Review of Aboriginal Night-sky Conceptions, a Western Australian Focus

Patricia Forster
17 The Promenade, Mount Pleasant, Western Australia 6153, Australia
Email: pat.forster@iinet.net.au

Submitted for review 10/03/2020, without images, to Journal of Astronomical History and Heritage

Abstract: This review of night-sky conceptions brings together accounts from widely dispersed places in Western Australia, from Noongar language groups in the south-west, through to groups in the Eastern Goldfields, the Pilbara, the Kimberley and the Central Deserts. Some references have appeared in theses and published papers. Others have been drawn from artist statements of paintings by Western Australian Aboriginal peoples and from other non-conventional sources. The intention for the review is that the scope is traditional, pre-European settlement understandings, but post-settlement records of oral accounts, and later articulation by Aboriginal peoples, are necessarily relied upon. In large part, the Western Australian accounts reflect understandings reported for other states, for example star maps were used for teaching routes on the ground, but there doesn’t seem to be conclusive documentation of star maps being used in real-time navigation. The narratives or Dreamings that have been uncovered differ most from those of other states: narratives which explain creation of night-sky objects and landforms on Earth, events such as lightening; and other narratives which are about socially acceptable or unacceptable behaviour.

Keywords: night-sky conceptions, cultural astronomy, Aboriginal Australians, Western Australia, review

Warning: Readers are respectfully advised that this review contains names of people who are deceased.

1 INTRODUCTION

1.1 The review and motivation for it

This review is the result of an extensive internet-based search for accounts about traditional night-sky conceptions held by Aboriginal peoples whose ‘country’ is completely, or partly, in Western Australia (WA). The search for night sky information was initially to support two art projects, then gained momentum when a key document in the field, ‘Dawes Review 5: Australian Aboriginal Astronomy and Navigation’ (Norris, 2016), which is national in scope, offered many references for the eastern states and the Northern Territory, but few for Western Australia. In correspondence, Ray Norris agreed with my view; and observed that the area, night sky conceptions from WA, is ripe for research (email, 10 August 2018). A year later, I sent Ray a compilation, and he encouraged publication (email, 5 August 2019).

1.2 Limitations of the review

This review represents values of an outsider, that is a non-Aboriginal person, in regards to selection of what has been included. A second aspect is that my internet-based search was largely restricted to freely-accessible accounts, and did not include publications that required special access. I mention also that I have no formal qualifications in the field of Aboriginal astronomy, but do have research skills developed through my doctoral inquiry and sole investigator Australian Research Council Post Doctoral Fellowship.

Further, whether or not current accounts by Aboriginal people reveal knowledge which is free of European influence is a moot point; and narratives evolve over time, in the oral tradition and by different speakers, and sometimes take in contemporary conditions (Maranda, 1972). In particular, narratives reclaimed by Noongar Elders, after the cultural impact of several generations of stolen children, may differ from those told pre-European settlement.

Another contingency is that recorders and researchers may overlay their own world views when collecting and interpreting data. Peer-reviewed papers from academic journals versus non peer-reviewed works, and accepted theses, all of which are identifiable in the reference list, can be an indication of integrity. Some works have been referenced which are non-traditional for academic papers, for example, artist statements for paintings, and storybooks. They were selected on the basis that the authors are Aboriginal, are included to complement other sources of information, and are clearly identified for the critical reader. Justification for storybook references is they are part of the fabric of Aboriginal peoples’ perceptions; albeit that more layers of meaning are revealed to children as they grow in maturity and knowledge (Nannup in Robertson et al., 2016).

1.3 Review organisation and references

The order in which subjects are treated follows the order of Dawes Review 5 (Norris, 2016). The order was chosen so that interested readers could easily read this paper in conjunction the Dawe’s Review. The major headings are Aboriginal
numbers systems; Sun, Moon and eclipses; Stars and constellations; Planets; Comets, meteors, meteorites, craters; Magellanic Clouds; Stone arrangements; Aboriginal timkeeping and calendars; Direction, Songlines and navigation; and Rock art. The numbering of the sections and subsections differs from those of the Dawes Review because of the different scope of findings. Generally, each section starts with a brief summary of the content of references which Norris cites but the authors are not listed – this approach was taken to avoid unwieldy referencing and was based on the assumption that this review would be read in conjunction with the Dawes review.

More references were sourced for Noongar Country in the south-west than for other regions of WA, and they are generally presented first in each section of the review. The spelling of Noongar in the review varies – each version matches that in the papers from which the references were retrieved. Noongar Country is approximately triangular with boundaries from Geraldton down the west coast of WA, and east along the south coast to Esperance: Esperance to Geraldton is the third side of the triangle. Noongar Country has fourteen language groups. Other major groupings referred to, each with multiple language groups, are peoples of the Eastern Goldfields, the mid-west (Murchison and Gascoyne regions), north-west (the Pilbara), north (the Kimberley), and the Central Deserts. To locate the territories of all language groups in WA, the reader can view, online, the map by Tindale (1940) and a simpler version by the Australian Institute of Aboriginal and Torres Straight Islander Studies (1996). The reader is also directed to online resources when inclusion of pertinent quotes in this review might infringe copyright.

To judge what might be completely-Aboriginal versus European-influenced conceptions of the night sky, the reader needs to know that the first European settlement in WA was in Albany, King Georges Sound, on the south coast in 1826, followed by proclamation, in 1829, of the Swan River Colony which included Perth. Noongar vocabularies, mainly drawn from First People in and around Perth, and quoted here, were published early on by Lyon (1833), Grey (1840) and Moore (1842). Publication of diaries and journals written during early settlement was often delayed, for example, Moore (1884) and posthumously for Salvado (1977) who landed in Fremantle in 1846 and lived most years until 1900 in New Norcia, 130 km north of Perth. Ethel Hassell (1857-1933) settled on the south-east coast of Noongar country in 1878 and wrote sketches of her experiences with Wheelman Noongar people. Her journal, Hassell (n.d.), is drawn on in this review, rather than edited versions of it.

2 ABORIGINAL NUMBER SYSTEMS

Norris (2016) cites Blake’s (1981) claim that no Aboriginal language has a word for a number higher than four, and supplies cardinal numbers as counter evidence. Base five counting is common. Numbers in Moore’s (1842) Noongar vocabulary also reflect base-five form: the number words are linked linguistically to the words for Marhra, the hand, and Jiuna, the foot. A word for half is included:

“Gyn Adjective One.” (Moore: 47).
“Dombart Adjective Alone; one; single.” (Moore: 37).
“Gudgal Numeral; two.” (Moore: 42).
“Warh-rang Numeral; three.” (Moore: 101).
“Mardyn (Northern word) Three.” (Moore: 70).
“Murtden (King George Sound) Three.” (Moore: 80).
“Gudjalingudjalin Numeral; four.” (Moore: 42).
“Bang-ga Part of; half of anything.” (Moore: 6).
“Marh-jin-bang-ga Five; literally, half the hands.” (Moore: 70).
“Marh-jin-bang-ga-gudjir-gyn Six; literally, half the hands and one.” (Moore: 70).
“Marh-jin-bang-ga gudjir-Gudjal Seven.” (Moore: 70).
“Marh-jin-belli-belli-Gudjir-jina-bangga Fifteen; literally, the hand on either side, and half the feet.” (Moore: 70).

A number poster available through the Noongar Boodjar Language Cultural Organisation website, and in current use in Western Australian schools, offers complementary evidence for Moore’s (1842) record. Differences between the poster entries and the oral language recorded by Moore are mostly phonetic or involve simplification of compound words.

Traditionally, Noongar people might have had notional understanding of a quarter and three-quarters, because Moore (1842) lists words for phases of the moon: moon waxing - new moon, first quarter, half moon, second quarter, full moon; and moon waning - three quarters, half moon, and last quarter. In listing the words, Moore (1842: 73) included the proviso that “the meaning of several terms has not been distinctly ascertained.” Certainly, the word for half moon (moon waxing) “Bangal” (Moore: 53) is linked linguistically to the word Bang-ga, half of anything.

Moore’s (1842) vocabulary also has words for ordinal numbers and ordered things, for example:
“First Gorijat; Gwadjat; Gwytychangat.” (Moore: 133).
“Kardijit ... the second son, also the middle finger.” (Moore: 56).
“Kardang Younger brother; third son; also third finger.” (Moore: 56).
As well, the vocabulary has words for two or more objects including: ngalla for brother and sister or two friends. The name for the Seven Sisters varies between language groups but a (contemporary) Noongar name is Danakat (Walley, 2013).

Consistent with most other findings for Aboriginal number systems Australia-wide (Norris, 2016), there are no words in the Noongar vocabularies of Lyon (1833), Grey (1840) or Moore (1842) for higher numbers such as one hundred. However, there is a word for many or abundant: “Bula Abundant; many; much; plentiful.” (Moore: 15). Also, Moore (1884: 225) recorded the following: “To-day I find that a great sensation has been created in the colony by rumours which have come to us, only through the natives, of a vessel that was wrecked nearly six months ago (30 days journey, as they described it) to the North of this—which is conjectured to be about Sharks Bay.” It would be interesting to know how 30 was spoken or gestured.

3 SUN, MOON AND ECLIPSES

3.1 The Sun

Commonly, Aboriginal people across Australia view the Sun as a female spirit, carrying lighted wood (a torch) from east to west across the sky (Norris, 2016). Other narratives cast the woman as chasing or being chased by the Moon - or that the Sun was created by the throwing of an emu egg which broke and caused a fire (ibid).

Macintyre and Dobson’s (2017a) linguistic analysis of Noongar words fits the notion of lighted wood carried across the sky. They link Moore’s (1842) Whadjuk Noongar word biyrt for daylight with the word biyrtch for cone of a banksia, which women carried smouldering to act as a firelighter. Other Noongar words in Moore’s vocabulary that support the Sun-fire link are: Malyar, the ignited portion of a piece of burning wood; and Malyarak, mid-day. Also, about the trajectory, the Kukatja people, south-east Kimberley, hold that: “The sun (tjintu) is considered to be close to the earth at dawn and further away at sunset.” (Clarke, 2015: 30, quoting Piele, 1997).

Sunset, from Cape Leveque, West Kimberley, photo by Jim Forster, 28/06/2009

In four Western Australian narratives, the Sun is cast as the giver of life. In 1830, Mokare, a Minang Noongar leader (south coast) shared a creation narrative with Captain Collet Barker:

... he told me that a very long time ago the only person living was an old woman named Annegar ... who had a beard as large as the garden. She was delivered of a daughter & then died. The daughter called Moerang grew up in the course of time to be a woman, when she had several children ... who were the fathers & mothers of all the black people. (Macintyre and Dobson 2017a: webpage, quoting Barker, 1830).

Macintyre and Dobson conjecture that Annegar may be Arnga, a bearded Sun-woman, providing as evidence, Arn-ga, the beard a corruption of nan-ga (Grey, 1840), and Sun, Nganga (Moore, 1842).

Whadjuk/Balardong Noongar Professor Len Collard (1959 - ), University of Western Australia, recorded the narrative The Walitj the Eagle, Kulbardi the Magpie, Wardong the Crow and Djidi the Willy Wagtail, told to him, in the oral tradition, by his Aunty Janet Hayden:

When darkness came over the earth, they [the birds] had no way of bringing light back, and the sun wouldn’t come back. They had to send a bird and all the birds volunteered. ... They had to fly as high as they possibly could ... They found old Gnarnk ... They brought the sun back. They told her that without her the earth would die. She was the Giver, they called her the sun, the Giver of Life. (Collard, 2009: 14-15).
Josie Boyle (c.1943 - ), Wongai Elder, Eastern Goldfields, relates narratives handed down by her mother. Creation, in brief, was when: the creator (Jindoo the sun) sent two spirit men down from the Milky Way to shape the Earth. They made landforms and the oceans. Then Jindoo sent seven sisters, stars of the Milky Way, to beautify the Earth with flowers, trees, birds, animals and creepy things (Boyle, 2007).

Jakayu Biljabu (1937 - ) of the Martu people, East Pilbara, was born near Pitu, east of Well 25 on the Canning Stock Route and lived with her family longer than most before leaving the traditional life (Martumili Artists, n.d.). The statement for her painting Nyilangkurr Claypan n.d., a claypan which is close to Well 25, includes a Dreamtime narrative for the area. It involves the sun as life-giving. The narrative is not reproduced here for copyright reasons but can be read online on the Estrangin Gallery (n.d.) webpage for the painting.

3.2 The Moon

Norris (2016) cites many Aboriginal Dreaming narratives in which the Moon is identified with a man. The Moon/ man link is evident in several Western Australian accounts. Hassell (n.d.: 281) wrote of the Wheelman Noongar people (south-east coast WA): “The moon they say is different for he dies and comes to life, also he gets very fat and thin just before he dies.” Hassell also recorded a kangaroo and moon story. The friends of a boastful kangaroo started avoiding him, so he made friends with the moon. The moon also tired of his boasting and eventually bragged:

“I never die, I live for ever”. There upon the kangaroo said “That is foolish talk” he knew better than that, everything died. The moon declared it was quite true that he [the moon] never died, the kangaroo said things would change now, the moon should die for a short time then come to life again and it has been so ever since. (Hassell: 588-589).

Palmer (2016: 197) refers to Moobbil’s story in his anthropological report for a Native Title claim saying a story “from the Jerramungup area, and relating to a particular site, tells of an interchange between the Kangaroo and Moon, both now being represented in the features of a large granite dome.” Noongar Professor Kim Scott (1957- ), Curtin University, also writes of the Kangaroo and Moon (Scott, n.d.: 15). The setting is potentially the same large granite dome:

I told Clancy of how Kayang [auntie] Hazel made us stop the car at the edge of the bitumen road ... she crossed the wire fence and led us across the shifting soil to a rocky outcrop. She pointed, there: a series of neat circles in the rock that grew small, then larger again. ‘Yongar and Miak, she said, and told the old story of Kangaroo and Moon [very similar to the above] ... It is both a responsibility and a privilege to stand beside where that story is imprinted in stone, and hear its ancient utterance.

For Wongry [Wongai people, Eastern Goldfields?], “Kalu, a man terrified of the blackness of the night, became pale and round, so obsessed was he by his problem. He became the moon and rests on a boomerang on occasions.” (Johnson, 2014: 196, citing Brennan in Noonuccal, 1990). For Lunga people, East Kimberley, “Moon is a man who broke incest (kinship) laws causing death.” (Johnson 2014: 195, citing Kaberry, 1939). Renowned artists Rusty Peters (1935 - ) and Mabel Juli (1931 - ), Gija people, East Kimberley, have painted the same topic with small variations. For example: Theliny Theliny-Warriny, Two Mothers for the Moon, 2012, by Peters (Desert River Sea, n.d.); and Garnkeny Ngarranggarni, 2010, by Juli (Desert River Sea, n.d.). Jaru Elder Jack Jugarie (1927 -1999), East Kimberley, tells the narrative of the moon wanting to marry his cousin sister, who was inappropriate for him (Goldsmith, 2014). An old woman tried to redirect his interest but the marriage took place. No consequences were mentioned - Goldsmith suggests the narrative may not be complete.
Other moon narratives address different subjects. One relates to the cave Meekadarabee (the bathing place of the moon), south-west Noongar Country. A girl drowned herself in the cave after her lover was killed. When the moon is bright, you can see her hair reflected in the water. A fuller version of the narrative can be read online at South West Aboriginal Land and Sea Council (n.d.).

A creation narrative for Lake Coogee in Perth, related by an Aboriginal consultant during a land survey (McDonald et al., 1997), tells of a sparrow and a hawk that flew to a round hole in the earth where the moon rested during the day. The hole is near North Lake. The two birds stole fire from the moon in the form of a firestick. They flew along the limestone ridge near the ocean. The bush caught fire. The moon called his uncle, the ocean, to help. The ocean rose and extinguished the fire. Nyungars were drowned, and the lakes in the area were formed, including Lake Coogee.

Perth Aboriginal people called Dale’s Cave, located north-east of Perth on the bank of the Avon River, “Mountain of the Moon,” because they believe that the moon once entered that cavern, and left the print of her hand on its side.” (Armstrong, 1836: 789). Another version is that:

Legend has it that in the Dreamtime the moon was a man on the earth and some warriors chased him into this cave. He got tired of being confined there so he put his hand on the cave wall and using that leverage he burst out, making the jagged hole in the roof and escaped into the sky where he roams around still. (Shire of York, n.d.: 4).

Nora Nungabar (c1919 - 2016) of the Martu people, East Pilbara, was born and grew up in country that became Wells 33 – 38 of the Canning Stock Route (Martumili Artists, n.d.). Her painting, Kinyu n.d., depicts Kinyu (Well 35, Canning Stock Route). The statement for the painting (Estrangin Gallery, n.d.) describes the Dingo Dreaming for the area in which dingoes with puppies are looked after by the moon, and they travel east towards the rising moon, to Kinyu. A fuller version of narrative can be read on the Estrangin Gallery webpage for the painting. For the Mowanjum community in the Kimberley, dark patches on the moon were from when a whirlwind carried away a disobedient girl and put her into the moon (Johnson, 2014, citing Utemorrah et al., 1980).

As well as being a subject of Dreaming narratives, the Moon is recognised as a weather indicator by Aboriginal people. Norris (2016: 9) explains that, “in cold weather, a halo often surrounds the Moon, as a result of ice crystals in the upper atmosphere.” A halo was also linked with cold weather by Ngadju people, Eastern Goldfields, WA. To them (O’Connor and Prober, 2010: 22): “A big circle around the moon indicates rain and cold temperatures.” and “The new crescent moon is a good time for hunting — when it is shaped like a boomerang. The kangaroos travel then, and animals come out and move around freely because it is dark. There is also an abundance of fish down at the coast before the new moon.”

Rusty Peters, East Kimberley, provides another insight into weather prediction in the statement for his painting Dry Season, 2013: “It’s getting dry, big dry season. You know it’s going to be hot when the stars are all [gestures twinkling movement] and the moon, so bright.” (Desert River Sea, n.d.: web page).

3.3 Solar Eclipse

Traditional beliefs by Aboriginal people about solar eclipses include that they are bad omens, they are caused by a conjunction between the Sun (woman) and the Moon (man), and they are caused by something covering the sun (Norris, 2016). Hassell (n.d.: 146-147) relates a narrative that fits the last category. In summary: Long ago, the Zhi (sun) shone all day, and all night the Maak (Moon) was bright. The men hunted in the daytime, but then they went to sleep and did
not hunt, and the women scolded them. There was a big noise, and the Zhi and Maak came down and split the earth in half. The men that slept and the women that scolded were left on one side. Those who had hunted remained on the other side. It is never cold, because the Zhi shines all day and the Maak all night. But now and then the Nunghars on the other side of the sun want to know what is going on here, so they crowd together and they tip the sun over one side as they peer down. There is a lot of them so they cover the Zhi and make it dark, then it is very cold down here. They take the warmth away for themselves. But they don’t stay long, they only stop long enough for each one to look down.

3.4 Relationship between Earth and Sky

In most accounts:

Earth and sky are two parallel worlds which mirror each other, and the sky ... is a reflection of the terrestrial landscape, with plant and animals living in both places ... Clever men are said to be able to move between land-world and sky-world ... The sky is often regarded as being relatively close to Earth ... Many groups believed that all celestial bodies were formerly living on Earth, partly as animals, partly as men, and that they moved from Earth to sky. (Norris, 2016: 11).

The same elements of the Skyworld are described by Clarke (2014, 2015), including for language groups in the Western Desert, part of which is in WA. Johnson (2014) provides other examples for north-west WA and the Kimberley.

The epic creation Dreaming ‘Moondang-ak Kaardjiny: the Carers of Everything’ (Nannup, 2008), told by Noongar Elder Noel Nannup (1948 - ) has the same elements except for clever men. In summary, spirits moved across the land during the nyetting (cold time), realised they were going to become real, and wanted one group (people, plants or animals) to become carers of everything. A spirit serpent, the Wogarl, used all its strength to partially lift the sky, became real, created trails and hills, went underground, and rose again where there would be lakes. Then, the sky was lifted up from Earth, by spirit children working in unison; the Milky Way was created by a spirit woman who carried spirit children up in her hair; shooting ‘stars’ are spirit children returning to Earth; spirits on Earth became real with the first hint of wind. Others tell the same Dreaming or elements of it including Noongar Elder Toogarr Morrison (1950- ) (Goldsmith, 2014), and the narrative is on a plaque in Victoria Park, Claisebrook, East Perth (Goldsmith, 2014). Robertson et al. (2016) have linked components of the narrative with events that are believed scientifically to have happened over millenia, focussing on the Permian ice ages, 350 million years ago, through to the Holocene flood, 7000 years ago. The purpose was not to prove the Carers of Everything narrative is true, but to seek synergies of meaning between cultures.

An account by Ethel Hassell (n.d.: 187) touches on an earth/sky relationship. She asked Tupin, an Aboriginal girl who knew a lot of Native law, with Tupin’s friend alongside:

Is the earth round like this ball (holding up a ball of crochet cotton) or square like the box I am sitting on? “Round like a ball” both the girls promptly replied. “How do you know?” I asked. Both the girls promptly replied “Oh Missus just look all round yer. See the sky touching the earth all round. Wherever you stand and look it is all round put baby down to walk he soon run round, not always straight along fence, see ship get lost they run round, say um Yonga [kangaroo] run straight very little, then run round and Missus white man know it ... How is it that extracts of this account are quoted to indicate that a traditional belief of Wheelman people is that the earth is finite and/or round? Maybe because extracts are relied upon.

The Karadjeri people, south-west Kimberley, viewed that the:

...sky was a canopy covering all and coming down beyond the horizon to meet and enclose the flat surface on which men and women followed the fixed pattern of their lives ... The vault itself was pictured as being composed of a very hard and durable substance. (Johnson, 2014: 23, citing Piddington, 1932).

The Karadjer “... thought this substance to be rock or shell.” (Johnson, 2014: 24). Also for the Karadjari, Bulanj, the rainbow serpent, “... is the rainbow of the day-time sky and the river of the Milky Way in the night sky.” (Clarke, 2014: 313, quoting Worms and Petri, 1998).

Places of the dead are also relevant to the Earth and Sky relationship. “Over much of Australia and in particular, parts of the west and northwest, the spirits of the dead went to and resided in the sky-world with the ancestral heroes.” (Johnson, 2014: 30, citing Berndt and Berndt, 1974); “... but as frequently, there was a specially designated earthly place of sojourn for the dead, always located well away from that of the living.” (Johnson, 2014: 30). For Wheelman Noongar people (Hassell, n.d.: 281):

The sun is the far off land where the natives go and live after they die, no evil spirit can get there, and it is wonderful fertile country. When I [Hassell] remarked that it must be very hot I was told it is not so, the heat came from the sky which was below the sun and had nothing to do with it. The sun was above everything, the stars, moon and heavens, and independent of them all. It was the abode of the departed.
In a native title submission to the Federal Court (Palmer, 2016: 136), Noongar informant Lynette Knapp (south coast) stated that her father had taught her that the spirit of the dead person went “beyond the sun.”

Also from Noongar Country: “The spirits of the dead had to journey under ‘father sea’, west to the land of the dead.” (Johnson, 2014: citing Bates, 1992). In a similar vein, Phillip Chauncy, the Western Australian Government Assistant Surveyor from 1841-1853, wrote:

Before the arrival of a ship from Europe, the Swan River natives supposed that the spirits of the deceased passed into the cormorants which frequent the Mewstone, a granite rock some miles out in the sea opposite the mouth of the Swan River, called by them Gu mitch, a compound of Gu-urt, the “heart,” and mit or mitch, the “medium” or “agent” – signifying that this island is the medium or agent by which the spirit of the departed one enters the body of a cormorant. Large flights of these birds used to pass up the estuary of the Swan every morning on fishing excursions, and return to the Mewstone in the evening, and the natives refrained from killing them lest thereby they should be slaying their ancestors. (Macintyre and Dobson, 2017b: web page, quoting Chauncey, in Brough Smith, 1878).

Again, for Noongar Country: “Their general belief is that the spirits of the dead go westward over the sea to the island of souls, which they connect with the home of their fathers.” (Moore, 1842: 83). “In the Kimberleys, the place of the dead was in the west.” (Johnson, 2014: 31, citing Kaberry 1939); and “The Milky Way was also seen as a place of the dead in some areas of the Kimberleys.” (Johnson, 2014: 31, citing Durack 1969).

4 STARS AND CONSTELLATIONS

Norris (2016) observes that, for Aboriginal cultures there are narratives for individual stars, constellations and dark spaces between stars. As does Norris, constellations and dark spaces only are considered in this review. I found few single star accounts from WA, and stars in those are sometimes assigned Aboriginal names, but not European names.

4.1 Orion

Most Aboriginal cultures “… associate Orion with a hunter, a young man, or a group of young men.” (Norris, 2016: 12). This is true for the many Seven Sisters narratives from WA, see Section 4.2 below. A different view of Orion was provided by Jaru Elder Jack Jugarie, East Kimberley. He “… referred to the stars which make up the belt and “sword” of the constellation Orion … as “Kalarrcar”, the lizard footprint. … Jack drew both the imprint of the lizard footprint, and the star pattern, noting the similarity between the two.” (Goldsmith, 2014: 142). No narratives about lizard were reported.

4.2 Pleiades

Norris (2016) identifies that, for nearly all Australian cultures, the Pleiades are female, often sisters or a group of young girls, chased by young men, usually in Orion; and that the number seven is puzzling because less than seven bright stars are visible in the cluster; but, in several accounts one or two of the sisters are absent which is consistent with less than seven visible stars. Narratives from WA mostly fit these descriptions.

Seven Sisters, The Pleades, by Luis Argerich, December 1, 2013. Taken in the Northern Hemisphere, turned to show the view from the Southern Hemisphere. Creative Commons license to publish. [https://www.flickr.com/photos/largerich/12092763445/](https://www.flickr.com/photos/largerich/12092763445/)

Two major art projects which involved Elder women painting and telling their Seven Sisters narratives have been completed: one relates to the Canning Stock Route (La Fontaine & Carty, 2011); the other to the Western Desert, central
WA, including part of the Canning Stock Route, and also to country between Alice Springs (NT) and Kalgoorlie (WA), and Anangu/Pitjantjatjara/Yankunytjatjara Country (partly in WA, mainly in South Australia) (Neale ed., 2017). In addition, Macfarlane and McConnell (2017) bring together Seven Sisters narratives for the Canning Stock Route. In brief, the Seven Sisters are chased by a man (Orion) known by different names by different language groups, who wants to have sex with them. The Sisters fly from place to place, drink at waterholes, create water sources and other landmarks, and, at various locations, they rest, dance, sing, pierce their noses, get lost or sick, hide, get caught by the man/men, defend themselves, suffer rape, escape, split up and regroup.

A Seven Sisters narrative from Bremer Bay, south-west WA, indicates only six stars in the Pleiades, and that the man chasing them is a star of Orion, not the star constellation (Hassell, n.d.). Noongar Elder Noel Nannup (2008: 98) relates:

When it comes to the story of the Seven, there are really only six, as the seventh is one of the planets, and the planets go the opposite way. This is why you will always hear the desert people saying the seventh sister is coming home. ... You will see the seventh sister getting closer and closer, but then she will go past ... And when that happens, people will say she has visited her sisters.

Six sisters remain in the sky in the creation narrative told by Wongai Elder Josie Boyle (Boyle, 2007). In brief, the Sisters come from the Milky Way to beautify the Earth, and they need water. The youngest sister is sent for it. Two spirit men find her, and she falls in love with them, something that is forbidden. After finding her, the six sisters return to the Milky Way, leaving the youngest sister with the men.

For the Pitjantjatjara people, Central Desert, partly in WA, the Sisters kept a pack of dingoes for protection against the man but “... he succeeded in raping one of the sisters who subsequently died...” (Haynes, 2000: 78, citing Mountford, 1976). The man pursued the other six who became birds and flew into the sky. He followed them and is seen in the stars of Orion’s belt.

Like Mountford (1976), see above, Noongar Elder Theresa Walley (1937 - ), in her storybook (Walley, 2013), links the Seven Sisters with birds. The Sisters had the names of birds, and were sent to search for their father. But they ventured too far, lay down to rest and never awoke. Their spirits drifted into the heavens and can be seen in the night sky. They return as beautiful birds during the day.

White witnessed a Seven Sisters ceremony of the narrative for desert areas from west of Warburton (WA) to Central Australia (Johnson, 2014, citing White, 1975). The ceremony was for a girl’s first menstruation. It included dingoes as does an account by Mountford (1976), see above. A woman took the role of a man, so represented Orion, who chased seven women. One was raped and died, a consequence of the man being a relative so that the rape was beyond moral behaviour as well as marriage lore. The six sisters continued with the man in pursuit. The women set their dingoes upon him when he attempted rape again.

Two other very different narratives are told about Seven Sisters. For the Goolarabooloo people of the Dampier Peninsular, West Kimberley: Marala the Emu Man (Emu in the sky) chased Ngadjayi (spirit women from the sea) (Salisbury et al., 2016). The spirit women failed to listen to a command of their leader, Yinara, who then shamed them, and together they moved into the sky and became the Pleiades. Stone pillars at Bungurunun Beach, south of Broome, now represent the Ngadjayi.

Hassell (n.d.: 287-294), south-east coast WA, recorded another narrative, in summary that: a man who goes hunting and meets three Kar Kar (men from another tribe). The man asks them to his camp with his wife, children and Wardah, who is to be the wife of the eldest son. They all travel to the coast. A Kar Kar wants Wardah as his wife so the Kar Kar are told to leave. The Kar Kar attack, the man and sons are speared, a wind blows them into the sky: Orion is the man with a son on each side, and the three stars hanging down are the Kar Kar trying to reach them, which is a warning to all not to take in strangers. The wife, children and Wardah hide, and a cloak is spread over the children. A storm blows up, wind catches a corner of the cloak and blows them all into the sky: the wife and Wardah are the two brightest stars in the Pleiades, the dimmer ones are the children because they are covered with the cloak.

The names of many desert locations visited by the Seven Sisters are publicly known, in particular along the Canning Stock Route (La Fontaine and Carty, 2011; Macfarlane and McConnell, 2017; Neale ed., 2017). That Seven Sisters Songline starts in Roebourne, crosses the Pilbara, goes north east up part of the Stock Route, then south east, and finishes at Innga in South Australia (Macfarlane and McConnell, 2017).
Noongar Elders identify Cantonment and Clontarf Hills in Fremantle with the Seven Sisters, and say that five other hills in the area have been flattened, but the spiritual essence of the landscape lives on (City of Fremantle et al., 2016) – the five other hills were quarried early on for the Fremantle Harbour development. Another Seven Sisters place is in the mid-west of WA:

... *in the back of Geraldton ... where that road goes, ... you go over that hill. You see all these beautiful formations of hills and things. Well along there, there is a lovely story of how they dropped the crystals through there.* (Josie Boyle, Wongai Elder, relating a narrative of her Noongar friend, in Goldsmith, 2014: 523).

Josie also speaks of a Seven Sisters site in the Eastern Goldfields: a hill in Coolgardie that was a dancing site and the end of the Sisters’ journey on Earth (Goldsmith, 2014). Noongar Elder Noel Nannup, referring to the Wongai people, wrote “their Seven Sisters Dreaming starts at a place called Weibo, north of Kagoorlie in the Goldfields, at a very special place where the sisters came down from the sky.” (Nannup, 2008: 98).

Paddy Walker, Wongai Elder, Eastern Goldfields, described how the Seven Sisters visited Lake Ballard: they stopped and played, and a man chased them (Gormley, 2005; Menzies Visitors Centre, n.d.). They hid in seven rock holes on the shore of the lake; became islands on the lake; the man seized the youngest of the girls; a young man loved one of the sisters and wished to dance with her; and a tree at the end of Lake Ballard is one of the sisters (Brody in Gormley, 2005). In her storybook (O’Brien, 2009), recognised educator (MBE) May O’Brien (1932 - ), of the Wongai people, names other Eastern Goldfields places which the Seven Sisters visited: a flat-topped plateau near Leonora; a hill near the plateau called Yabu Yulangu which means the hill where they cried; and places close to Wiluna, Laverton, Kalgoorlie and Menzies - Lake Ballard, in Paddy Roe’s account, see above, is accessed via Menzies.

Also in the Eastern Goldfields, Ngalia people hold that the Die Hardy Range including Mount Geraldine, is associated with and represents the man who pursues the Seven Sisters, and that peaks in the Yokradine hills represent the Sisters (Muir, 2012). The name of the Yokradine Hills is based on the Noongar term “Yokrakine, yoka kaany, women’s spirit place” (Muir, 2012, 17, source Tim McCabe). Muir (1970 - ) is leader of the Ngalia people. Tim McCabe is a long-standing Noongar Language Teacher, Ph.D. Curtin University.
Lake Ballard looking North photo by Pat Forster 01/08/19

Lake Ballard, the oldest sister became the conical hill, photo by Pat Forster 01/08/19

Men performing the Balga traditional corroboree in the Kimberley carry totem boards which depict elements of the corroboree story. The dance style is traditional, but the story can be current: the story is passed through the generations via dreams; the current owner is Alan Griffiths (Carriageworks n.d.: web page). The totems, traditionally made with hair and now made with thread, depict the Seven Sisters, the Morning Star and other non-night-sky elements, as do the paintings by Alan Griffiths, for example Bali Bali Balga, 2012 (Desert River Sea, n.d.: web page). I haven’t uncovered the connection between the current story and the Seven Sisters and Morning Star.

4.3 The Milky Way

The Milky Way is widely recognised across Australia but interpretations vary, including that it is a celestial river, a canoe, Rainbow Serpent(s), that nebulae are camp-fires; and dark patches in the Milky Way are also subjects of narratives (Norris, 2016). Aboriginal accounts from WA about the Milky Way are considered in this Section, while dark patches are considered in Section 4.5 below.

The Carers of Everything narrative (Nannup, 2008), partly related in Section 3.4 above, describes the creation of the Milky Way by a spirit woman who carried spirit children up in her hair where they became stars. In a similar account on a plaque in Victoria Park, Claisebrook, East Perth, she is referred to as the Charrnock Woman, with long white hair, and her campsite is the Hyades star cluster - Aldebaran is her fire (Goldsmith, 2014).

The narrative of the Charrnock Woman, variously called Charnock, Junda and Jindalee, has many retellings, including by Noongar Elder Trevor Walley (1957- ) on Utube (Walley, 2015) and by Noongar Elder Toogarr Morrison - in story and in two large paintings in public buildings (Goldsmith, 2014). As well, many places in Noongar Country are identified with the narrative. It features in a Songline from Bunbury to Geraldton to Wave Rock (Robertson et al., 2016, citing Nannup and Hopper, 2015). A strand of her hair snapped off and created the lakes at Joondalup (Robertson et al., 2016). During full moon, you can see her long white hair reflected in Lake Joondalup from the stars (City of Joondalup, n.d.). She left a footprint at Blackwall Reach alongside the Swan River (Robertson et al., 2016). The sandbar in the Swan River at Point Walter is a strand of her hair (Parks and Wildlife Service WA, n.d., audio files by Noongar Elder Marie Taylor (1948- )). She left earth by leaping off Wave Rock, Hyden (Nannup, 2008); her man who ate spirit children lived in Bates Cave, otherwise known as Mulga’s Cave, near Hyden, and the first place where the spirit children returned to earth as stones was Hippos Yawn, at the base of Wave Rock (Goldsmith, 2014, citing the Claisebrook Plaque).
4.4 Crux: the Southern Cross

Interpretations of the Southern Cross by Aboriginal people vary across Australia (Norris, 2016), including that, for people in the Kimberley, the Cross is an eaglehawk (Norris, citing Kaberry, 1939). From Noongar Elder Noel Nannup: “The Southern Cross and the stars around it are really the head of a kangaroo. You can see the ears and the teeth, you can see the kangaroo’s back coming down and the tail going off.” (Nannup, 2008: 103).

In a storybook (Petterson, 2007) by Merninga-Gnudju Noongar Carol Pettersen (1940 - ), of the south coast WA, four sisters go to a sacred place. They are chased away by men who attack them with spears but they escape by fleeing to the sky, where they become the Southern Cross. In the version recorded by Hassell (n.d.), four sisters are sent to fetch water. Instead of coming straight back, they play. Men of the tribe find them playing and, as punishment, prod the girls in the carves of their legs with hunting spears. The girls run as fast as they can. A big wind springs up and blows them into the sky – they spread out to avoid the spears the men throw at them, which is why they are not clustered like other stars. They stay up there because they are frightened, which is a lesson to other girls not to play when sent on a task, because they will never get to find a man and be married.

From the north-west of WA, the “Southern Cross is the camp of two mothers and their fires are the Pointers Alpha and Beta Centauri. They came to earth in search of food. The fire sticks they carried got out of control and the ensuing fire was captured by people on earth.” (Johnson, 2014: 167, citing Roberts and Mountford, 1974). In the West Kimberley, the Southern Cross is Jina (eagle’s claw print) and the pointers are Gwuraarra (hitting stick) (Salisbury et al., 2016).
4.5 Dark Spaces

Emu in the Sky, seen as dark spaces in the Milky Way, is widely recognised by Aboriginal people, with the Coalsack as the head, and the body extending along the body of the Milky Way through Scorpius and Sagittarius constellations, although there are other variations (Norris, 2016). Early references to Emu from WA sources cited by Fuller et al. (2014) are of: a resting Emu, by Aboriginal groups in the Musgrave Ranges (Basedow, 1925); and an Emu called Kalaia, by Pitjantjatjarra people (Tindale, 1935). Badimia people in the Murchison (Day and Morrisey, 1995) and Watjarri in the Murchison (Goldsmith, 2014) also recognise Emu and use it as a seasonal indicator - see Section 9.1 of this review.
Hassell (n.d.: 183) recorded a story about Waitch (Emu) in the sky among the Gindies (Stars), told by Tupin, who learnt Aboriginal law from her mother and old father. When thunder was heard, Tupin said “Waitch far away, there she move again, as the thunder rumbled again.” In brief (183 -187, paraphrased): Waitch was blown into the sky in smoke from a fire. She went to the moon to rest, but the moon got fat and squeezed her out. She went to the sun but the Nunghars there did not want her as she talked too much. She went to the Gindies who were keeping the earth up and they allowed Waitch to camp with them if she would help take the load. But little by little, they put all the load on Waitch’s back. She spreads out her wings to keep the load in place. She groans and moves one part of the load from one wing to the other when the weather is very hot. Sometimes she moves her load with a jirk and the whole earth trembles. If she makes too much fuss the Nunghars in the Sun get angry and make it dark, and send out flashes of light to frighten her and make her quiet. When it rains very hard, that is Waitch crying because her load is so heavy.

For the Goolarabooloo traditional custodians of the Dampier Peninsular, West Kimberley, Emu is Marala, the Emu Man (Salisbury et al., 2016: 2-4, citing Mountford, 1973). Marala is an important Bugarrigarra [creation time] being associated with the Ululong Songline. He “was the ‘lawgiver’, and instilled in the country the codes of conduct for behaviour needed to help ensure its well-being”. As he moved along the Songline:

Marala left behind threetoed tracks. He also left behind the grooved impressions of his tail feathers (his ‘ramu’ or ceremonial engravings) when he sat down to rest ... Today, three-toed dinosaur tracks (typically those assigned to Megalosauroidea broomensis) and impressions of cycad-like bennettitaleans (Marala’s tail feather impressions and ramu) are seen as testimony to Marala’s journey as narrated in the Song Cycle ... Marala’s emu-like form persists today as a shadow of dark nebulae running virtually the length of the Milky Way.
Johnson (2014: 112, citing Worms, 1986) reports:

The creation hero spirit, Galalang of the northern Kimberley groups is represented as living in the dark patch of the Milky Way, between the European constellations Centaurus and Scorpius. Remnants of his feathered headdress are seen in Alpha and Beta Centauri which also act as an allusion to Galalang’s establishment of the two moieties within the tribe.

The dark patches were seen as a bullroarer among the Lunga of the Kimberley (Johnson 2014, citing Kaberry 1939). Haynes (2000: 84, quoting Tindale, 1936) reports:

The Ngadadjara people of the Warburton Ranges WA saw in a long line of dark patches along the Milky Way between Alpha Centauri and Alpha Cygni a great totem board made by two ancestral heroes, the Wati Kutjara, while they were accompanying the seven sisters.

5 PLANETS

Aboriginal people’s star knowledge included distinguishing between fixed stars and the planets that moved straight across the sky; Mercury, Venus, Mars, Jupiter and Saturn were all visible and recognised (Norris, 2016). Hassell (n.d.: 285) wrote that:

Noongars on the south coast though they recognised they [the planets] are different from other stars they called them the mulgas of the tribes and say they visit the tribes also they have the power to look through the clouds, never mind how thick they are or how dark the night be...[and] I was told the names of several tribes of stars, the names I regret to say I have forgotten.

Mulgarss were tribal doctors who had magic powers and travelled between family groups or tribes on the ground. The earth-sky-tribe analogy is carried further in a storybook (Winmar, 2009) by Kerry-Ann Winmar, Noongar heritage, in which she describes the stars as looking like campfires, the campfires of the ancestors.

5.1 Venus - The Morning Star

Venus, the morning star, is important in some Aboriginal cultures and is associated with death; for Yolngu people, Northern Territory, Venus was a creator spirit who led humans to Australia and named and created animals and places; some Yolngu perform a Morning Star Ceremony as part of the funeral process (Norris, 2016).

In the Western Desert which is partly in WA: “... the local people viewed Venus (Iruwanja) and Saturn (Irukulpinja) as brothers, with Jupiter as their dog. Irukulpinja and the dog spend most of their time catching food for Iruwanja.” (Hamacher and Banks, 2018: 11, quoting Mountford 1976). For Kukatja people (Gugadja) of the Kimberley, Venus, the morning star, is cast as the man who chased the Seven Sisters (Johnson, 2014, citing Berndt and Berndt, 1989). For Whadjuk Noongar people, Venus signals a time of day: Teean benne kwejjat Hoolat means Venus, daylight now coming (Thieberger, 2017, citing Jooobaitch of Guildford and Perth, recorded by Bates).

Jaru Elder Stan Brumby (1933 - 2012), East Kimberley, referred to the Morning Star when interviewed by Goldsmith (2014: 476) and that he, the star, cannot always be seen:

One big star, not too big, come out from sunrise. He come out, at night, proper star. This star, bin fall down, that’s the main star, we been use him for... droving cattle, that’s the morning star, that’s the main star. Well the drover lost that, we can’t see him anymore. He’s underground here, ... Yeh, yeh, very bright, morning star, he come and take a break now.

Venus reflected on the Pacific Ocean, by Brocken Inaglory, Nov 15, 2008, Creative Commons license
https://commons.wikimedia.org/wiki/File:Venus-Pacific-levelled.jpg
5.2 Venus the Evening Star

Some Aboriginal people recognise that the Morning Star and Evening Star are related, but do not necessarily see them to be the same object (Norris, 2016). Moore (1884: 387) recorded:

When I was last in the bush in search of the natives, the stars were shining brightly at night. What star is that?” I said to Deenat, pointing to Venus. "Oh, that is Julagoling," was the answer, "What is it—a man, or a woman, or what?” I enquired. "Oh, very pretty young woman," was the reply. "Where is her husband?” I said. “She has no husband; she has had some children, but she always kills them; she is very powerful in magic. Ah, there she goes off to the West, now to practice her enchantments upon us.

Goldsmith (2014) interviewed Jaru Elders, East Kimberley, who referred to the Evening Star, in the context of the creation of Wolfe Creek Crater. Elder Stan Brumby described the evening star as two stars, and that the mother one, the biggest one, came to the ground and left behind the baby one; and he drew the two stars. Elder Jack Jugarie described how "Wada [star]. Each one moves because the other one wants to come in there, it gives him room to move ...” (Goldsmith: 139); and that a big star was the first to come up a little bit, and that another bright one came up - the moon Yalgarn, and Yalgarn came very close to the star and was too hot for him so it fell in Wolfe Creek Crater.

Kirsty Burgu (1972 - ), daughter of a Ngarinyin Elder, Kimberley, writes about elements of her painting Marriage Laws 2011: that the evening star and moon always try to come closer to each other (Desert River Sea, n.d.: web page). See the web page for the complete statement.

Venus Appears over Kandimalal (Wolfe Creek Crater by Roberta Chantler, 2019. Photo by Pat Forster

6 COMETS, METEORS, METEORITES, CRATERS

Norris (2016: 20) observes that “Some Aboriginal languages do not distinguish between meteors and comets”, but it could be that the recorder did not distinguish them; and association with bad omens and death is common among Aboriginal people. Consistent with these observations, Moore (1842) has the same word, Binnar, for comet and meteor in his Noongar vocabulary. He also listed:

Binnar A meteor, described by the natives as a star of fire; seldom visible, but when seen considered by them as an omen of death. A remarkably large and bright meteor was observed a few years ago traversing a large space in the heavens from east to west. Its progress was accompanied by a loud crackling sound, like the combined discharge of musketry. (Moore: 1842: 13).

6.1 Meteors

Several Aboriginal groups associate meteors with death, even as causing death, sometimes as punishment for breaking the law (Norris, 2016). Yolunga people, Northern Territory, tell how a spirit, as a meteor, brought fire to Earth, causing massive fires unintentionally; and meteors are also associated with new life, sometimes due to reincarnation of spirits of the dead returning to Earth (ibid).

Noongar Elder Noel Nannup, in the Carers of Everything narrative, references shooting stars, meteorites and meteor showers, in relation to spirit children returning to earth:

I know that we have all been outside on the dark night and seen a shooting star streak across the sky, I have heard some people say make a wish, when we see this we always say by-ee coolunger nyina, which means little spirit children returning to earth. When they reach earth they are nothing more than a little stone, some are a bit bigger
than others, and some don’t make it at all. The spirit children return to earth all the time, with a known pattern of large showers about every thirty three years, that is when we believe that our spiritual energy is at its strongest. (in Goldsmith, 2014: 195).

Recognition of meteor showers has not been conclusively reported for other Aboriginal groups (Norris, 2016). The thirty-three year reference to them may be contemporary knowledge.

6.2 Meteorites and Tektites

Bevan and Bindon (1996) review recognition of meteorites, and transportation and utilisation of them by Aboriginal people. Large masses have been found away from, and traced back to, the Western Australian impact sites, Mount Dowling and the Dalgaranga Crater. They were potentially transported by Aboriginal people, but Bevan and Bindon found no reports of that. There are documented examples of Aboriginal people discovering meteorites in modern times - pieces from the Mundrabilla meteorite shower fell and are found on the Nullabor Plain, WA.

No known examples of traditional use of meteorites for practical purposes have been found (Bevan and Bindon, 1996). Explanations are that most samples are friable, although some crystalline meteorites are suitable for tool making. Bevan and Bindon note the use of tektites as sacred objects. “Tektites are small, pebble-like glassy objects of Earth material that have been melted by meteorite impact, splashed up into our atmosphere, and fallen to Earth again under gravity.” (The Australian Museum, n.d.: web page). They are not meteorites, that is, not rocks originating in space.

Clarke (2019) reviews Aboriginal use of a category of tektites called australites, which have been traced back to a meteorite strike in Southeast Asia about 793 000 years ago (Clarke, citing Lei and Wei, 2000) and that rained down on Australia. They are found in a variety of shapes including ovals and teardrops, and are widely scattered, sometimes in ancient Aboriginal campsites. They hold significance for Aboriginal people as magic stones, with their power derived “from their connection to ancestors who went up to the Skyworld after Creation.” (Clarke: 158). Early records for WA indicate that possessors of the stones believed that: they were able to cure sick people and bewitch enemies (Clarke citing Tate, 1879); that faith healing procedures of sucking them from the body could cure sickness (Clarke citing Baker, 1957); and carrying them gave power to medicine men to convey messages long distances (Clarke citing Baker, 1957). The glassy composition of australites sets them apart from meteorites, as does their shape and composition, but there is a history of them not being distinguished in the naming.

Hassell (n.d.) found a booliah (wizard stone), which she gave to an older Aboriginal woman, and which others held to ensure their babies would be boys. She also saw stones owned by a Mulga (tribal doctor) that he used for rain making, curses and other things. Two were iron stones “... I am certain were meteorites. ... [Another was] in size and shape like a goose’s egg but dark green colour and extremely heavy and smooth.” (Hassell: 249). Clarke (2019) refers to Hassell in his review, but not conclusively as having seen meteorites or australites.

6.3 Meteorite Craters

Wolfe Creek Crater (East Kimberley) is the second largest in the world from which meteorite fragments have been removed; the average diameter is 892 m, and the most recent estimate of age, based on modern methods (exposure dating using the cosmogenic nuclides, and optically stimulated luminescence) is approximately 120 000 years (Barrows et al, 2019). While craters can be subject to erosion, Wolfe Creek Crater is reasonably stable due to being in an arid region, so age estimates are possible (ibid). The local Jaru people call it Kandimalal (Goldsmith, 2014). Parke (2019) reported that local people say Kandimalal means no potatoes, since the bush potato doesn’t seem to grow in the area around the crater (source, Ms. Darkie, Kimberley resident of Aboriginal heritage). In interviews with Goldsmith (2014: 457-459), Jaru Elder Jack Jugarie called the place “Muurring” and “Kandimalal”.

There are several creation narratives about the crater. In one, two rainbow snakes crossed the desert and formed the nearby Wolfe and Sturt Creeks, and one emerged from the ground, forming the crater (Bevan and Bindoon, 1993; Goldsmith, 2014, citing National Park signage at the crater). Elder Jack Jugarie described the first star rising up in the afternoon, followed by the moon rising and making the star too hot, so it fell down (Goldsmith, 2014). Jaru Elder Stan Brumby told how bush women lived near the spring soak water in the centre of the crater near sugar leaf trees.

A star man comes and sees that bush women and he wants that sugar leaf so he comes down and that bush women runs away and that star man comes crashing into the earth and takes the sugar leaf and then he went into the earth never to come out again. That women comes back ... There is still a soak water hole in the middle of the crater and the sugar leaf today. (Goldsmith, 2014: 405, citing Yarliyil Art Centre).

Since formation of the crater preceded Aboriginal presence in Australia, the star explanations might intuitive deductions based on seeing ‘falling stars’, or might be European influenced.
Paruka (Lake Gregory) in the Kimberley, like Wolfe Creek Crater, is the subject of a falling star narrative. It is told in the Welcome Paruka brochure (Mulan and Mindibungu Aboriginal Corporations, n.d.), yet no meteoric impact seems to have been recorded for Paruka. This is consistent with an observation by Norris (2016) that falling star impact narratives do not necessarily line up with the existence of craters. The small Veevers Meteorite Crater in WA could arguably be the subject of a star falling narrative since it is relatively young, less than 20 000 years, so the impact might have been witnessed by Aboriginal people (Hamacher and Norris, 2009). Yet, narratives do not seem to exist for it (ibid).

7 THE MAGELLANIC CLOUDS

The Magellanic Clouds are subjects of a number of narratives, including that they are the campfires of old people and places where the dead go (Norris, 2016). For people in the Kimberley they are “lily-roots that exploded whilst being cooked by a creator-being.” (Norris citing Akerman, 2014). Noongar Elder Noel Nannup comments on the importance of Magellanic Clouds for people in south-west WA: “the Small Magellanic Cloud is associated with law and is sensitive and/or secret, and the Large Magellanic Cloud contains “everybody’s” story, and is much more open.” (in Goldsmith, 2014: 69); and “the Milky Way and the Megilion [sic] Clouds are The Seven Sisters Dreaming; it runs a long way down from the Pilbara region.” (in Kerwin, 2006: 69).

Elders Jack Jugari and Jack Lannigan of the East Kimberley, when interviewed by Goldsmith (2014: 143), gave accounts of a man being speared or people being otherwise hurt; then, “the Small Magellanic Cloud comes down like a misty, smoky cloud over the dead body, and takes blood out of the dead body”. The person comes back to life, and after two or three days returns to the dead state. Goldsmith proposes the initial dead state may be a trancelike state.

In the ‘Two Men in the Sky’ narrative told and sketched by Elder Jack Lannigan, the men are the Large and Small Magellanic Clouds with the Milky Way around them (Goldsmith, 2014: 146). The ‘men’ come down and make a man numb due to wrong-way marriage: “Because he steal your wife, wrong type of marriage. Mulli (in laws) would straighten him out. Two men come out of the Milky Way, two men, he take your spirit away. He keeps you in the Milky Way till you die. That’s finish.”

8 STONE ARRANGEMENTS

Norris (2016) reviews literature on stone arrangements, mainly for New South Wales and Victoria. They comprise small stones and/or large stones. Some have functional uses such as fish traps or indicate direction. Others have ceremonial purposes, including initiation ceremonies. Some seem linked with the night sky including that sight lines from a gap between two largest stones of an arrangement, over outlier stones, go to where the sun sets on the solstice and equinox.

Some stone arrangements in WA are also classified as having functional uses, for example, at “Shackleton there is a circle of rocks on the ground with an added triangle of rocks on the end that points to where permanent water could be found.” (Noongar Elder Kevin Davis in Wheatbelt Natural Resource Management, n.d.: 7). There is a similar one at Mukinbudin (ibid). Stone fish traps at Oyster Harbour on the south coast, and Denham in the mid-west, are other examples. Hill (2013) identifies standing stones (single and in groups) in the Helena Valley and surrounds, and proposes them to be traditional boundary markers, or associates them with Dreaming narratives, but not with the night sky.

Randolph (2011) describes twelve stone arrangements in the south and mid-west of WA, and acknowledges there are many others. None of the arrangements are identified as being linked to the sky, but one has alignments of stones that extend south, west and north of large granite boulders, and several rocks are placed in trees to the east. The directions of the lines may have been decided using the sun. Schwede (1990) describes stone arrangements in the Helena Valley, Perth, one of which has lines of stones in particular directions – the lines border cairns on the western and northern edges of the arrangement; an Aboriginal informant said it may have been an initiation site.

In an interview by Goldsmith (2014: 516), Josie Boyle, Wongai elder, Eastern Goldfields, spoke about her mother and how her people came together for:

[The]... big Gurandgora, like a big dance, ... it was also for singing, alignment to the stars, and everybody ... brought these rock, from east and west of the land, and the walls are still there, ... these big trenches for dust storm sites, where people sheltered from the dust storms.

Josie mentions that six of the sites are on a zigzag that is matched by stars on a zigzag, and names three sites: Gindowee, Niagra Falls, and Boorley Well. Niagra Falls is potentially the present Niagra Dam, north of Kalgoorlie. I can’t identify the other sites on a map, even with different spellings.

9 ABORIGINAL TIMEKEEPING AND CALENDARS

9.1 Calendars and seasons
The number of seasons recognised by Aboriginal people depends on where they live (Norris, 2016), which is certainly true for WA. For example, six are recognised in Noongar Country in the south-west (Ryan, 2013) and four are recognised by Muludja people in the Kimberley (Davis et al., 2011). About seasons, Norris also observes that, across Australia, heliacal risings of stars, including Pleiades, Vega, Orion, Leo, Scorpius, are recognised as marking seasonal changes.

There are several references to the Pleiades or Seven Sisters in WA accounts that relate to the onset of colder weather and the dingo-pup season. For Ngadjju people, Eastern Goldfields/ Great Western Woodlands, Kupilya ngarrin:

... is the sleeping and hibernating season ... This season is cold and rainy. People are resting up; it’s good for mushrooms. ... the Seven Sisters are in the north-west sky just after sundown to indicate that female jula* (emus) will start egg laying. (O’Connor and Prober, 2010: 36). [* jula may not be the currently accepted Ngadjju word]

"After the emu eggs comes a part of Kupilya ngarrin called the time of the ngurpany, dingo pups (Canis lupus dingo). This is about June, about nine weeks after the dingoes mate.” (O’Connor and Prober, 2010: 38).

For the Pitjantjatjara people in the Western Desert, which is adjacent to the Great Western Woodlands:

... the appearance of the Pleiades in the dawn sky in late autumn was particularly important as the sign that the annual dingo breeding season had begun. Fertility ceremonies were then performed for the dingoes, or native dogs, and some weeks later the tribe raided the lairs, culling and feasting on the young pups. (Haynes, 2000: 65, citing Tindale and George, 1976).

In the Great Sandy Desert:

The Pleiades, when they were in the sky before dawn ... were seen as a signal of the onset of the coldest nights. According to local myth, the Pleiades women dropped water on the people sleeping below, causing them to shiver with cold. (Johnson, 2014: 42, citing Lowe et al., 1990).

Emu in the Sky is another seasonal indicator in many places in Australia (Norris, 2016). The different forms of Emu signal: the time (or season) to change camp; and the time for initiation ceremonies. The positions and poses of Emu also indicate: the lifecycle of emus - when they travel to waterholes, sit on them, leave them, when eggs are available and when the chicks hatch (Fuller et al., 2014). Early references to Emu from WA as cited by Fuller et al. (2014) are of a resting Emu, by Aboriginal Groups in the Musgrave Ranges (Basedow, 1925), and an Emu called Kalaia, by Pitjantjatjarra people (Tindale, 1935).

For the Badimia people, Murchison WA: “In autumn, once the nights become colder and following the first rains, the emu in the night sky becomes quite visible. Below the emu is a cluster of eggs. This signifies that the time is right to look for emu eggs.” (Day and Morrissey, 1995: 4). Badimia Carol Dowling, who tells the stories of her great-great-grandmother, grandmother and mother, refers to Emu as Yalibirri, and adds: “Below the emu is a cluster of eggs (known as Wallah). ... This was also the time for dancing as central focus of Badimia practical, judicial and spiritual law.” (Dowling, 2017: 149). Watjarri Elder Olive Boddington (c1940 - 2016), from the Murchison, in Goldsmith (2014: 183), describes the changing angles of Emu:

When you first see the emu, you don't see the whole of him, just you see the neck and the head part and as the months go by it shapes more into the emu, and then ... it's sort of lying and when it does that that's when the emu's laying eggs and everyone seems to hunt for them then...(the emu eggs) ... special time.

Bulian is reported as another night-sky seasonal indicator - for the Karadjeri, north-western WA (Johnson, 2014: 57-58, citing Piddington, 1930). The:

...change of season from dry to wet ... was seen to be affected by bulian, a great water-serpent. The eyes of bulian were seen to be two stars in the sky. And if bulian was annoyed, it was thought that he would produce change prematurely... The stars in Scorpius were also associated with bulian but set earlier, during the hot-dry season. This change in season took place in mid-December and was regarded as being very significant because it altered economic and social life to a great extent. There was usually no rain from May to December and after that, heavy rains fell during January and February.

9.2 Lunar markers of time

Norris (2016) provides examples where lunar phases and months governed the timing of Aboriginal ceremonies including initiation; and artefacts with marks measured age in lunar months and half moons. WA examples of ceremony being linked to the moon include that, in the north west, prior to the initiation ceremony for boys,

... the women store a large quantity of grass seeds, etc., so as to have a supply in readiness for the feast, which is a feature of this ceremony. The families then meet at some given spot, the time being arranged by the stages of the moon, as “new” or “full,” until the company present is of vast numbers. (Withnell, 1901: 10).
For the Mowanjum people in the Kimberley, a halo around the moon “...indicated the time for a boy to be initiated.” (Johnson, 2014: 132. citing Utemorrah et al., 1980). Hassell (n.d.: 191), south-east coast WA, noticed that, for big yardies - the coming together of groups for ceremonies, discussions and trade and marriage, “Some large plains where food and water were plentiful was settled on as a meeting place and they were all together there just before the full moon.”

Withnell (1901: 36) recorded:

When a death occurs in the camp the men and women throw themselves on the ground, run a few paces ... In memorial they gather round and cry every time that stage of the moon returns, as they mark the time by new and full moon. This is done every month until the season changes ... they know the periods of summer and winter-not only by the heat and cold, but by the difference in the vegetation.

On a different note, the Firestick Ceremony performed by Gija people in the East Kimberley, is performed to welcome the new moon and ensure bountiful hunting (Massola, 2016). The painting held by the Parliament of Western Australia, Seasonal Hunters by Noongar Tjyllyungoo Lance Chadd, depicts Aboriginal men ready to hunt at full moon (Parliament of Western Australia website, n.d.).

Norris (2016) observes that lunar months, unlike seasons are not named. The non-naming resonates with observations of Salvado (Ryan, 2013: 16, quoting Salvado, 1977):

The months are distinguished from one another by the moon, but they are not given individual names, or divided into weeks. Again the days are not distinguished except by the position of the moon.

“Moreover, Salvado noted that Nyoongars reckoned weeks and days according to the moon, but that these smaller divisions of time were not as important as the six seasons in the Nyoongar temporal order” (Ryan: 2013, 17).

An entry in Moore’s (1884: 331) journal indicates that lunar months served as a distance as well as time indicator: “I persisted in my enquiries from the natives about the water to the East. They still say there is a sea in that direction, but far away "Moons plenty dead" is all the information I can get.” On a different topic, Hassell (n.d.: 255) noticed how the Mulga or wizard man who visited:

...had a small irregular piece of white quartz with two tiny specks of gold this had something to do with making the women bear children it was carefully wrapped in bark and wound round with kangaroo sinew and carried in the woman’s Coot [cloak] from full moon to full moon then returned to him when he pronounced some magic words over the woman.

9.3 Timekeeping

For Australia in general:

Other than ... using the position of the Sun during the day as guide to the time of day ... there are few recorded instances of using the sky to measure time. One exception is the Yaraldi of South Australia, who divided the day into seven sectors ... (Norris, 2016: 27).
Macintyre and Dobson (2017a) propose that Noongar people traditionally divided their day into at least nine interphasing temporal categories corresponding to dawn, daybreak, sunrise, morning, noon, early afternoon, late afternoon, sunset and twilight. Macintyre and Dobson assign words to the categories, drawing on vocabularies of Lyon (1833), Moore (1842), and Grey (1840). Some words relate to specific times for example, biddorong, biddurong – forenoon, about two o’clock in the day (Moore), and others to time intervals, for example, waullu - light, dawn, daylight, the morning twilight, the interval been light and darkness (Moore).

While the lunar month served as a distance/ time indicator for Noongar people (see Section 9.2 above), number of sleeps gave a smaller division of the same. Lyon’s (1833, April 13: 59) vocabulary lists: “beedjar, sleep. This is the term by which they reckon both time and distance. Not so many days; but so many beedjars; that is so many sleeps, or nights; night being the proper time for sleep.” A poignant comment about timekeeping by Wongai Elder Josie Boyle, Eastern Goldfields, was recorded by Goldsmith (2014: 518). Josie was speaking of her mother: “Because every day, my mother couldn’t read or write, so she had to tell the time by the birds, or the sun or the way everything was out in the land.”

10 DIRECTION,SONGLINES AND NAVIGATION

Most Aboriginal navigation skills were used on land - their canoes did not permit ocean travel, except that Yolngu people navigated along the coast; many language groups were fearful of travelling at night, so navigation by following the stars was not a consideration, however a few groups were expert at it (Norris, 2016). An example for WA of navigation following a star is provided by Grey (1841, digital version: April 9, no page number). His exploration party had been unsuccessful in locating water north of Perth: “We therefore continued our search … it was now dark and we soon wandered from the path. Kaiber [the Aboriginal tracker] took a star for his guide and led us straight across the country.” The diary of explorer John Septimus Roe (2014), for the years 1829 –1849 when Roe was in WA, doesn’t seem to mention use of stars by his Aboriginal guides, but does mention many night-sky objects seen by Roe – he was alert to them so potentially would have been alert to his guides navigating with them.

10.1 Aboriginal traderoutes

Trade-routes were interconnected across Australia, were used to trade commodities and pass-on stories, and served to connect Aboriginal people (Norris, 2016). An illustrative example, documented in the diary of Admiral C H Fremantle who landed in Fremantle in 1829 (Cottesloe (ed.), 1799), and more recently by the City of Fremantle et al. (2016), is that Walyalup (Fremantle) was a key meeting place, where Bathers Beach and Arthurs Head Reserve was a Manjaree; in other words a mun-djä, that is ”... a sort of annual fair, which takes place in the spring of the year, when the natives of different districts meet for the purpose of exchanging different articles of utility with one another.” (Grey, 1840: 89). Several trails led to it and gatherings were when food was plentiful. Navigation by the stars is not mentioned in the Walyalup accounts. Neither does it seem to be mentioned in Kerwin’s (2006) thesis on Aboriginal traderoutes in Australia. Possible explanations are that observers and investigators omit to ask about star navigation (Kerwin), or that it is secret information – an explanation that Norris (2016) suggests for other routes.

10.2 Direction

Many Aboriginal groups were familiar with cardinal directions (north, south, east, west), sometimes loosely defined (Norris, 2016). The Guugu Yimithirr language group used cardinal directions to communicate left, right and behind concepts (Norris, citing Levinson, 1997); that is, they predominantly thought in terms of absolute direction rather than relative direction (Levinson, 1997: 98). The Noongar vocabulary by Moore (1842) has words for north, south, east (kakur), west, and “… kngal the east or, more properly, the spot of sun-rising, as it varies throughout the year.” (Moore: 55). Linguistically, kngal is linked to one of the Noongar words for sun (nganga), as Norris (2016) notes for east in other Aboriginal languages. Moore does not describe how Noongar people identified kakur or how they distinguished it from kngal. The Noongar vocabulary by Grey (1840) overlaps Moore’s, but has additional words including kunning, the south-west.

From Moore’s (1842: 23) vocabulary, it seems that the use of cardinal directions to indicate left and right might not have been limited to Guugu Yimithirr people (Norris, 2016), at least in the context of navigation: “Buyal, s.—The south. They always direct you by the points of the compass, and not by the right or the left.” Cardinal directions may have been used more widely (not only for navigation), since none of the Noongar vocabularies by Moore, Grey and Lyon (1833), and the recent compilation by Bindon and Chadwick (2011), have words for left, right, or in front. A Noongar word for behind is listed, but seems to relate to time.

Winds in the Noongar vocabularies are named according to direction: south, south-east, south-west, west; and Nandat “... the east wind; the land wind.” (Moore, 1842: 82). Grey (1840) lists Nanggeroon, the east wind. Again, these east words are built from the word for sun. Variations between the vocabularies is explained by pitfalls in recording oral language, and that words differ between Noongar language groups. A reference to direction from Wongai Elder Josie
Boyle (Eastern Goldfields) when speaking of the traditional life has no ambiguity: “... *simple ways the people had of lovely ways of describing the land, you know. Sunup and sundown. ... Sun down country, see, the sun sets here and the other mob, up there, Sun up, but I was really born in sun up country.*” (Goldsmith, 2014: 517).

Moore (1884: 346) also recorded directions in relation to burials:

Then they placed the body carefully in the grave on its right side with the head to the South, the face directed to the East, in which they seemed to be particular. When I remarked this, they said that the people to whom the deceased belonged always buried the bodies North and South, the face looking to the sunrise, but that others buried the bodies East and West, with the face looking to the midday sun.

Hassell (n.d.) observed similar care with the direction that the head faced and the alignment of the bodies: north-south and east-west alignments distinguished burial for hill people and plains people respectively.

10.3 Songlines and Dreaming Tracks

Songlines or Dreaming Tracks are typically believed to have been created and followed by spirit ancestors, and have been followed through the generations, including for trading; songs guide journeys along them so act as oral maps; star maps exist for them but don’t seem intended for navigation; rather star maps seem to be used to illustrate the songs and to act as memory aids (Norris, 2016). Noongar Elder Noel Nannup describes a star map for a Songline in south-west WA (British Broadcasting Corporation, 2017: video). Lines joining five stars are imagined. The map is “almost an exact mirror image” of the route linking five prominent granite rocks on the ground. Of the map’s use, Nannup says only “When you are teaching the children, then you lie flat on your back and look up there [pointing to the night sky].”

Some Songlines are associated with particular constellations including the Seven Sisters Songlines in WA (see Section 4.2 above). Another is the Ululong Songline along the Dampier Peninsula, north of Broome, which is associated with Emu in the Sky (see Section 4.5). Landforms on the Songlines are believed to have been created or used by spirit ancestors who now persist as the constellations or as single stars. For example, “The *Minyipuru [Seven Sisters]* sit down to rest on top of a hill overlooking present day Parnngurr community.” (FORM, 2018, no page number). This statement is for the painting Parnngurr, 2014, by Bugai Whyoulter (c1939 - ), Great Sandy Desert, who grew up living a traditional nomadic life (Martumili Artists, n.d.). A second example is that Marala the Emu man (Emu in the Sky) left three toed footprints on the rock platforms of the Dampier Peninsula (Salisbury et al., 2016). A third example is that, to create the Milky Way, the Charrnock Woman used Wave Rock on the W in the Sky Songline to leave Earth (Nannup, 2008). In numerous other Songline narratives, landforms are associated with stars but, like the narratives cited here, I haven’t found any that hint of stars being used for real-time navigation between landforms.

The interview by Goldsmith (2014: 520-521) of Wongai Elder Josie Boyle, Eastern Goldfields, speaking about her mother provides navigation detail:

... and they did lots of journeys ... straight across the Nullarbor where the railway line is today. ... That was the walking path of those people, my people, that walked from (Ombi?), long time ago, for ceremonies for star stories and star aligning stories ... That’s how we got walking paths ... where they were going to their ceremonies, for the *Guarnadagas and the singing songs of the alignment of everything, see, of the earth and the sky. ... and that’s what she talked about all the time see, and see she drew these things in the sand.*

Did ‘these things’ drawn in the sand represent objects on earth, or stars in the sky, or both? Were the drawings sand maps?

11 ROCK ART

Norris (2016) addresses rock engravings and rock paintings in two sections of his review, and identifies astronomical links for both. The two art forms, as they occur in WA, are considered only briefly in this section. There are 452 painted/stencilled motifs in Bates Cave, also known as Mulga’s Cave, near Hyden, south-west WA (Gunn, 2006). Mulga was the man of the Charrnock woman who created the Milky Way (see Section 4.3). The motifs are carbon dated at 500 years but many motifs are superimposed others which Gunn suggests might be older. Gunn (2006: 38) suggests also that the large Geometric designs “... most likely refer to the Dreaming tracks.” He makes no link with night-sky objects. The hand stencil in Dales Cave, near Perth close to the Avon River, has been described in Section 3.2 in relation to the Moon.

Gunn et al. (2011) describe the Kybra petroglyph (engraving) site, south coast WA, on horizontal limestone sheets that are open to the weather. There are 240 motifs, predominantly of emu and kangaroo foot-prints. There is one star, length 24 cm.
The Seven Sisters Songline that crosses the Pilbara and finishes in South Australia is painted on the walls of Walinyna (Cave Hill), near Amata, Musgrave Ranges, South Australia (MacFarlane and McConnell, 2017). It includes many concentric circles and tracks. My web search did not reveal literature describing the painting as a map. The Songline is also pecked (engraved) into the rock at the Kuli waterhole, Musgrave Ranges, South Australia (MacFarlane and McConnell, 2017, citing James, 2009). Other rich rock art sites in WA have not been considered for this review including the aggregations of painted Wandjina spirits and Gwion Gwion (Bradshaw) figures in the Kimberley, rock engravings on the Burrup Peninsular in the Pilbara, and rock engravings in Port Hedland (the Pilbara) at Burgess Point, Mourambine Kariyarra and South West Creek.

12 CONCLUSION
My review of the night-sky knowledge of Western Australian Aboriginal peoples provides examples from Noongar culture that counter a claim that, traditionally, Aboriginal people did not count past four. The counting examples follow similar identified by Norris (2016). Other references indicate that night-sky knowledge was used for practical purposes in Western Australia: particular stars were recognised as being seasonal indicators; and time was defined by lunar phase, lunar months, and by the nature of sunlight, for example twilight; but most commonly by season. Navigation using a star as a guide was not unknown, and star maps were used to teach Songline routes, but I have not identified any media (documents, audio or video) which state that star maps were used in real-time navigation of Songlines. There is Noongar language for cardinal directions, for the spot where the sun rises, and for winds by direction, but I did not uncover precise methods for determining direction.

A number of narratives indicate Aboriginal peoples’ beliefs. That the Earth and Sky were one, in the cold time, then the Sky was lifted up; or the Sky is a canopy meeting Earth at the horizon. That the Sun is the giver of life; and there are various beliefs about where the dead reside. That planets differ from stars and have magic powers. That the Magellanic Clouds provoke death. Meteors and comets were seen, but may not have been distinguished, and were considered bad omens. Tribal doctors carried stones which might have been tektites, or the category of tektites called australites – they were used to call for rain and cure people, amongst other things.

Other narratives with night-sky subjects convey a moral, for example, the man who opted for ‘wrong-way’ marriage became the Moon; and some are creation narratives of landforms, for example, Marala the Emu man (Emu in the Sky) made three toed footprints on the Dampier Peninsular. Several narratives premise the creation of night-sky objects, for example, the Southern Cross, while others explain events, for example, a solar eclipse. In fact, many of the narratives could be interpreted from several perspectives – as conveying beliefs about creation, moral behaviour and events.

My search for references was, in most part, internet-based and was limited mainly to freely available works, so cannot be considered comprehensive. It did not reveal anything, or very little, on several topics considered in the Dawes review (Norris, 2016), namely lunar eclipses, Orion, Scorpius, most of the planets, and stone arrangements. It could be that these topics are ripe for future research in WA. I made personal inquiries about stone arrangements and made little headway. Perhaps the information is secret per se, or men’s knowledge. The sighting and beliefs about aurora and supernova are not included in the review.

Neither did I consider rock art to any great extent. It is a huge topic for Western Australia, and I suggest warrants inquiry from a night-sky perspective. Further investigation of non-digitised early records, and of acrylic paintings and statements by Aboriginal people who carry traditional knowledge, would likely reveal more on many topics in this review. The topic that draws me most is the Seven Sisters Songline through the Eastern Goldfields. Where did the sisters go in addition to the places uncovered so far? Did the Goldfields Songline connect with the Seven Sisters Songline through the Pilbara? There are leads to pursue.

13 NOTE
The typed title page of Ethel Hassell’s journal, ‘My Dusky Friends, Sketches of the South Eastern Natives of Western Australia, Some of their Legends and Customs’, does not include a typed date. It is dated in the literature as Hassell (1861-1910). In 1861 Ethel was five years old, and she didn’t live with her ‘Dusky friends’ until at least 1878. So, in this review, I reference the journal as Hassell (n.d.). The page numbers that I provide are the pencilled page numbers in her journal in the Mitchell Library, Sydney – an electronic copy is available online.

14 ACKNOWLEDGEMENTS
I acknowledge and pay respect to past and present Aboriginal peoples who have shared their night-sky knowledge, and respect the right of others who have not done so. I thank WA Inspired Art Quilters for our projects connected with Aboriginal culture, which led to my inquiry into Aboriginal night-sky knowledge. I thank Ray Norris for his
encouragement to publish, John Goldsmith for his critical review, and Marianne McLaughlan for critical feedback on cultural protocol.

15 REFERENCES


Davis, J., Street M., Malo H., Cherel I., and Woodward E., 2011. Mingayooroo – Manyi Waranggiri Yarrangi. Gooniyandi Seasons, Margaret River, Fitzroy Valley, Western Australia. CSIRO Ecosystem Sciences, Darwin, NT.

http://desertriversea.com.au/art/244 accessed 26/12/19


Estrangin Gallery, n.d.. Web pages. Biljabu
http://www.aboriginalsignature.com/martumilartpeintureaborigene/jakayu-biljabu-country-around-the-canning-stock-route-16-502-91x61-cm; Nungabar

FORM, 2018. Bugai Exhibition Catalogue. FORM, Claremont, WA.


https://books.google.com.au/books/about/A_Vocabulary_of_the_Dialects_of_South_We.html?id=ue8UAAAAYAAJ &redir_esc=y accessed 26/12/19


https://www.researchgate.net/publication/325642982_The_Planets_in_Indigenous_Australian_Traditions accessed 26/12/19


Mulan and Mindibungu Aboriginal Corporations
Muir, K.
Moore, G.F.
https://consultation.epa.wa.gov.au/seven
day-comment-on-referrals/marda-east-gold-
project/supporting_documents/App%202%20Cultural%20Heritage%20Reports.pdf
accessed 27/12/19

Moore, G.F.
accessed 27/12/19

http://anthropologyfromtheshed.com/project/light-time-traditional-noongar-culture/ accessed 26/12/19

https://anthropologyfromtheshed.com/project/conveyor-souls-pied-cormorant/ accessed 26/12/19


Menzies Visitors Centre, n.d.. Lake Ballard and the Seven Sisters Dreaming. Web page. Shire of Menzies, WA.


Moore, G.F., 1884. Diary of Ten Years Eventful Life of an Early Settler in Western Australia; and also A Descriptive Vocabulary of the language of the Aborigines. M. Walbrook, London.
https://ia802604.us.archive.org/20/items/diaryoftenyearse00mooriala/diaryoftenyearse00mooriala.pdf accessed 27/12/19

project/supporting_documents/App%202%20Cultural%20Heritage%20Reports.pdf accessed 27/12/19

Mulan and Mindibungu Aboriginal Corporations, n.d.. Welcome Paruka brochure. Mulan and Mindibungu Aboriginal Corporations, Halls Creek, NT.
https://static1.squarespace.com/static/59fecece017db2ab70aa1874/t/5a7be2078165f5f6263856d7/1518068299850/paruku-visitors-information-guide.pdf accessed 27/12/19


Lyon, R., 1833. A glance at the manners, and language of Western Australia; with a short vocabulary, Perth Gazette and Western Australian Journal Vol 1.
https://en.wikisource.org/wiki/The_Perth_Gazette_and_Western_Australian_Journal/Volume_1 accessed 27/12/19


http://anthropologyfromtheshed.com/project/light-time-traditional-noongar-culture/ accessed 26/12/19

https://anthropologyfromtheshed.com/project/conveyor-souls-pied-cormorant/ accessed 26/12/19


Menzies Visitors Centre, n.d.. Lake Ballard and the Seven Sisters Dreaming. Web page. Shire of Menzies, WA.


Moore, G.F., 1884. Diary of Ten Years Eventful Life of an Early Settler in Western Australia; and also A Descriptive Vocabulary of the language of the Aborigines. M. Walbrook, London.
https://ia802604.us.archive.org/20/items/diaryoftenyearse00mooriala/diaryoftenyearse00mooriala.pdf accessed 27/12/19

project/supporting_documents/App%202%20Cultural%20Heritage%20Reports.pdf accessed 27/12/19

Mulan and Mindibungu Aboriginal Corporations, n.d.. Welcome Paruka brochure. Mulan and Mindibungu Aboriginal Corporations, Halls Creek, NT.
https://static1.squarespace.com/static/59fecece017db2ab70aa1874/t/5a7be2078165f5f6263856d7/1518068299850/paruku-visitors-information-guide.pdf accessed 27/12/19


Salisbury, S. W. et al., 2016. The Dinosaurian Ichnofauna of the Lower Cretaceous (Valanginian–Barremian) Broome Sandstone of the Walmadany Area (James Price Point), Dampier Peninsula, Western Australia, *Journal of Vertebrate Paleontology*, 36 sup1, 1-152. https://doi.org/10.1080/02724634.2016.1269539 accessed 27/12/19


REFERENCES CITED BY OTHERS


Armstrong, F. F., 1836. Manners and habits of the Aborigines of Western Australia, Perth Gazette, Battye Library, Perth.


Barker, C., 1830. No reference provided


