Eramurra Solar Salt Project

Results of acoustic surveys conducted for the Night Parrot (*Pezoporus occidentalis*) and assessment of possible presence in project area

Report to:

Leichhardt Salt Pty. Ltd

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1. Summary

Between December 2019 and February 2020, and again in November / December 2021, several autonomous recording units (ARUs) were deployed at sites within the development envelope for the Eramurra Solar Salt Project, on the Pilbara coast of Western Australia. These ARUs were deployed to survey for Night Parrots (*Pezoporus occidentalis*). Resulting acoustic data was analysed using a signal detection algorithm able to detect Night Parrot calls. No Night Parrot calls were detected. The limited data provided prevent robust conclusions around the presence of Night Parrots in the wider project area. However, analysis of vegetation reports from the project area suggest there is only limited suitable habitat available in the development envelope, and that the project area is unlikely to support a population of Night Parrots.

2. Historical distribution of the Night Parrot

The area of interest for this report is the footprint of the Eramurra Solar Salt Project. The project area is located on the Pilbara coast of Western Australia, approximately 60 km southwest of Karratha. There are numerous historical reports of Night Parrot from the region, although most of these do not have enough supporting information to be considered conclusive (Leseberg *et al*. 2021a). However, the volume of reports from the region, including at least two high veracity reports (Fig. 1; Leseberg *et al*. 2021a), suggest the Pilbara was once a relative stronghold for the species. There is a recent high veracity report from the Fortescue Marsh, approximately 350 km southeast of the project area (Leseberg *et al*. 2021b).

It is noteworthy that the majority of reports, including all high veracity reports, are from inland areas of the Pilbara. While there are some reports from the coast, including a 1966 report from Yarraloola Station, approximately 50 km southwest of the project area, these reports are unverified and may not be records of Night Parrot. Given there are so few historical records from coastal areas when compared with the areas further inland, and that these coastal areas are likely to have been relatively well travelled, it is possible that these areas have never represented critical Night Parrot habitat.

3. Ecology of the Night Parrot

Research from western Queensland (QLD), and emerging research from Western Australia (WA), has demonstrated that Night Parrots occupy long-term stable roost sites for periods of

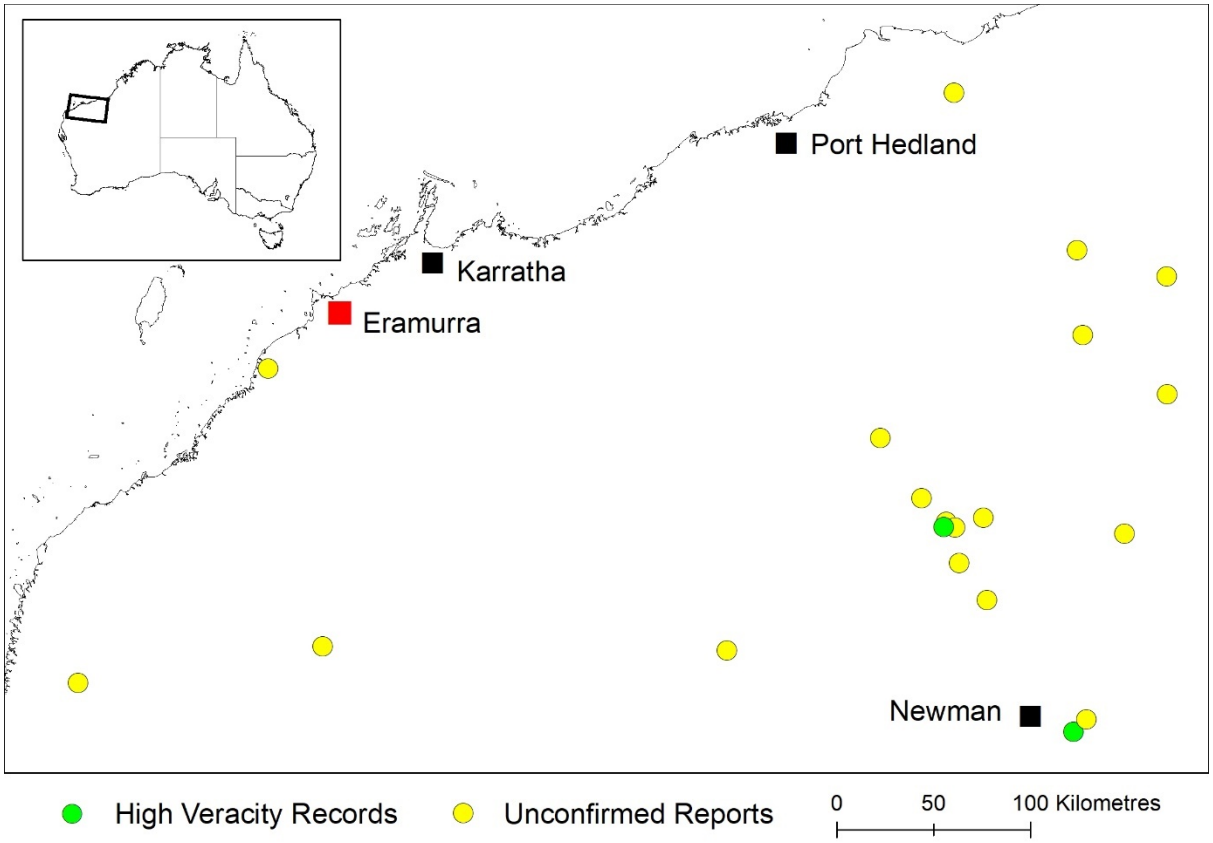

Fig. 1. The location of all reports of the Night Parrot from the Pilbara region of Western Australia (data from Leseberg *et al*. 2021a). Note there are no high veracity reports from coastal areas.

up to several years (Murphy *et al*. 2017b). This site fidelity persists through years that may vary significantly in terms of rainfall (N. Leseberg, unpub. data). These long-term stable roost sites support both roosting and breeding, and are typically established in low, dense vegetation such as *Triodia*, and samphire (Sturt 1849, Andrews 1883). All currently known Night Parrot populations have been found roosting in *Triodia* (see i.e. Jackett *et al*. 2017, Murphy *et al*. 2017b).

A key feature of the areas where Night Parrots have been found roosting in QLD and WA is the long-term stability of cover (Jackett *et al*. 2017, Murphy *et al*. 2017b). For *Triodia* systems, fire is the main disturbance agent that can influence the stability and extent of cover. Indeed, fire regimes that retain cover across localised scales through fostering the establishment and subsequent protection of multiple long unburnt patches of *Triodia*, seem to be a feature of occupied sites in QLD and WA (Fig. 2). These fire regimes may be the result of planned burning aimed at maintaining a variety of age classes or may result from inherent features of

the landscape such as topography that ensures patches of *Triodia* are naturally isolated, and therefore protected from fire (Murphy *et al*. 2018).

Another apparently important factor in the suitability of roosting habitat is the extent and scale over which it occurs. In western QLD there are important roosting sites that are very small in extent; in some cases, only a dozen or so widely separated clumps of *Triodia* on an otherwise bare stony surface that extends for tens of hectares (Murphy *et al*. 2017b). While it is unlikely Night Parrots would persist if this was the total sum of all suitable roosting habitat at a landscape scale, the presence of multiple similar areas of roosting habitat nearby gives this resource a stability at that landscape scale which is apparently a requirement for Night Parrots to persist. This landscape scale availability of suitable roosting habitat has also been noted at sites where the birds occur in WA (Jackett *et al*. 2017).

Fig. 2. Four different sites where Night Parrots have established long-term stable roosts. The *Triodia* is not necessarily extensive, but has complex structure and at least some large hummocks. Sites are invariably open with few trees or shrubs.

In addition to suitable roosting habitat, Night Parrots require suitable feeding habitat. Unpublished DNA analyses of faecal samples show that Night Parrots in western QLD eat a relatively broad array of food plants including grasses (e.g. *Triodia longcieps*, *Uranthoecium truncatum*, *Brachyachne ciliaris*, *Astrebla lappacea*, *Dactyloctenium radulans*) and forbs (e.g. *Trianthema triquetra*) (N. Leseberg unpub. data). The nightly foraging activity of Night Parrots in western QLD focuses on productive patches where these food plants are relatively abundant (Murphy *et al*. 2017b). These productive patches are characterised by their hydrology, relative floristic diversity within an unproductive landscape, and the quick growth response of their vegetation following inundation. These run-on zones may be small, and only inundated after local rain (e.g. gilgai formations), or extensive, and inundated by large flood events which may result from rain far upstream (e.g. floodplains). It is the presence of topography which creates these productive patches, that in turn supports the presence of Night Parrots. Preliminary research in WA suggests Night Parrots rely on similar habitat.

Overlaying this requirement for distinct feeding and roosting habitats is the Night Parrot's physical ability to access the resources it requires. A Night Parrot tracked using a GPS tag over several nights in western QLD was travelling to feeding and drinking sites up to 10 km from its roost site, and moved a minimum of 40 km on one of those nights while accessing these resources (Murphy *et al*. 2017b). The mean distance moved each night (noting that this is a minimum given limitations in the way tracking data is obtained) was around 30 km. Over a period of several nights the bird moved within an area of nearly 3500 ha, although the nightly mean was around 800 ha. Given the small sample size, it is not known whether these distances and areas are typical for the species – it may be capable of covering much larger distances – but they provide a starting point for assessing the species' ability to access resources within a wider landscape.

4. Night Parrot habitat in the project area

Based on reports prepared by Phoenix Environmental Services (PES), there is potential Night Parrot habitat in the project area (Phoenix Environmental Services 2022). Land systems that could support the hard spinifex required by Night Parrots for roosting and breeding represented 16.8 % of the project area, while the Horseflat System, representing potential feeding habitat for the Night Parrot, covered 62.8 % of the project area. The presence of these two habitat types suggests that Night Parrots may have occurred in the area historically.

Table 1. Notes on the suitability of survey sites as potential Night Parrot roosting habitat.

Site	Habitat Notes	Suitability
NP01	Extensive open *Triodia*, some large hummocks, few shrubs	Possibly suitable
NP02	Extensive open *Triodia*, few shrubs, but hummocks apparently quite small	Unlikely to be suitable
NP03	Open *Triodia*, few shrubs. Not clear whether hummocks are of sufficient size	Possibly suitable
NP04	Extensive open *Triodia*, some large hummocks, few shrubs	Possibly suitable
NP05	Extensive *Triodia*, with some large hummocks, but significant shrub cover	Unlikely to be suitable
NP06	Extensive *Triodia*, with some large hummocks, but appears to have significant shrub cover	Unlikely to be suitable
NP07	Extensive *Triodia*, with some large hummocks, but significant shrub cover	Unlikely to be suitable
NP08	Extensive *Triodia*, with some large hummocks, but appears to have significant shrub cover	Unlikely to be suitable
NP09	Limited *Triodia* cover, with only small hummocks. Significant shrub cover	Unsuitable
NP10	Some *Triodia*, with some large hummocks, but appears to have significant shrub cover	Unsuitable
NP11	Some *Triodia*, with some large hummocks, but appears to have significant shrub cover	Unsuitable
NP12	Extensive *Triodia*, with some large hummocks, but appears to have significant shrub cover	Unlikely to be suitable
NP13	Extensive *Triodia*, with some large hummocks, but significant overstorey	Unsuitable
NP14	No photo provided; report states site is open grassland containing primarily large hummocks of unburnt *Triodia*	Possibly suitable

However, site descriptions and photographs provided by PES of potential Night Parrot roosting habitat identified within the project area suggest suitable roosting habitat is limited. Based on these photos and descriptions, only four of the 14 selected survey sites appeared to possibly contain *Triodia* with the required size, structure, and complexity to support roosting Night Parrots (Table 1). It is difficult to make firm conclusions on habitat quality based on a single

photograph, but even at those four possible roosting sites it appears the *Triodia* represents marginal Night Parrot roosting habitat when compared to sites where birds have been found. It is not immediately clear why the *Triodia* has not attained the necessary size, structure and complexity. The report notes that time since fire at each site is greater than five years. At sites where Night Parrots are known to occur, time since fire has been assessed as several decades (Murphy *et al*. 2016). Other factors can affect the growth patterns of *Triodia*, including access to water and substrate. If suitable roosting habitat is of the limited extent suggested by the PES report, it is unlikely the wider landscape supports sufficient suitable roosting habitat necessary for Night Parrots to persist in the project area.

5. Detecting Night Parrots

Night Parrots have predictable year-round calling periods at dusk and dawn (Murphy *et al*. 2017a, Leseberg *et al*. 2019). This ensures that if Night Parrots are roosting at a particular site, the likelihood of detecting them using ARUs is very high, provided the ARU is placed for a minimum of four nights in calm weather, and the recorder is set to record during the peak calling periods (Department of Parks and Wildlife 2017). During breeding, and following large rain events, calling is more frequent, extends throughout the night, and the likelihood of detection is increased (Murphy *et al*. 2017a). Preliminary results from research in central Western Australia suggest patterns of behaviour in that region are similar (Jackett *et al*. 2017).

Night Parrots are also known to call during the night at feeding and drinking sites (S. Murphy, N. Leseberg, N. Jackett unpubl. data). Anecdotal evidence suggests they may call when moving between these sites (N. Leseberg, N. Jackett, S. Murphy unpubl. data). However, the detection of birds away from roosting sites is likely to be a chance event given the large area over which birds range at night (Murphy *et al*. 2017b). Night Parrots are known to drink, and modelling suggests they may be reliant on free-standing water (or succulent food containing >55% water) during hot weather (Kearney *et al*. 2016). Birds have been detected in the Great Sandy Desert by focusing survey effort at water sources (J. Brown pers. comm.). It is likely this technique will be most effective during periods of water scarcity, when survey effort can focus on just a few possible locations.

The likelihood of detecting Night Parrots during acoustic surveys is influenced by the type of ARU being used. For this survey Song Meter 4s and Song Meter Minis (Wildlife Acoustics,

MA, USA) were used. In calm conditions, a Song Meter 4 fitted with new microphones is known to be capable of reliably detecting 95% of Night Parrot calls out to a range of around 200 m (Leseberg *et al*. 2022).

6. Survey effort

Details of the survey period for each site are included at Table 2. Data were only provided by PES for 10 of the 14 survey sites. Of those 10 sites for which data was provided, enough data was provided from seven sites to allow robust conclusions around Night Parrot presence in the immediate vicinity of those sites.

Table 2. Notes on acoustic data provided by site, and whether robust conclusions around Night Parrot presence can be supported.

Site	**Nights**	**Notes**	**Conclusions possible**
NP01	4	ARU malfunction; still recorded four nights of data.	Yes
NP02	36		Yes
NP03	34		Yes
NP04	21	ARU program error; record until ≈ 0300 each night.	Yes
NP05	0	No data provided	No
NP06	0	No data provided	No
NP07	1	ARU malfunction; only 1.5 hours of data recorded	No
NP08	17		Yes
NP09	6*	See note below	Yes (see note)
NP10	6*	See note below	Yes (see note)
NP11	0	No data provided	
NP12	6*	See note below	Yes (see note)
NP13	2	Only two nights of data recorded	No
NP14	2	Only two nights of data recorded	No

* Data provided for two of NP09, NP10 and NP12, but not labelled sufficiently to tell which

7. Data analysis

Acoustic analysis was undertaken using the software Kaleidoscope Pro v5.2.1, targeting the frequency range of 1000 – 4000 Hz, within which all known calls of the Night Parrot are distributed (Leseberg *et al*. 2019). Searching for calls over a large frequency range such as this is likely to produce a high number of false-positive results due to many other bird species calling at similar frequencies but is a necessary procedure in order to capture the potential repertoire of Night Parrot.

Potential Night Parrot calls detected during the analysis were compared to a reference library comprising several thousand Night Parrot calls from Western Australia. This library consists of calls recorded at sites where Night Parrots have been confirmed using visual means and is therefore considered of high reliability. The library also comprises multiple examples of all known call types from Western Australia (Leseberg *et al*. 2019).

Kaleidoscope Pro search parameters were tested using a random selection of 250 Night Parrot call examples manually detected from both Great Sandy Desert and East Murchison datasets, of which 205 (82.0%) were automatically detected. Calls not detected were typically extremely faint. The probability of non-detection of a true-positive call was 18.0%; two true-positive calls was 3.2%; three true-positive calls was 0.6%; etc. Of the data tested, the median number of consecutive (spaced at < 5 minutes apart) calls in a sequence when Night Parrots were recorded was 5 (1–34, n = 29). The probability of at least one call being detected within a sequence of median length, assuming there was variation in the location of the source of the call, was > 99.9%.

The technique described has been used to successfully detect Night Parrot calls in datasets from Western Australia. Night Parrot calls vary significantly, even at the local scale (Leseberg *et al*. 2019). However, given the similarity in the structure and quality of known Night Parrot calls from across the bird's range, we expect this system would reliably detect at least some of the likely Night Parrot calls that would occur in this dataset if Night Parrots were roosting or feeding in proximity to the survey sites.

8. Survey results

No calls attributable to Night Parrots were detected during the analysis. It is therefore unlikely any long-term stable Night Parrot roosts exist within approximately 200 m of the points for which data was provided for analysis. It is important to note that given the nature of this survey, which targeted only a few specific sites within a matrix of potential habitat, this analysis only permits conclusions about the presence of long-term stable Night Parrot roost sites within close proximity to the sampling sites at the time of sampling. Without further information about the extent of possible roosting habitat within the project area, it is not possible to conclude whether the absence of detections reflects a true absence of Night Parrots within the area where the surveys occurred.

9. Conclusion

Although analysis of the provided acoustic data did not detect any Night Parrot calls, given the limited number of sites surveyed and uncertainty around what proportion of suitable roosting habitat was sampled, a robust conclusion around the presence or absence of Night Parrots in the project area based on acoustic data alone is not possible. However, a brief desktop analysis of vegetation reports provided by PES suggests that suitable roosting habitat either may not exist within the project area, or may be of very limited extent. If this is the case it is very unlikely that Night Parrots occur within the project area, and further acoustic surveys are unnecessary.

If a more conclusive answer on the presence of Night Parrots is required, this could be achieved through a more detailed desktop analysis of habitat in the project area, preferably using a combination of high-resolution satellite imagery, fire mapping, and site photographs. This would clarify whether suitable roosting habitat actually exists within the project area, and if so, what proportion of that habitat was sampled, and whether further surveys are necessary.

10. References

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