resource sustenance and layered resource partitioning and security. The issues of climatic alteration, species displacement, pollution, increased population and coastal development are current and accumulative. Indigenous perspectives and values on marine ecosystems provide another light on how these systems can be managed. This change revolves primarily around the psychology of the people and their resource values and connections.

Throughout Oceania (Pacific region), community-based conservation such as Indigenous Protected Areas (IPA) and Locally Managed Marine Areas (LMMA) are examples of conservation and management shifting to conservation frameworks that recognise sea-based culture areas as the resolution to protecting the marine environment (Cordell 1991).

Due to the genetics of marine management frameworks in Australia, inherently of western science, law, social policy and economics, it is difficult for such entities to comprehend or cope with the divergence of perceptions of cultural values permeated in such systems. These Eurocentric, science-based conservation assessments fail to have the contextual constituent to integrate such cultural and biocultural diversity into marine protected area conservation toolkits and frameworks at present.

Then one must ask if the traditional knowledge and cultural values of the marine environment have validity and are worth preserving in marine environments where the process is ultimately defined by governments and western science. Decisions, planning and conclusions are ultimately set within frameworks that separate Indigenous values from the ecological, whereas many Aboriginal groups see our cultural attributes as part of and inseparable from the natural environment.

Supporting the development of a framework for Indigenous governance, which would set out the appropriate institutional and legislative platform for Aboriginal processes that detail Aboriginal interests, rights, values, significance and associations with contextual integration into MPA strategic planning, processes would provide rational and equitable tools in the establishment and acknowledgement of Indigenous rights and values in Sea Country adjoining already Aboriginal owned lands. It gives substance to a real blue economy that is 100 per cent inclusive of Aboriginal peoples. However, the benefits of greater Indigenous power in decision-making goes beyond this. In the next chapter, it is argued that Indigenous environmental management principles and practice are both beneficial and vital to environmental management in general.

Chapter 10: Designing a Future Based on Past Ideology: The Detailing of Sustainability and Utilisation and Application of Cultural Environmental Knowledge

If we learn to value nature, our real wealth, we will take better care of it.

Our economic system works for no one, except maybe the one per cent at the very top.

Our system wastes the environment. It wastes people.

And, it's very, very expensive.

We need a radical change in how we relate to resources and people and the environment.

P. Hawken, 1993

10.1 Introduction

In times of changeable global economy, political uncertainty, environmental instability, food insecurity, profound species loss and ecosystem breakdowns, the natural systems essential to our existence and survival, including forests, oceans, rivers and air, continue to decline and diminish. In 2012 the UN panel on Global sustainability highlighted that forest cover is being lost at an alarming rate globally where we have lost 53 per cent of the original primary vegetation cover of the planet's terrestrial surface, mostly in developed nations. The report also noted that the rate of overfishing has led to 85 per cent of all fish stocks now being classified as overexploited, depleted, recovering or fully exploited, added to this agricultural run-off has increased levels of nitrogen and phosphorus leading to coastal "dead zones". As a result of carbon absorption the world's oceans have become more acidic affecting marine food chains and coral reef resilience. This then flows to natural habitats in decline and the accelerating rate of species extinction and genetic diversity in decline globally. Overall nearly two thirds of the services provided by nature to humans are in decline worldwide (UN 2012).

Scientific basis for actions to conserve and use the natural environment sustainably has been highlighted in such reports as *Climate Science* (IPBES 2011; IPCC 2013, 2014, 2018), the *Millennium Ecosystem Assessment* (Millennium Ecosystem Assessment 2005), United Nations secretary-General's high-level panel on Global sustainability (2012) and the Economics of Ecosystems and Biodiversity report (TEEB 2010). These and many more reports make clear that without a radical reform of the human-nature relation — in favour of nature — human civilisation is under threat and at grave risk (Ekins 2011).

The unknown factors are too many to ignore or to leave to someone else to fix or deal with. We are now at the point where a mass social paradigm shift through mind frame and actions are required to bring balance back to eco-centric thought, lifestyles and existence. Whilst reading an article on sustainability, finally someone asked, 'why hasn't the world become much more environmentally sustainable despite decades of international agreements, national policies, state laws and local plans?' (Howes, 2017).

10.2 Sustainability

The idea of sustainability stems from the concept of sustainable development, which became common language at the world's first Convention on Biological Diversity earth summit in Rio in 1992. The original definition of sustainable development is generally considered to be 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs' (World Commission on Environment and Development 1987).

Since its original conception, there have been many variations and extensions on this basic definition and there are many different views on what sustainable development is and how it can be achieved. Historically, the three dimensions of sustainability are the economic, environmental and social, forming the 'triple bottom line'. This framework has been at the heart of several decades of reform in natural resource management, construction and development industry. The principles have also made a global impact on land administration and legislative policy development.

We also must remember that the sustainability concept materialises from dominant Euro-centric paradigms with western frameworks and processes and western Euro-centric ideology and interpretation. The concepts and constructs are also primarily driven by western institutional models, opinions and ideologies. The definition of sustainable development seems to be void of a cultural dimension and the associated established societal values and worldview. Its meaning is not representative of original (Indigenous) sustainable knowledge systems.

Many of the environmental challenges we face, be these climate change, pollution, environmental degradation, etc., are caused not by our own actions but by the dominant societies who are incessantly pursuing development path of unsustainable production and consumption. Climate change is the biggest proof that this dominant development model is unsustainable and therefore needs to be changed (Tebtebba Foundation 2008).

Within this western time- and mind frame, there is a perception that sustainability constructs are functioning adequately. Nearly all institutions, companies, industries and businesses are working on sustainability and using all kinds of performance systems for energy efficiency, indoor climate and comfort, waste management and resource viability. However, the real sustainability is almost out of sight, namely that the land, earth, air and sea, which all consist of a holistic and whole systems dynamics, are being manipulated to service market-based economies.

This is potentially why key environmental indicators and ecological functions continue to decline despite initiatives of sustainability. Now, consider and process that since 1970 humanity's ecological footprint has exceeded the planet's capacity to provide. It is now at the point of where 1.6 planets would be needed to provide resources sustainably. We are standing on the edge of the tipping point, where if status quo continues there will be irreversible consequences. We are also at the point of where the biodiversity index has declined more than 50 per cent and wild species populations continue to decline. Greenhouse gas emissions have nearly doubled, with climate change impacts increasingly dominating our livelihoods. The planet is devoid of more than 48 per cent of its tropical and sub-tropical forests. The rate at which these indicators deteriorated was largely unchanged over the two decades either side of the Rio summit in 1992 (Howes 3 April 2017).

It is also through these market-based performance frameworks that many argue sustainability has been hijacked and twisted to suit government and industry, facilitating a notion of business as usual, a perception that sustainability is only adhered to if it has economic profit attached. Where we once did things for the greater good and not just the bank account or national and global economy, sustainability fundamentals seem to be disorientated and we now exist and tolerate an economic-driven, self-indulgent and corporate gain culture that overlooks environmental destruction and demise.

10.3 Ecological sustainability

Wills (2006) maintains that the sustainability issue is in the interactions between the economy and the environment, or more so, the habitats and species cycles within the wider environment. It prompts the question whether, over time, continued expansion of economic activity is consistent with ecological stability and the continued functioning of the ecosystems on which all human activity, and life itself, ultimately depends. This mindset of economic gain over environment has caused massive gaps and declines in ecosystem functions, their cycles and the earth's ability to renew and regenerate. Species and ecosystems are struggling and expiring. The earth is in need of palliative care. Therefore,

the question to be asked is, 'Sustainable from whose perspective?' Certainly, from my perspective as an Indigenous woman, that's not sustainable. I come from a living culture that has had 60,000 years of recorded scientific evidence of being on this planet in harmony and with equity and respect for other species. Research has revealed through the *Zygomaturus* specimen that Aboriginal peoples and megafauna co-existed for at least 17,000 years in Australia, with existence up to the period where the climate began to change dramatically during the Last Glacial Maximum (Westaway et al. 2017). Evidence also exists that Aboriginal peoples across the whole continent of Australia were using domesticated plants, sowing, harvesting, irrigating, storing, engineering, constructing and populating (Pascoe 2018), aligned with true representation of sustainability through social constructs and belief systems (lore) that aligned and holistically integrated multiple systems of nature-based habitual living ideology based on cyclic existence rather than linear models of thought and design.

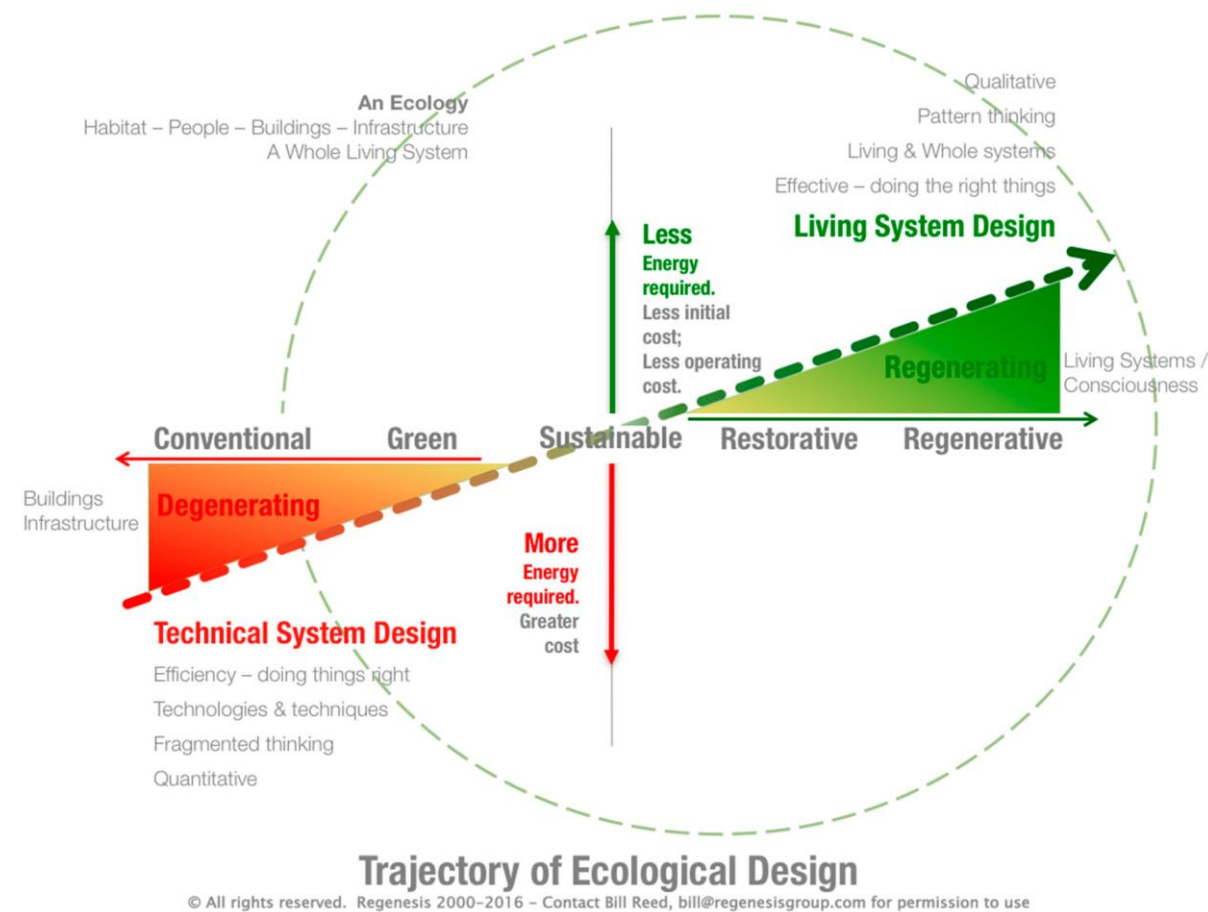


Figure 58: Habitual living ideology as expressed by the Regenesiis group shows the trajectory of regenerative design concepts that have ecological consciousness and outcomes as the main thinking. Source: Image used with the permission of Bill Reed 2019.

As it turns out, these natural biomes are the cultural and environmental systems Indigenous people have thrived and survived in sustainably for thousands of years. This was achieved through social practices and constructs that placed the environment and its species in levels of equity and higher influence with the notion of cyclic existence, in which everything relates to each other and where collaboration is more important than ownership. The current definition of sustainable development seems to be void of a cultural dimension and established societal values and beliefs are not representative of Earth's Indigenous people. We now move into a space where we need to utilise all systems of thinking and emotional intelligence to guide and alter our human-dominated dimension of existence and move with new ideologies and tools or frameworks to way find into a future by design.

It is at this crisis point that we must look at other forms of management, including a sustainability model derived from Indigenous ideologies of equitable existence and technical and ecological cultural resource management — all under the banner of caretakers and custodians, which includes spiritual, intellectual, emotional, innovative, resilient and physical constructs. No matter where we start our analysis, the world clearly needs better land and resource management through effective governance and administration. Full implementation of ecologically sustainable development principles in Australian requires genuine ecosystem-based approaches that include Indigenous cultural knowledge (ICK) and practices.

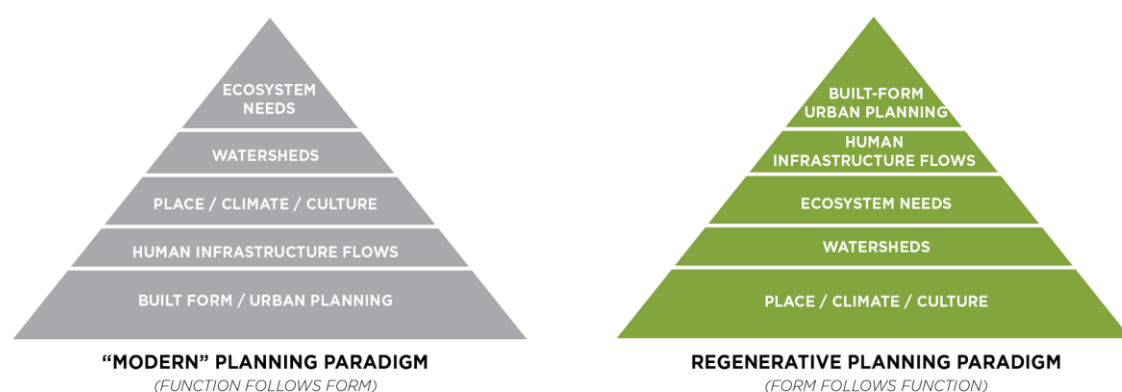


Figure 59: The comparison of modern planning paradigm and regenerative planning paradigm. Source: McLennan 2016; McLennan and Reed 2013.

10.4 Traditional knowledge systems

A key to understanding the role of Indigenous-led sustainability in society is understanding the evolving relationships of people to land and how these relationships and the land administration system provide a framework with the infrastructure to implement adaptive and sustainable land-related policies and land-management strategies. This includes a regenerative planning paradigm that places, culture, climate and ecosystems need as the primary nucleus of sustainability. The development of an administration system based on IKS and Indigenous cultural adaptive management principles is now warranted.

The application of traditional knowledge systems (TKS) preservation, intergenerational knowledge transfer and continuing cultural practice. The use of TKS has the potential to extend further and into new realms of integrated design in the application of architecture, construction, planning, urban design and local capacity building (building local knowledge and strengthening local governance and organisation), as most Indigenous adaptation principles are embedded in local knowledge, sustainable livelihoods and community-based innovation (Nakashima et al. 2012).

These principles have value in both the components of initial design of the urban landscape and in the design of community governance objectives, principles and policies. These applications are in line with the notions of different ways of knowing, thinking, being and producing solutions to the uncertainty of future challenges in climate change and sustainability. Ecological knowledge systems show that there is a component of local observational knowledge of species and other environmental phenomena, a component of practice in the way people carry out their resource use activities, and further, a component of belief regarding how people fit into or relate to ecosystems. In short, traditional knowledge is a knowledge–practice–belief complex (Berkes 1999).

Studies reveal that a diversity of local or traditional practices for ecosystem management exist, such as multiple species management, resource rotation, succession management, landscape patchiness management and other ways of responding to and managing pulses and ecological surprises. For example, formal and informal religions and associated spirituality contribute through mechanisms such as taboos, practices of care and community motivations for conservation (IUCN 2019). Social

mechanisms behind these traditional practices include a number of adaptations for the generation, accumulation and transmission of knowledge; the use of local institutions to provide leaders/stewards and rules for social regulation; mechanisms for cultural internalisation of traditional practices; and the development of appropriate worldviews and cultural values.

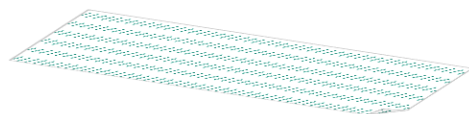
Some traditional knowledge and management systems are characterised by the use of local ecological knowledge to interpret and respond to feedback from the environment to guide the direction of resource management. These traditional systems have certain similarities to adaptive management, with its emphasis on feedback learning and its treatment of uncertainty and unpredictability intrinsic to all ecosystems (Berkes et al. 2000).

10.5 The role of Indigenous paradigms and traditional knowledge systems in modern humanity's sustainability quest

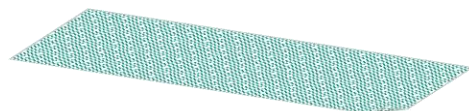
In order to effectively incorporate TKS and associated value systems and beliefs into sustainability decision-making, an approach based on Indigenous concepts is essential. Why would we not include the fundamental principles of the oldest living sustainable culture in the world? It requires knowledge and understanding of Aboriginal peoples' culture, values and belief systems, a culturally consistent measure of sustainability along with a culturally consistent model for including cultural sustainability in decision-making (Morgan 2006) and the decision support tools of the Indigenous paradigm.



Governance | community management framework and systems



Architecture | design | built form



Planning and engineering of services & infrastructure | water | roads | drainage



Associated green space, including ecological corridors| traditional foods/medicines | community food and open space | fire and micro climates



Cultural place/traditional landscape variables and local traditional uses and significance

Figure 60: The Indigenous knowledge design and development stratum. Source: C. Marshall 2019

In design and planning, owning land should not be the main goal and will definitely not lead to sustainability, as there are only a very few people that profit from developing land. Shared ownership will automatically conserve the land and together the owners will make sure that the land will give back for eternity. It is now time for those with innovative intellect in design and the built environment to step up in altering the perspective from individual wealth to that of a shared ownership and a holistic acknowledgement of land, nature and humans as all part of one system.

Armitage et al. (2008) define knowledge co-production as 'the collaborative process of bringing a plurality of knowledge sources and types together to address a defined problem and build an integrated or systems-oriented understanding of that problem'. These cross-scale and cross-cultural methodologies provide an important framework for adaptation action on the ground (Alexander et al. 2011; Berkes 2008).

10.6 Environmental kinship and totemic relations

Animism can be described as belief in personalised, supernatural beings (or spirits) that inhabit animals and objects, essentially governing their existence. In discussing animism, the complexity of religion, the philosophy and metaphysics of 'beliefs' and belief systems can be daunting. What can be examined is an openness to consider that humans are neither separate from the world nor distinct from other kinds of beings in most significant ways. Totemism as a perspective where humans are not only closely related to other humans but also to particular animals, plants, etc. These fundamental principles can be seen as the key to understanding the relationship between natural elements and human's place within the environment and the associated beliefs and values and their links to the natural environment.

In 2006, T.K. Morgan wrote a paper on decisions to support the Indigenous paradigm and a culturally consistent measure of sustainability with a culturally consistent model for including that cultural dimension in sustainable decision-making. Cultural inclusion in all dimensions of sustainability as a methodology, for myself, derives from my worldview of totemism and animism, where being embedded within the holistic elements of nature directs the ideology of behaviour towards it. The

Indigenous sustainability framework within the environment and its holistic perspective is the geographic relationship that enforces belonging.

In presenting a different way of thinking, it may not be called science, but Indigenous knowledge refers to the scientific skills that Aboriginal peoples value and have used throughout the evolution and refining of societal construct and human behaviour. It is based on the fundamental knowledge of how the environment exists and our relationship with it. It embodies a process of eco-centric perspectives and principles. It includes knowledge systems of environmental indicators and familiarities. This thought dimension promotes an existence of equity, an intimate relationship with the environment and the landscape around you. This includes the relationships of these connective systems to the earth and involves all components of these cyclic systems. This paradigm looks at moving out of egocentric consciousness, in seeing, being and doing, and into a more nature-based, nature-focused perspective.

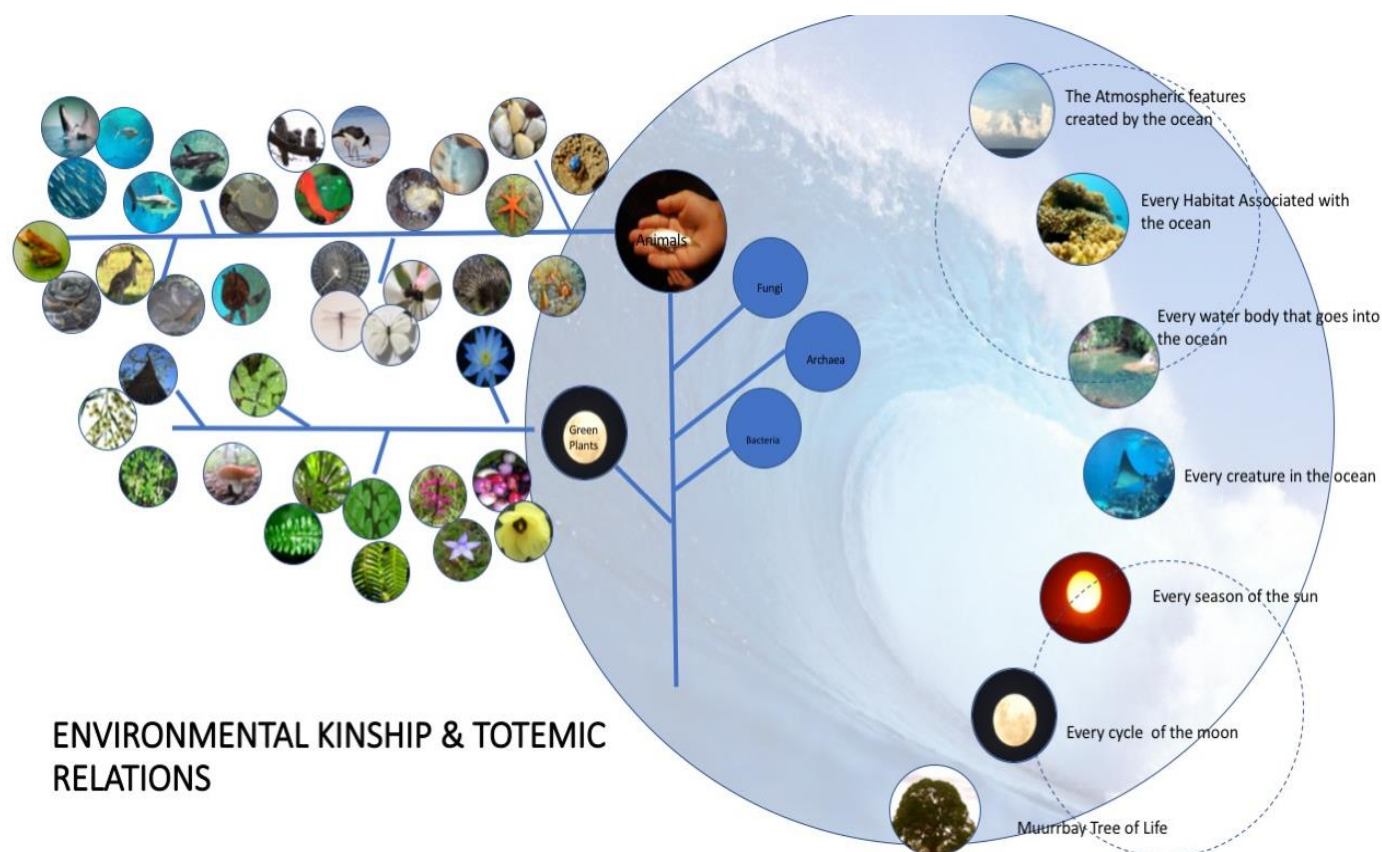


Figure 61: A small example section from my Gumbaynggirr/Ngambaa-Baga Baga kinship paradigm with elements, animals, plants and habitats. Source: C. Marshall 2019.

This is my environmental kinship and my totemic relationships to Gumbaynggirr country. For me, the ocean is my totem. I hold the ocean sacred and I see it as a living entity, living and breathing. It is to

be respected, and in return it will respect me. There is also a female component related to ceremony and kinship to ocean. Associated to the ocean are the atmospheric features created by the ocean. The clouds, the wind, the temperatures, our global weather patterns, these are products of the ocean and therefore also hold the same respect. Every habitat that is in the ocean is also associated to me. Every water body that goes into that ocean. The *ngaarl* (water) that comes from the mountains and clouds that makes its way, meandering through the landscape. Every creature in the ocean, because the ocean is the blanket that encompasses those living organisms. I have a kinship association to these. Every season of the sun that then also influences the different ecological stages of those animals, the habitats and the atmosphere. Every cycle of the moon and the tides that are associated with that ocean and then, the tree of life, the story of resources and sharing.

As well as that, I have myself and my family. I am a *yugiirr* (dolphin). I come from a family of *yamaarr* (fish). My family's totem is the red bass that lives in the ocean and reef system. I have cousins who are sharks and my mother is a *guruja* (whale) who comes from a family of dolphins. I have a daughter who is a frog, a godson who is the lightning storm. I have a father who is a bat, and I have cousins who are birds and carpet snakes.

As it moves along, you can see the tree gets bigger and extends into nearly all associations in the environment's natural kingdoms and their systems. My kinship is to everything that is in my Gumbaynggirr land and seascape, my *jagun* (home) and *bari* (country). The associations then relate to the knowledges that come with all these other variables to do with the ocean, that then also influences the vegetation and the biodiversity on the land.

Social Component	Association to Totem
Exogamy (the custom in some societies of marrying outside their people's own social group)	Classes, sections, position in clan group and family, order to social relations and blood. Totem Clans
Totemic names	All family clans, some individual and Country /language group
Taboo	Totemic and non-totemic, restrictions on place and species
Decent from Totem	Totem clans, family groups and responsibilities within country and clan
Ceremonies	Associated with totemism
Reincarnation	Associated with totemism, spirit animals
Guardian spirits	Associated with totemism, represented as guides or spirit animals
Art	Responsibilities to totem and restricted in use
Rank	Passively associated with totemism

Table 13: Totemism in Gumbaynggirr. Adapted from Frazer 1910; Durkheim 1965.

What we're looking at is a mind frame that has environmental variables as equal components in a living system. It is an ideology of equity and environmental primacy. The theory of ideology states that the ideas and beliefs people have are systematically related to their actual and material conditions of existence (Wolff.1981). Cormack (1992) identifies ideology as a process that links socio-economic reality to individual consciousness. It establishes a conceptual framework, which results in specific uses of mental concepts and gives rise to our ideas of ourselves, where the structure of our thinking about the social world and about ourselves and our role within that world, is related by ideology ultimately to socio-economic conditions. Where a particular ideology is caused by a particular socio-economic system and the function of the ideology is the perpetuation of this system, this social system or structure gives rise to particular ways of thinking.

In a cultural paradigm or ideology where the foundations of everything is that place, the climate, landscape and the culture sets the foundation for how we build and plan the urban environment and our needs as humans, these environmental factors have primacy in what we do. Why do we want to build a system based on Indigenous knowledge in adaptive management? I think the answer is quite clear: what we're doing at the moment is not working. Some might think it's brilliant, it's fantastic, it's the best thing since sliced bread. This is definitely not the case from an Indigenous perspective. Indigenous-lead ideology applied to socio-economic governance and administration policy provides pathways to social-ecological relationships to land and resources. This concept represents relationships mediated through kinship networks that represent another conceptual construct by which Aboriginal peoples organised their ecological knowledge (Glowczewski and Warnayaka Art Centre 2000).

10.7 Moving into new territory

We now move into a space where we need to utilise all systems of thinking and emotional intelligence to guide and alter our human-dominated dimension of existence and move with new ideologies and tools or frameworks to find way into a future by design. Effective adaptation planning requires access to the best available knowledge, whatever its source. In the face of climate change risks and impacts that remain uncertain and unpredictable, there is a growing need for policies and action that foster the co-production of new knowledge sets based upon collaborative efforts involving community-based knowledge holders and natural and social scientists (Nakashima et al. 2012).

How does this inter-dynamic future by design evolve? By integrating traditional knowledge practices in worldview and consciousness to recalibrate our future. Success in making the next generation more

aware, eco-centric and with intelligence in holistic solution solving. Indigenous frameworks tend to be more fluid and organic by virtue of not being locked and focused in narrow perspective with the inability to adjust and adapt.

In the end, necessity will force innovation, science and technology to deliver the mechanisms and substance. These materials will need to be based on more efficient resources that do not drain, alter or remove non-renewable resources. This innovation and technology are already in play with many solutions and adaptations most likely only evolving from our next generations. The fundamental component of this is the mindset and the psychological shift that is required to accompany the technological shift. In changing our status quo livelihoods and to have the ability to support, accept and demand that financial investment resources and governance direction are focused and applied to advance these environmental technologies in research and design paradigms. Advancing small solutions that can be scaled up and deployed at global scales. These innovative solutions and adaptive mechanisms are all useless if only a small percentage of the population are committed or believe in the practicality.

The precautionary principle, the application of dealing cautiously with risk and irreversibility (DEH 2006), would guide sensible technological developments whilst resources remain and are available. Leaving things to the 11th hour is bad management. Human actions are presently outside the global 'safe operating space' supplied by natural systems in respect of climate change, biodiversity loss and the nitrogen cycle (Rockström et al. 2009). Simultaneously, over-increasing capacity of the quality and quantity of water resources (Gleick 2007) and persistent land degradation pose real threats to long-term habitability and human infrastructure.

However, it is the mind shift and intelligence in the finite resource consumption that has dire consequences. Knowledge of economy–environment interactions are imperfect, especially as we move into the future. What do we really know of technology, lifestyle or social preferences of future generations? Having a singular mind frame based on capitalist systems, ideas and beliefs with capital forces for profit and gain that only benefits small sections of the globe and small sections of society who dominate with capitalist ideologies, promotes political failures as governments cannot or will not implement effective environmental or sustainable legislation and policy when there is fear of financial loss. This is not a model that is in line with Indigenous ways of being and knowing. The dominance brings primacy when our future and environment is changing and unstable and any intense single or multiple natural disaster can bring economic crashes and instability. The desperation in shortages can

cause domino effects of bad decisions. The disparity also causes unbalance in natural systems which can favour negative environmental configuration (i.e.; the removal of keystone species and apex predators through desperation of Indigenous communities to be competitive in global economies). Resistance of individuals, corporations and companies to compensate the rest of the world due to their products and businesses impacting globally, which in many instances is on Indigenous peoples, is not conducive to sustainability. Basing the future on finite industry and finite resources is not intelligent. When these end or collapses, there will be no transition time or mechanisms for recovering from exhausted natural energy resources.

This provides a psychological mindset and thought pathways that derive from and are mindful of the bigger picture, not just short-term gain. Designing our future does not just involve research into alternative products or innovative solutions or technology to mend or advance. It firstly needs mindset, the ability to understand and process and connect as to why we need to change our values and society from capitalist, industrial, market-driven, throw away finite delusion to one that is comprehensive and holistically intelligent about future outcomes. A mindset is needed that comprehends what and why we need to alter the behavioural and psychological conditioning of the ideology of a primarily western-dominated society to evolve into the future as a resilient, capable structure for common good and healthy environments.

In 2013 an incentive on Lakota Native American community wealth building looked at new models of broad-based ownership of Indian owned Country. A five- year co-learning and co-creation collaboration was undertaken. The initial goal of the Native Employee-Owned Development Pilot Project was to coach a cohort of Native American organizations in launching enterprises to root jobs and wealth in Native communities. In the five years since then, the initiative grew into something beyond enterprise development: shifting mindsets and the way that economic development is done in Indian Country (Gutierrez 2018). In the end, the actual projects were less important than the process of engaging with a broader way of thinking and ultimately, a shifting of mindset within the organizations (Gutierrez 2018). An example of this was at Thunder Valley where social enterprise focussed on having Native-owned enterprises. A whole mindset was at work: instead of having wealth leave the Reservation it was kept recirculating locally; instead of having non-Native-owned companies it empowered Natives as owners the framework empowered self-sufficiency in every economic step taken therefore building community wealth. The shift is embodied in the work of Thunder Valley with its Regenerative Community—a village of homes, businesses, and community spaces, that aims to be a net zero development, producing all its own energy, with an aim of 100 per- cent water reclamation.

Thunder Valley is also training youth in sustainable construction techniques, in addition to building Native-owned businesses (Gutierrez 2018).

10.8 A New System

Just like natural environmental systems, we need diversity. Diversity brings room for recovery after change or alteration. A monoculture of a few species has no room for error. Any impact causes immense and rapid breakdown.

The innovative approaches from the regenerative design concept come close to the paradigm. The Cultural regenerative framework and its principles arose first in Australia with the author as a founder of its parent body, Regenerative Australia. The main principles involve using Indigenous guidance and knowledge in wider planning and design. They are based on process-orientated systems theory, of creating again, and are part of sustainable living. A regenerative system makes no waste. Regenerative design aims to design for a future of co-existence and co-evolution of humans and other species. Whereas sustainable design aims to provide for fundamental human needs, the regenerative approach uses biomimicry to find solutions to human problems and model patterns for industry and human habitats. The key element of biomimicry in regenerative concept is that it uses all species within a system. According to the regenisists, the use of conservation and recognising that humans are a part of the ecosystem and need to be incorporated into it provides a better system of existence.

Regenerative design is based on the following principles:

- Life is viable only through the exchange of energies.
- Life increases in resilience and evolutionary potential when water, soil, sunlight, energy, living entities, information, and so on have greater opportunities for exchange.

This approach is to put nature first and then use good design and building science to define form (form follows function). Doing so ensures that natural systems and passive design form the basis of community design and human infrastructure flows work with rather than against nature. Final built form is then a product of a systems level process rather than the driving force.

The regenerative design process is one where iterative designs are holistically integrated across multiple systems by multiple disciplines rather than a traditional 'through-put' or linear model of design (McLennan and Reed 2013).

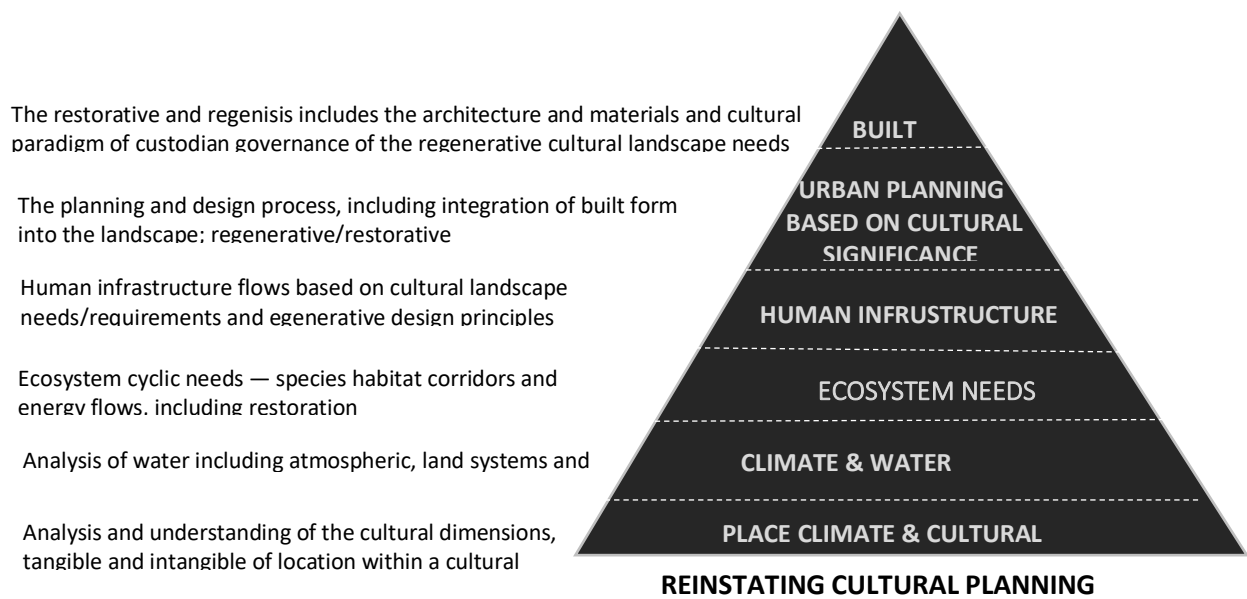


Figure 63: Reinstating cultural planning paradigms in a modern context. Adapted from McLennan and Reed 2013, the comparison of modern planning paradigm and regenerative planning paradigm.

The purpose is to provide pathways of innovative thinking and approaches, inserting a paradigm in the toolbox that advances to evolving in adaptation in the face of human-induced climate change. That includes the key derivatives of what sustained Indigenous cultures, the species we provided custodianship for and the environment we have been caretakers of for many generations with contentment.

10.9 Conclusion

One evident issue in the climate change debate is the general collective of western urban societies, ethnic isolations and religious sects' disassociation with or ignorance of Indigenous people's deep, intricate connections to the ocean. The very reality of industrialism and technology sees much of the general population inside buildings or nestled within the comforts of industrialised societies. Exposure to the raw environment and environmental processes is becoming less. The rapid changes of the global economy and economic pressures has played a significant role in the oblivious demise, damage and destruction of our natural environment, cultural rights and connective habitation in these ecological systems. The very existence of increasing population, global economic pressures and resource competition poses a threat to fragile habitats and environments. The issue of rapid human-

induced climatic change is an unaccustomed space, a new frontier, no one in this timeframe has really experienced.

The issue of climate change and its effect on the people of the Pacific, I feel, has become a 'common familiar', where disconnection and denial of our everyday actions or moral justification of actions are used to avoid the issue of human-induced climate change. This disconnection and denial are unsatisfactory and uneasy for many, but have persisted because of a presumed absence of corrective alternatives. Regenerative design and especially Indigenous principles and practices offer that alternative, as will be discussed in the next chapter.

Chapter 11: A Future through Indigenous Principles for Design

The shift from a fragmented worldview to a whole systems mental model is the significant leap our culture must make.

Jason Twill, Urban Apostles and Regenerative Design 2018

11.1 Introduction

Design involves solving problems, creating something new or transforming less desirable situations to preferred situations (Friedman 2003). To do this, designers must know how things work and why. Understanding how things work and why requires us to analyze and explain. This is the purpose of theory. The framework for a theory of efficient community living evolves by understanding the principles and imperatives of sustainable existence. Existence founded on Indigenous eco-centric principles as foundations is a new concept for design. By understanding Indigenous people's ways of knowing and being and how this relates to existing in and with the natural environment can provide another paradigm in planning and design. This chapter discusses the framework for the meaning and theory of cultural habitat design. It will also explore the approaches of holistic mechanisms that integrates the social and natural sciences of Indigenous knowledges and worldviews.

With the complexities of world order and environmental confusion, what do we do? Where do we go? For those with wealth and means, the vision of space and new planets is the alternative option, with space programs, Mars planetary missions and new spacecraft providing luring aspirations for another planet to colonise. But for those not engulfed with personal or national wealth, this option is far-fetched and ungraspable. These people tend to be those with long-standing cultural and spiritual ties to the creation of Earth and traditional responsibilities to its sustenance, to place, our place and to the peoples that evolved and sustained, adapted and created — the innovators of earth-based technology who existed and preserved through seasonal fluctuations and extreme climate changes. To do so required an intimate understanding of the cyclic processes and connections of land, sky and sea, but primarily a paradigm of how to exist and live within these cycles and be immersed in the cycle and functions of ecological processes so that resources were plentiful and society could thrive. This sustainable, adaptable existence evolved from a worldview and perspective based in eco-centrism. Unfortunately, no sacred texts or written scripts exist to dictate to the masses what this all means, but what does remain in tracts and patches is the landscape, within which this knowledge is embodied, and the people who hold the oral transmissions.

The application of traditional knowledge or traditional ecological knowledge (TEK) in a modern context has been amalgamated into or applied in the context of scientific research, Indigenous knowledge preservation, intergenerational knowledge transfer and enhancement of continuing cultural practice. The use of TEK has the potential to extend further and into new realms of integrated design in the application of architecture, urban design, land use planning and local capacity building by means of building local knowledge and strengthening local governance and organisation.

This concept understandably changes according to the strata of each Indigenous identity attached to land and seascapes. However, what is clear is the one fundamental that aligns all. Most Indigenous adaption principles are embedded in local knowledge, sustainable livelihoods and community-based innovation (Nakashima et al. 2012). These principles have value in both the components of initial design of the urban landscape and in the design of community governance objectives, ideologies and policies. These applications are in line with the notions of different ways of knowing, thinking and being. Essentially, it would be a construct of providing a framework for mental models and thought design process, along with the governance frameworks for the formation of producing solutions to the uncertainty of future challenges in climate change and human adaptation mechanisms.

Effective adaptation planning requires access to the best available knowledge, whatever its source. In the face of climate change, where risks and impacts remain uncertain and unpredictable, there is a growing need for policies and action that foster the co-production of new knowledge sets based upon collaborative efforts involving community-based knowledge holders and natural and social scientists. (Nakashima et al. 2012).

Co-management regimes that bring Indigenous communities and the government together to jointly manage the environment and its natural resources have provided an important arena for the development of knowledge co-production (Freeman and Carbyn 1988; Berkes 1993).

Indigenous peoples have long and multi-generational histories of interaction with our environments that include coping with environmental uncertainty, variability and change. As previously mentioned, we have demonstrated our resourcefulness and response capacity in the face of adaptation, resilience and global climate change. Resilience in the face of change is rooted in Indigenous knowledge and know-how, diversified resources and livelihoods, social institutions and networks and cultural values and attitudes (Nakashima et al. 2012). The capability and functional dimensions of Indigenous

knowledge as applied to sustainability models has yet to be completely explored. This could be attributed to archaic mindsets, reluctance or the inability to fully engage Indigenous people in the application and analysis of sustainability or apprehension about a framework that could change or threaten capital gain. As indicated by Byg and Salick (2009:157), 'until recently, local knowledge of climate change and its impacts has largely been ignored by most climate change studies'.

The viability and practicability of incorporating various options of Indigenous knowledge, viewpoints, beliefs and philosophies, coping strategies and traditional technologies has value and capability. These are benefits that fit and render the emerging role of adaptation planning. The missing part is the understanding from western economy and industry design ideology of how these components can strengthen communities' resilience in the face of environmental fluctuations or human-induced climatic change. The capacity and facilitation of the processes must be inclusive of Indigenous philosophies with our integral involvement. Despite being labeled the Traditional Owners and knowledge holders, our mandate and cultural authority falls short in many planning and governance structures.

One could argue that the intelligence in the Indigenous mind frame in sustaining natural capital allowed rapid evolution of land administration and resource allocation leading to industrialisation on a global scale. Just how exactly does that occur? Thanks to mindful and logical management systems, the land and seas were immensely abundant in every resource.

The primary rationale and principle of the industrial revolution transformation was productivity. This industrial revolution opened up the advancement of machinery that would capitalise on dispossessing Indigenous people of land and resources on every continent throughout the world. This industrial revolution took place during a period when many Indigenous people were still being invaded, fighting incursion or saturated in racist and colonist treatment.

The two liable dominant invading Euro-American empires of the 18th, 19th and 20th centuries, the British, French Dutch and American, have now progressed to be among the most dominant and productive economies globally. The incursion of dispossession allowed the western mentality of ownership to thrive. It also included a set of values and relationships to land and ownership that every utopian dreamer wanted. It provided opportunity for the dominant cultures to thrive, to reward their hard work and dedication to the operations of colonist land administration and capitalist domination. This capitalist philosophy that much of society has accepted, enhanced or strived toward has its place

in human-centric ideology, which puts humans above and in control of all other living things in the natural world, including the atmosphere, biosphere and cryosphere. Central to this belief is the notion of private property, the fortification of the colonists' land administration systems of surveying, legislating, subdividing, partitioning and portioning what once was sacred Indigenous lands.

The basic reason that societies manage land is to satisfy human needs (World Commission on Environment and Development 1987). Having a secure home, or even a secure place to sleep or work, satisfies fundamental necessities of life, just as guaranteeing a harvest to the sower of grain delivers food security (Williamson et al. 2010). These sociological aspects influence how people build systems to organise their unique approaches and capital influences. This system of sociological capital has been dominated by western concepts and land ideologies in the Pacific for the past two centuries. These land administration models are constructed from and influenced by colonialism to spatialise oppression (Porter et al. 2017). The manifestation of economic wealth in many continents also left the earth's caretakers behind, excluding Indigenous people, their culture and their knowledge for egocentric, economic greed-based industrialism that is now destroying the planet.

In just our corner of the earth, Australia's ecological footprint is 6.9 global hectares per person (Global Footprint Network 2018). Its deemed to be approximately 5.5 times greater than the sustainable level. This means that if everybody on the planet lived like the average Australian, we would need 5.5 planets to support us (ibid.). This estimate was five years ago.

Australia has one of the largest footprints in the world. Facilitated by a generation of people living in the awe of electricity and addicted to fossil fuels, in 2014–15 non-renewable energy shares were at 86.3 per cent compared with renewables at 13.7 per cent (Australian Government Department of the Environment and Energy 2016). The great Australian fixation with farming hooved animals contributes to the large ecological footprint and the amount of land required for crops and grazing, another continuing nostalgic residue from colonisation. The following diagrams illustrate the concept of Earth overshoot time periods from 1969 to 2018. The second shows country overshoot days in 2018.

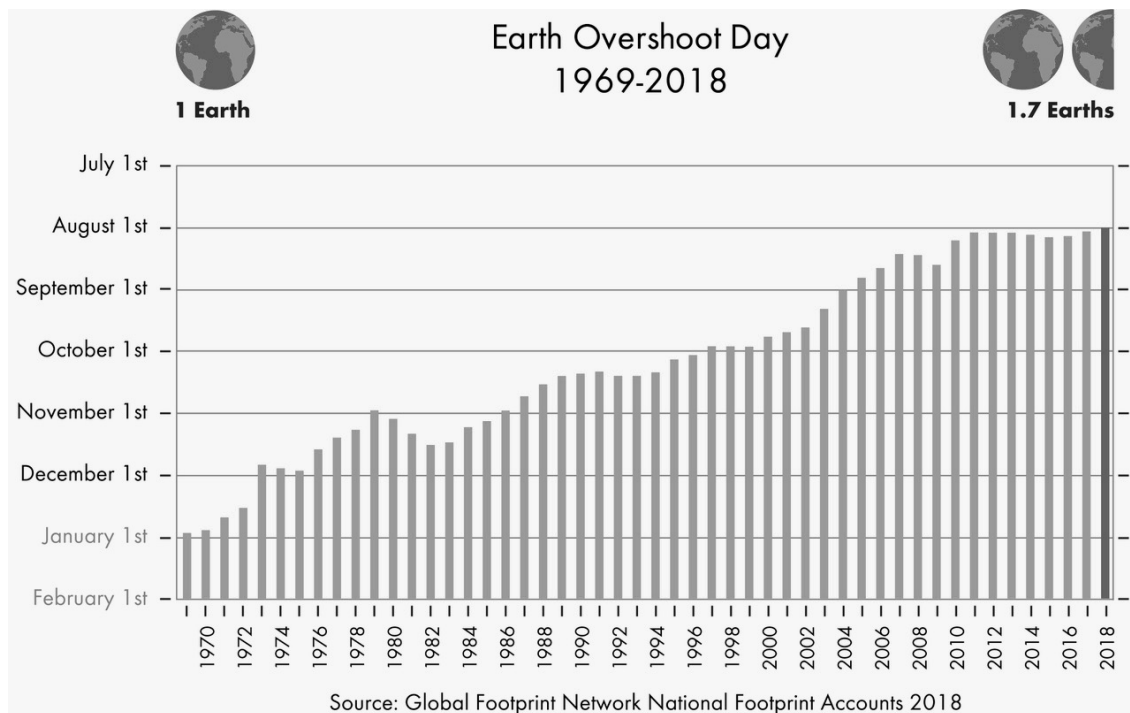


Figure 64: Earth overshoot day 1969–2018. Source: Global Footprint Network 2018.

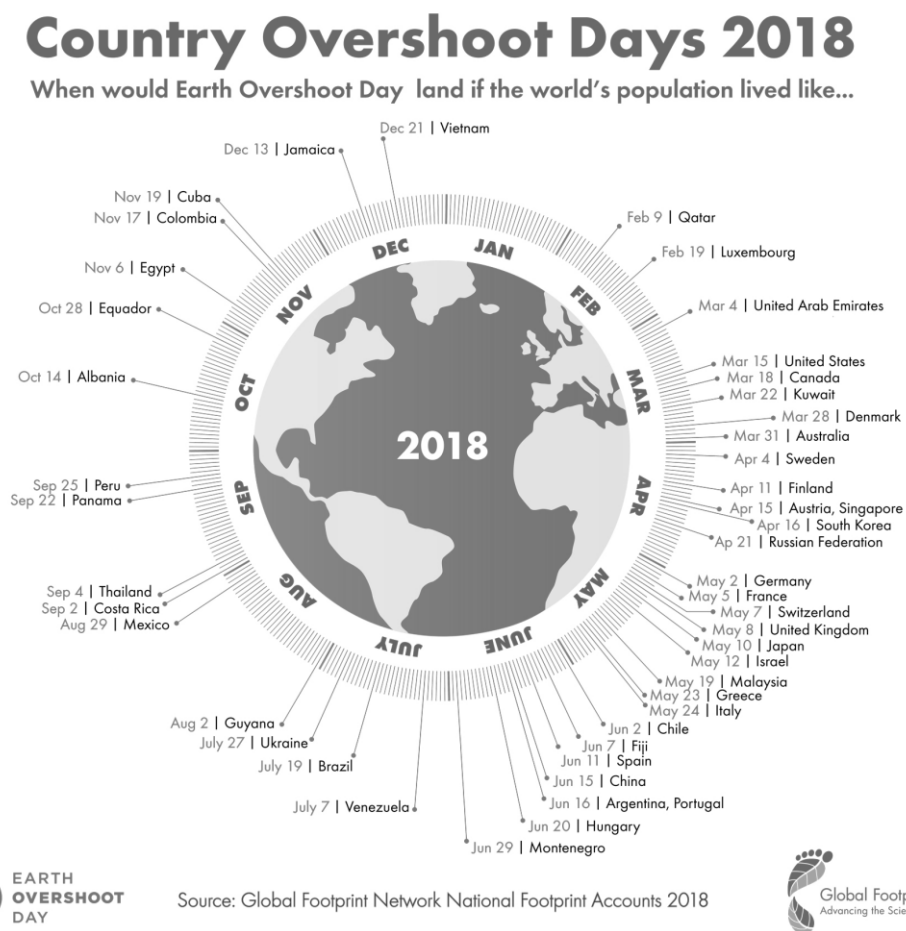


Figure 65: Country overshoot days 2018. Source: Global Footprint Network 2018.

These diagrams illustrate the fact that nearly every country has overshoot its resources. Heavily unbalanced governmental policies based on degenerative, indiscriminate resource use and prevailing economically driven societies are impeding future innovation and adaptive capacity. This fast stolen car mentality can have negative effects on adaptive capacity. By removing options and reducing choices, government and government policies constrain, restrict and undermine community efforts to adapt. In particular, removing the fundamentals of life necessities such as water, atmosphere and climate completely oppresses the functionality of advanced evolution. At present, major utilities (energy, water, sanitation) and associated services, food supply, food production and public infrastructure are highly dependent on either government legislation and policy (along with ideology), the global economy or private companies.

Over the last decade, a number of studies have emerged that illustrate the value of Indigenous knowledge to complement or add value to scientific climate data (King et al. 2008; Lefale 2010). It also provides culturally and locally appropriate solutions to community-based climate change adaptation strategies and planning (Berkes et al. 2000; McNamara and Westoby 2011); and is fundamental in monitoring local climatic and seasonal patterns (McNamara and Westoby 2011; Riedlinger and Berkes 2001).

A framework for new regenerative design that is inclusive of Indigenous people and our philosophies and viewpoints can only produce another alternative to the detrimental path we are currently traveling down. Collaboration between Indigenous knowledge holders, Indigenous cultural ecologists, design, engineers, financiers and industry is generating new co-produced and progressive mainstream strategies that are fabricating a new form of Indigenous-led regenerative design for effective adaptation action on the ground in how we think, live and move in our home space and society.

As unconventional as it may sound, the concept evolves from a viewpoint and frame of mind that together form an ideology of land as a living entity. It encompasses all living biotic and abiotic components, including the cultural integrity of the site. It asks, who is this place, what is its history, how has it been treated, has it already been given a meaning, what is this meaning and how can it be nurtured and cared for? This is somewhat uncommon place to start a development, but we are talking about new adaptive mindsets. No matter how you approach the analysis, the basic fundamental is that the world needs better land and resource management through transformative and effective design and governance.

For many communities, however, there is a marked disconnect between public policies and traditional knowledge-based adaptation. At present, deliberations on policy responses to climate change are typically restricted to the national level. Also, national strategies developed and implemented by governmental agencies are often not conducive to Indigenous efforts to adapt to climate change. Indigenous people and our views and perspectives were excluded from the negotiations under the UN Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and, in many places, the discussions and policy development at national levels (Tebtebba Foundation 2008).

It would seem critical to differentiate between policy decisions that support and empower Indigenous peoples and those that may undermine their adaptive capacities by reinforcing their resilience. In other words, adaptation planning at local, national and international levels may be fruitfully directed at creating a policy environment that facilitates the fullest expression of Indigenous adaptive capacity in the face of climate change (Ford and Pearce 2010; Ford et al. 2007; Nyong et al. 2007).

Little work has been done to identify the different policy environments that might galvanise, or alternatively undermine, endogenous capacities for climate change adaptation (Adger et al. 2013. A review of the literature nevertheless identifies some key policy domains that impact community-level adaptive capacity, including sustaining biological and cultural diversity; maintaining territorial integrity and mobility; and enhancing the transmission of Indigenous knowledge and practices (Nakashima et al. 2012).

Crop and herd diversity, landscape diversity, linguistic diversity and diversity of livelihoods are all components of cultural and biological diversity. These elements are socially and culturally created and maintained and contribute significantly to community resilience in the face of environmental variation and change. In many cases, however, external pressures, including development impacts, external agricultural policies, forced migration and market economics, are leading to the loss of traditional knowledge, the fragmentation of communities and, consequently, the loss of valuable adaptive capacity (Nakashima et al. 2012).

For many countries, alleviating poverty, furthering economic development and managing population growth, intensive agriculture and rapidly expanding cities with simultaneously shrinking resources poses pressing challenges on the notion of environmental sustainability. The intensifying and rapid responses required by local governments to fix or consolidate areas already being damaged or under

threat from environmental processes strengthens the ability for Indigenous people to participate in the production of planning documents and strategies. As many communities still have priorities in social and emotional objectives like housing and legal processes for regaining dispossessed lands, the protection and enhancement of traditional ways of life and responsibilities to one's country or homeland also intensifies this situation.

Chapter 12: Cultural Summary and Conclusions

Indigenous people's knowledge traditionally uses oral transmission. This oral transmission takes many forms, from explanations in song, movement in dance and philosophical fundamentals in creation stories of explorations and quests undertaken by creators and kin.

Due to the different forms of genocides, displacement and dispossession many Indigenous cultures have endured at the hands of avaricious western cultures, this knowledge and its transfer was forbidden in many places. Over time, this knowledge has become less visible in the glare of contemporary European culture (Whaanga and Matamua 2016).

Fortunately, the resilience and strength of Indigenous people and their insight into the importance of retaining and transmitting knowledge as part of culture has overcome these oppressive initial encounters and tactics of western intruders. With this there has been an urgent appeal to support the preservation of Indigenous knowledge. The fear associated with low life expectancy and the passing of Elders and knowledge holders is that it will ultimately also be the death of orally based knowledge, unable to be retrieved. This has also prompted the establishment of knowledge management systems, which include processes for intergenerational knowledge transfer. It is for these reasons that immediate injections of resources are required to facilitate cultural knowledge transfer and integration of these systems into societal operational change.

Australian terrestrial landscapes are defined by native ecosystems: eucalypt forests, woodlands, deserts, rainforests and grasslands. These were all positioned at some point along a catchment system that moves water through the landscape and into the sea. The majority are also constructs and consequences of thousands of years of Aboriginal land and resource management regimes. The marine ecosystems have been the nucleus and foundation for knowledge, spiritual understandings, sustenance and resource management. Like all fluctuations and modifications in natural systems, human-induced climate change is anticipated to alter abundance, diversity and distribution of species and ecosystems.

Human-induced climate change imposes threat and impact consequences on both terrestrial and marine ecosystems. There is inherently a flow-on effect that is expected to have direct effects on culturally important plant and animal species for Indigenous communities and our cultural sustenance health, access and utilisation. These changes also include physical changes in landscapes, especially on coastlines. Changes in ocean temperatures and acidity affect the distribution and abundance of

culturally important food sources like fish and shellfish. Warmer temperatures, frequent drought events and hot dry summers are likely to feature more intense fire incidences and are expected to pose threats to not only cultural species but to traditional country and the people living on country. These components of change combined cause species loss and shifts in species ranges, distribution and densities, which in turn threatens culturally significant and important species, medicinal plants, traditional foods, cultural economics and cultural traditional systems.

It will now be impossible to stop many species becoming extinct, along with the climatic and biological transformation of the environment. The additional impacts and pressures on our environment and the flow of cycles leave consequential decisions of what change is acceptable and what we want to maintain. This is a discussion and decision that needs the input and participation of Indigenous peoples as part of being present and integrated into redesigning our future. As these decision structures emerge, the impacts will be different for each language group and cultural species. The logical approach would be to minimise loss and provide holistic protection to cultural habitats. Cultural conservation will then have a number of objectives pertaining to each cultural area and landscape, which would potentially include the following:

- Protecting species, especially those that provide ecosystem functions and cycles to traditional food production.
- Facilitating the monitoring of natural changes in species and ecosystems on country by incorporating Indigenous people's knowledge.
- Adapting and facilitating cultural mechanisms for species movement and environmental change.
- More intensive management of invasive species.
- Identifying and assisting cultural species to respond and adapt to changing conditions.
- Resourcing and facilitating cultural adaptation.
- Establishing a process of cultural trade and exchange of traditional foods and materials, i.e. some species will thrive and increase in numbers, some will establish new areas as the climate and conditions become favourable and some will decline or become non-existent

Sustenance collection is an important educational tool for teaching younger generations law through the expression of knowledge and reinforcement of spiritual beliefs (Collins 1996). Caughley et al. (1996) suggest that without collective food gathering, social networks would be disrupted. To this day, the gathering of marine resources is a social event. I have witnessed many conversations and

discussions on whether resources are 'right' to eat, and the excitement of when a favourite food is 'coming into season'. The arrangements of meeting up to gather or fish is a perfect example of kinship and social interaction based on cultural values. These processes are a part of culture and are significant in the sustenance of resource teaching. However, this form of knowledge exchange and intergenerational teaching requires access to the resource. To practice culture, one needs access to the resource to enable continuation of the knowledge.

The application of traditional knowledge or Indigenous ecological knowledge systems (IEKS) in a modern context has been amalgamated into or applied in the context of scientific research, Indigenous knowledge preservation, intergenerational knowledge transfer and the enhancement of continuing cultural practice. The use of IEKS has the potential to extend further and into new realms of integrated design in the application of architecture, urban design, land use planning and local capacity building by means of building local knowledge and strengthening local governance and organisation with the re-education of Indigenous concepts of sustainability for future resilience.

As most Indigenous adaption principles are embedded in local knowledge, sustainable livelihoods and community-based innovation (Nakashima et al. 2012), these principles have value in both the components of initial design of the urban landscape and in the design of community governance objectives, ideologies and policies. These applications are in line with the notions of different ways of knowing, thinking and being. Essentially, it would be a construct providing a framework for mental models and thought design process, along with the governance frameworks for the formation of producing solutions to the uncertainty of future challenges in climate change and human adaptation mechanisms.

Over the last two centuries, the value and application of Aboriginal ecological knowledge (AEK) has been accepted and consequently fused into western lifestyles without too much controversy. When the holistic-ness of AEK is deconstructed, and values are isolated into separate elements, such as knowledge pertaining to medicinal properties of many native plants (such as antiseptics eucalyptus, tea tree, lemon myrtle, manuka, etc.), or in the case of the application of fire and land ecosystem management (CSIRO 2006; CSIRO 2016), it is evident that the knowledge has immediate value. Resistance and questioning of relativity and worth is more so when the holistic application of AEK is applied. In particular, links with Aboriginal customary livelihoods, culture and spirituality are key components of Indigenous knowledge and emphasise the holistic nature of Aboriginal natural resource management, which is essentially developed and adapted management regimes within a

worldview that stresses respect for natural resources (Aikenhead and Ogawa 2007; Gadgil et al. 1993) through spiritual attachment to the resource.

This application of holistic Indigenous management contrasts with models built on western ideology in both science and culture, where science tends to focus on reductionist explanations and is accompanied by a worldview that isolates and separates humans from and above the natural world (ibid.). Folke et al. (2003) and Gadgil et al. (1993) see reductionism as the aid in manipulating and understanding simpler systems, but it is argued that it is less effective for managing complex social-ecological systems. This paradigm of social-ecological systems and processes relates to concepts of sustainable living and social-ecological resilience, which continue to emerge in natural resource management (Folke et al. 2003; International Union for Conservation of Nature 2006). These social-ecological concepts contain some attempt at holistic attributes, though these models are still in simple development and application (Barrett and Wuetherick 2012).

Aboriginal ecological knowledge is inherently linked and connected to land and sea tenure. The origins and continuum of knowledge is embedded in tradition and cultural behaviour where many paths or song lines travelled by ancestral beings encrypt environmental knowledge (Baker 1993; Newsome 1980). The embedded knowledge is in its attachment to place. As with Aboriginal livelihoods, it will always be strongly connected to land and resource tenure, which in turn is intrinsically linked with environmental knowledge of country through the agency of mythology (Barrett and Wuetherick 2012).

Effective adaptation planning requires access to the best available knowledge, whatever its source. In the face of climate change, where risks and impacts remain uncertain and unpredictable, there is a growing need for an expansion of ideology that directs policies and actions that in turn foster the co-production of new knowledge sets based upon collaborative efforts involving community-based knowledge holders, an understanding of the cultural worldviews and natural and social scientists (Nakashima et al. 2012).

From an Indigenous perspective, the climate change space and discussion is currently highly dominated by western science and politics. Unfortunately, the progress in understanding Indigenous culture and cultural needs has not advanced to a point where social-ecological knowledge and primacy in ontological theory or rational has been injected into the debate. One prime example is the use of traditional seasonal cycles and cultural calendars. The movement away from the Northern Hemisphere's four-season calendar and cycle may assist in adaptation. Its replacement with Aboriginal

calendars would be better suited to understand the fluctuations and changes in climatic cycles and associated changes to plant and animal variations and adaptations. It also is an environmental monitoring device. By acknowledging the seasonal variations of Southern Hemisphere, Indigenous interpretations of weather, climate and species observations, it provides a deeper understanding of seasonal climatic changes and is better suited over the Northern Hemisphere's four-season variation.

Changes to knowledge and understanding require participation in practice and observation of transformation, essential components to Indigenous knowledge systems when applied to cultural landscape connection and continuation. The issues of climate change, national adaptations and resource management need to have a space to consider and discuss the impacts to cultural identity and the integrity of cultural landscapes for Indigenous people of the Pacific.

The understanding and consideration of seasonal cycles, species biology, astronomy and ocean has influenced people, cultures, society, science, religions and the evolution of all peoples. These dynamics are interwoven into Indigenous language, belief systems, the environment, governance, administration and reflective culture. These attributes play a vital role in everyday life that is reflective of cultural landscapes and seascapes. The cultural landscapes and seascapes in turn are the result of and provide the focus for ancestral events together with Indigenous peoples' social, political and religious systems. Lands, ocean, atmosphere and species are interwoven into a tightly integrated cultural system. This integrated cultural system forms the basis for Indigenous knowledge.

I have undertaken spatial analysis and mapping of cultural knowledge as it relates to species and habitats in marine protected area as part of my Master of Science in marine science and management. I have found now, in undertaking a PhD on Indigenous knowledge as it relates to seasonal cycles, atmospheres, ocean, species and people, that one of the key fundamentals in 'using', 'having', 'finding' or 'inserting' a place for Indigenous knowledge is the fact that this Indigenous cultural environmental knowledge system needs a place itself. I make this statement in comparison to western science, which for centuries has had its place in factual accounts and formulated methodology and is used as the basis in many decision-making processes both locally and globally. The methodology of Indigenous knowledge systems is crucial in supporting the process of participatory development between Indigenous ideology and science. The methodology or framework of how Indigenous knowledge systems are managed by community, family or individuals is crucial in supporting the process of participatory development between Indigenous local knowledge (ILK), decision-making processes and western science.

I read and interpreted many 'scientific' papers on the amalgamation and blending of ILK, TEK, IEK with western science, the integration of ILK, TEK, IEK with western science, and even the compartmentalising of ILK and what components can be utilised to 'assist' western science. All enquires were quite valid in time and place, but with the intent of finding a place where traditional knowledge sits as either integrated into western science, has components blended with western science or has components used by western science. Many papers and documents also attempted to justify ILK's role and place alongside western science. The lightbulb moment for science in discovering traditional knowledges derives from western scientists looking for holistic methods in conservation and sustaining both ecosystem services and biodiversity.

The inherent problem is the differences between ILK and western science. The history of western science as we know it today stems from a long chronicle of beliefs, idolism, religious domination, revolt and purism. These factors shaped and built what scientific theory and ideology is today. This history had roots embedded in extremist thought processes, in religion, primarily Christianity, and then the extreme scale opposite in purest notions of scientific theory. The extreme contrast of this evolution somewhat eliminated the human element of participation and a component of this formula. The numerous studies and observations of Indigenous societies in space and time have revealed knowledge and norms that have foundations in ecologically sustainable relationships between the individual, the collective and the natural world. Nabhan (1997) and Gadgil and Berkes (1991) evaluate several traditional cultural practices that sustain biodiversity, species and ecosystems but also grow and build social capital, allowing Indigenous cultures to thrive.

Western ecological science indicates knowledge regarding environmental, natural or biological interactions and functions, including spatial variability, seasonal ecological cycles, biology of species, migrations and fluctuations. Each scientific variable operates in isolation from each other as do the different types of scientific studies. Western science fails to pick up the holistic nature of cultural knowledge in the context of atmospheric, cosmological, climatic or seasonality. Its interpretations constitute only a percentage of the awareness, understanding and comprehension of essential intelligence needed for resource management, utilisation, adaptability and cultural sustenance. This knowledge has its forms embedded in foundations of kinship, religious belief systems and rituals and is entrenched in the psychology of existence (being). It then influences principles in culture (knowing).

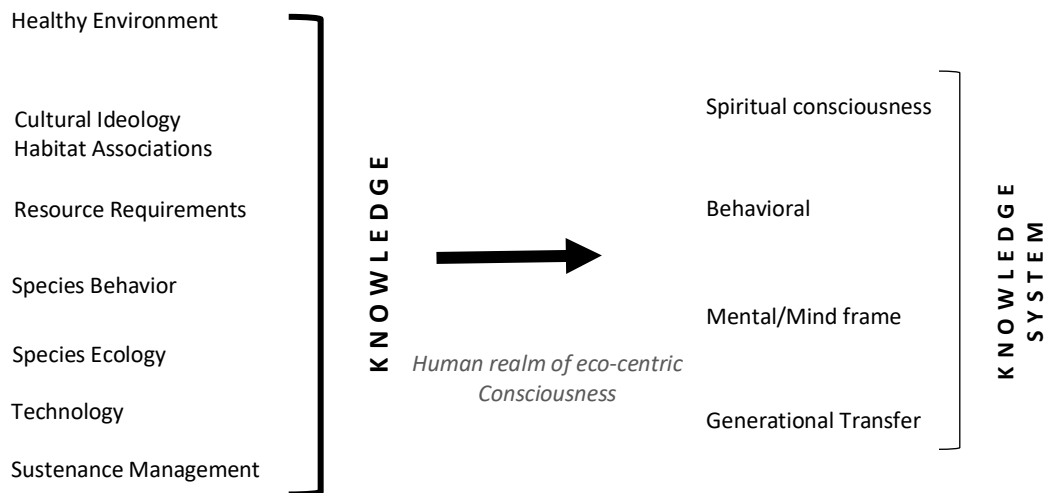


Figure 66: Principles in Indigenous knowledge systems and governance. Source: C. Marshall 2018.

Both have evolved over time to become legitimate and competent in presenting explanations and reasons for ecological and environmental features. The two are variable in their meaning and in their foundations and origins. Western science also inherently has self-regulated privilege mechanisms to review and critique the intellectual achievements of its members according to a rigidly defined set of institutions (Johnson 1992). This also is mentioned by Nakashima et al. 2012), who notes that university degrees, journal publications and conference presentations are the milestones that mark the narrow ‘path to knowledge’. Guided by these inflexible norms, environmental scientists reject the knowledge systems of Indigenous peoples as anecdotal, nonquantitative and a-methodical (ibid.). One crucial observation from Nakashima et al. (ibid.) and Wolfe et al. (1992) is the acknowledgement that even among those scientists who do acknowledge the existence of Indigenous knowledge, they generally apply scientific categories and methods to collect, verify and validate it.

What both methods are doing is environmental monitoring, which can be conducted for a number of purposes, including to establish environmental ‘baselines, trends and cumulative effects’ (Mitchell 2002:318), to test environmental modelling processes, to educate the public about environmental conditions, to inform policy design and decision-making, to ensure compliance with environmental regulations, to assess the effects of anthropogenic influences or to conduct an inventory of natural resources (Mitchell 2002). Environmental monitoring programs can vary significantly in the scale of their spatial and temporal scales, though to date ‘monitoring tends to inherently be conducted under a rigorous application of the scientific method’ (Artiola et al. 2004)

In looking at the origin of 'western science', including ethics and method of the origin, where the question, hypothesis or prediction leads to the conducting of the experiment or observation, then the analysis of the experiment and data with conclusions drawn, the hypothesis and testing and then the scientific theory, the function of this process has led to this 'science' not moving or changing for centuries and being quite linear in its function. This is opposed to most IK systems, which are, particularly when dealing with species and environment, cyclic and based on observation throughout time and space. In many instances, they amalgamated into cultural practice and teaching. The ethics and principles applied to Indigenous theory and environmental observation (ITEO) are also epistemology and habitat-based.

Many scholars emphasise the practical and ethical importance of retaining and applying Indigenous ecological knowledge. The International Union for Conservation of Nature and Natural Resources (IUCN) Program on Traditional Knowledge for Conservation (IUCN 1986) summarises five practical and tangible benefits of TEK:

- May be useful for new biological and ecological insights.
- Resource management, in particular rules and rote procedures, are often just as good as western scientific prescriptions.
- Protected areas and conservation education.
- In development planning where traditional knowledge can provide more realistic evaluations of environment, natural resources and production systems.
- Environmental assessment. Those dependant on local resources for livelihood are in better positions to assess true costs and benefits of development.

I feel that if the origin and application of ITEO, which leads to IK, is not given a place or as a 'recognised entity' in a toolbox of monitoring applications, it will always be an add on or novelty for western science and scientists. It will also always be deconstructed, compartmentalised and used without its complete, holistic philosophy. This, in reality, poses obstacles at the institutional and policy levels when applying its validity. There is no doubt that IK contributions to conservation and the sustainable use of biodiversity have benefited the ideologies and perspectives of both Indigenous and non-Indigenous peoples. Acknowledgement of 'another science' flowing onto species, habitats, ecosystems and interactive biosphere dynamics, management and conservation based on environmental-human connectivity or eco-centric mindset has a place in resilience and adaptation to human-induced climate change.

Given the influences in principles of Indigenous knowledge systems, there are more spaces and structures that this could be applied to to achieve real sustainable outcomes. There is an increasing awareness, indicated in the Convention on Biological Diversity (CBD) of the critical need for IK to achieve environmental sustainability. Indigenous ways of knowing are holistic, acknowledging the 'interconnectedness of physical, mental, emotional and spiritual aspects of individuals with all living things and with Earth, the star world, and the universe' (Lavallee 2009). It is an ideology of how to really live sustainably that encompasses every facet of existing. Conventionally framed resource management approaches are able to contend with factual observations, past and current land uses and some traditional land management systems, however they do not effectively grapple with issues of cosmology (Houde 2007). The theory of ideology states that the ideas and beliefs people have are systematically related to their actual and material conditions of existence (Wolff 1981). In the traditional Marxist account, ideology has purely economic cause (Cormack 1992). Cormack (ibid.) reiterates that ideology is a process that links socio-economic reality to individual consciousness. It establishes a conceptual framework, which results in specific uses of mental concepts and gives rise to our ideas of ourselves, where the structure of our thinking about the social world, about ourselves and our role within that world is ultimately related by ideology to socio-economic conditions (ibid.). Where a particular ideology is caused by a particular socio-economic system and the function of the ideology is the perpetuation of this system, this social system or structure gives rise to particular ways of thinking.

Western societies have a deep history embedded in cultures based on imperialism (Bowden 2014; Patnaik and Prabhat 2016). With this, there seems to be an obsession with conquering other people's landscapes and associated cultures. Western science is a construct of this one-dimensional society. The notion of sustainability is also a construct from this science. As mentioned in earlier chapters, there is criticism and explanation as to why sustainability derived from western ideology is flawed (Howes 3 April 2017). It has not achieved its original intentions effectively. In time, western science will eventually catch up with Indigenous science. It has had a taste and a glimpse of alternative thinking through consciousness and awareness. Indigenous people have always made clear our intention of sustaining the planet and have been open to western science and people to learn the associated fundamentals of existence in a holistic worldview. Indigenous people have had the insight to the principles of sustainable systems for thousands of years. We have also already shown initiatives and willingness to provide guidance on how IKS is applied. It is with a deep sigh of dejected reality that I admit the thought of those with a western mind frame and the social construct of western society implementing this ideological change in a less effective manner may be the only way of achieving this transition in my lifetime. We currently exist in a dominant paradigm where we find rightness in short-

term thinking, compromise in short-term gain and solutions in band-aid methodologies. As humans with the inability to accept and execute change in a closed technological society (Marcuse 1964), I cannot help but wonder if the resistance to let go of these privileged, comfortable positions is because everything else seems primitive, romantic or too big of a change in socio-political engineering. Knowledges and systems that engage in sharing and true sustainability as a foundational construct would be a very compromising move for a society that prides itself on the industrialism of productivity imposed by the interests of capital and private profit (ibid.).

Cultural ideology as it applies to ecology is the science of interactions among the five spheres of the earth's systems. Organisms do not live in isolation but as functioning communities that are inseparable from the environment. These environment–community complexes are ecosystems that range in size from minute algal cells in water to the universe itself. Humans are an integral part of natural ecosystems and the earth's ecosystem as a whole. Modern human activities have modified and exceeded the balance of these cycles, creating human-induced systems or artificial processes. This human-centric process has placed humans as dominate forces in these complex systems operations. Knowing that this ecological system has limitations and interconnectivity, we continue to exceed them with an egocentric drive that leading to the disappearance and breakdown of these sensitive systems (Armitage et al. 2012; Bruno et al. 2016.) It is now more than ever time for that paradigm shift.

12.1 *Giingan.gundi maangun bindaala: Juungamala ngiyambaygu*

Giingan.gundi maangun bindaala: Juungamala ngiyambaygu

(Let's Build a Law/Lore Belonging to Peace: Let's Set Things Right, For All of Us)

This original story was told to me and my cousins as children. This story was conveyed by my grandmother's brother Uncle Harry Buchanan and reprinted by the Muurrabay Language Centre in 2015. It is the story of Guruja (the whale), the Dungirr gagu (koala brothers) and Baligin (the quoll). It is a continuing epic second component to the Making of the Sea, a five-part series. This story is interpreted and written with my kin sister Shar Smith (2019).

It was an act of violence against the sacredness of life and country that resulted in the two Goanna Sisters making the sea. The land became flooded and the people who were far out on the ocean fishing became cut off from their homeland. They took refuge on a hilltop and asked the Koala Brothers if they

could use their intestines to make a bridge back to their homeland. All the people were on the bridge making their way back when the mischievous Baligin (eastern quoll) filled them with fear by making the waves bigger and threatening to chop down the bridge. He continued his mischief by calling in the huge sea creature, Guruja, the whale. However, Guruja could see the people were afraid and reassured them he was there to help them. Guruja carried in his huge heart much love and respect for all life, for life is sacred. He started singing and his song went straight into the hearts of the people so they were then filled with the same love and respect. The people felt strong, relaxed, encouraged and continued on their way to their drastically changed jagun (landscape). They knew they would need to listen to Bari (country) to hear the new songs and to see the new dances. They would have new responsibilities and new relationships. They would need to make new agreements to be part of the continuation in the sacredness and holisticness of all life, to build again the law belonging to place and peace.

The previous story the Making of Gaagal (The Sea) has two main female characters, the Goanna Sisters, they are responsible for making the ocean, the coastline and the north and south winds. They now sit in the sky as part of the Seven Sisters star constellation (the Pleiades). They remind us of the role females have in maintaining ocean lore and ceremony and the reasons women have integrated and integral roles in the management of marine environments and the protection and associated responsibilities of looking after our Gumbaynggirr totem, the ocean. They also remind us of climate change. The other components of the story tell of the last sea level rise, the intensity of storms and the changes of the land and seascape. It reminds and warns us of the fear and hysteria that could happen. It tells us of the whales that started their migrations up the east coast and the love and happiness they brought with them as they still do today. This story is a reminder, a warning and a solution to the consequences of climate change and sea level rise. I must stay optimistic that change will come and Indigenous peoples will become equal in decision-making processes and the future direction of our Pacific countries in the challenges and consequences of environmental change.

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Appendix 1

Information Sheet

Customary Environmental Knowledge, Climate Change in the Pacific and Connections of Atmosphere, Oceans, Species and People

Dear

I would like you to consider participating in my research study for a PhD degree. Participation would involve yarning with me about climate change, intergenerational knowledge transfer and views about issues affecting our oceans and people today.

The purpose of this study is to highlight the extent of ecological knowledge and potential similarities in cultural knowledge practices, examining the monitoring methods used in environmental observation and detailing the sustainability, utilisation and application of cultural environmental knowledge and intergenerational transfer

Participation is voluntary and you can withdraw from the study at any time without providing a reason.

Our talks/yarns will be recorded on a tape recorder and the stories written up. You will be given an opportunity to check the written stories are accurate and before your contribution is published in the thesis.

Your contribution will assist in the rewriting of Indigenous knowledges in the Pacific

Please contact me if you have any further questions on 0434744513 or email H20critter@gmail.com

Yours sincerely,

Chels Marshall

Appendix 2

Consent Form

Customary Environmental Knowledge, Climate Change in the Pacific and Connections of Atmosphere, Oceans, Species and People

I.....have read the Information Sheet regarding my participation in the above Research Project. I fully understand what my involvement in this research will be and I am willing to participate in this Research Project.

I understand that I may withdraw from the research at any time, without providing any explanation.

.....(Participant's signature)

..... (Date)