Nature Glenelg Trust

Middle Island Little Penguin Monitoring Program

2015-16 Season Report

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Project Partners:

middle island maremma project

Warrnambool Coastcare Landcare Group

Warrnambool City Council

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Cover photos (left to right):

Volunteers crossing to Middle Island (J Bourchier), Maremma Guardian Dog on Middle Island (M Wells), Sunset from Middle Island (J Bourchier), 2-3 week old Little Penguin chick (J Bourchier), 7 week old Little Penguin chick (J Bourchier)

Disclaimer

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- Middle Island Project Working Group, which includes representatives from WCLN, Warrnambool City Council, Deakin University, Department of Environment, Land Water and Planning (DELWP).
- Warrnambool City Council.
- Philip Island Nature Park.

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1. SUMMARY

The Middle Island Little Penguin monitoring program, run by Warrnambool Coastcare Landcare Network, has now completed its tenth monitoring season. The program commenced in 2006 with the aim of monitoring the recovery of the Little Penguin colony on the island following a number of years of severe fox predation. The program directly informs the Middle Island Working Group and the Maremma Project (managed by Warrnambool City Council) about the effectiveness of current management actions.

Over the duration of the Maremma Project, no Little Penguin mortalities attributed to fox kills have been observed on Middle Island, although some sightings of foxes have been reported in Stingray Bay. The Little Penguin monitoring has indicated a recovery in the colony in the terms of the number of adult penguins arriving to the island during dusk arrival counts over their breeding seasons, and evidence of successful breeding attempts and rearing of fledglings.

Over the 2015/16 monitoring season, arrival counts and breeding surveys, indicate a stabilisation in recovery of Little Penguin numbers following observed declines during the previous seasons. The estimated colony size, calculated from the peak arrival count figures for the 2015/2016 breeding season was 123, compared to 130 in 2014/2015, and 103 for 2013/2014. Based on existing methods, 9 breeding pairs were recorded, with 17 eggs laid, and a 100% hatch rate. These suggests a large improvement of breeding on previous years, although survey effort has varied.

To undertake monitoring, the Middle Island Little Penguin monitoring program received approximately 300 hours of voluntary support and also attracted six separate media crews producing newspaper articles, documentaries, television show segments and stock footage to be used by media crews in the future. These crews highlight the conservation efforts by volunteers on Middle Island.

Revisiting the aims and monitoring methods of the monitoring program would be beneficial to ensure that human related stress is reduced to a minimum, achieve a consistent survey effort and capture any early breeding. Specific monitoring equipment, such as a burrow scope will also assist with reducing the stress on Little Penguins and revising current and historical seasonal data estimates for arrival counts will improve comparison of breeding effort between seasons.

2. BACKGROUND

Middle Island, located off the coast from Warrnambool, Victoria, currently supports a population of approximately 130 Little Penguins (*Eudyptula minor*) (Bourchier 2015) (Figure 1). The island, its resident penguins and their conservation story have recently been highlighted in the movie 'Oddball', which was released in 2015. 'Oddball' has substantially increased community interest in Little Penguins at Middle Island and the use of guardian dogs in conservation programs.

Figure 1. Location map of Warrnambool (inset) and Middle Island (red) with surrounding coastal features.

The Middle Island Maremma project was introduced as a trial in October 2006 after a devastating fox predation event in 2005, where 268 Little Penguin carcasses were found on Middle Island. A Maremma Sheepdog was placed on the island to protect the Little Penguins from canid predation, in particular red fox (*Vulpes vulpes)* and domestic dogs (*Canis lupus familiaris*). The trial was a success, with no foxes observed on Middle Island during the trial (King et al., 2015). The Middle Island Little Penguin monitoring program was implemented to examine the population recovery of Little Penguins after the introduction of the guardian dog trial, funded by the Warrnambool City Council.

The Little Penguin monitoring program on Middle Island was developed and continues to be managed by the Warrnambool Coastcare Landcare Network (WCLN), with delivery by Nature Glenelg Trust (NGT) from 2012 to present (Kivisalu, 2013; Kivisalu, 2014; Bourchier, 2015). The WCLN determined a program based on that implemented at Phillip Island Nature Park (Dann, 1992), which has two core monitoring methods:

- **Dusk arrival counts** – providing an indirect measure of the adult Little Penguin colony size; and
- **Breeding surveys** – assessing the presence and success of breeding activity within the Little Penguin colony.

Data gathered by the Middle Island penguin monitoring programs, together with canid observations and information from the public, are provided to the Middle Island Project Working Group (MIPWG) so that it can be determined whether the Maremma Project is meeting its key objectives (Kivisalu, 2014). The MIPWG also uses this information to help guide other management decisions for the Little Penguins and Middle Island.

Historically, the Little Penguin Middle Island population was observed to be substantially larger (Kivisalu, 2014). During the 1999/2000 Little Penguin breeding season the peak population was estimated at 800, with 342 active burrows recorded (Overeem & Wallis, 2003). Following the fox predation events, monitoring resumed in September, at the beginning of the 2005/06 breeding season. The population had substantially declined, recording only 52 active burrows and 4 penguins during the dusk arrival count (estimated population 7), with no evidence of breeding (Overeem & Wallis, 2007). Further monitoring was abandoned over the season due to the poor results.

The first dusk arrival count undertaken following the introduction of the Maremma guardian dogs (November 2006) recorded 31 Little Penguins (estimated population 51) at 6 sites, with a peak of 70 (estimated population 116) on 8th December 2006. Breeding surveys conducted throughout the 2006/07 season recorded thirteen fledged chicks, and no Little Penguin kills attributed to fox predation (King, 2007). As a result of this successful outcome, the Middle Island Maremma project has continued and now serves as a world first conservation project using the guardian-dog technique to protect native seabirds.

Although there have been several confirmed reports of fox activity around the Stingray Bay area, to date no observed fox kills on Middle Island have been recorded following the initiation of the Maremma Project. With the exception of the 2013/14 season, when sea surface temperatures were particularly high, arrival counts of Little Penguins have generally indicated a steady increase in both colony size and breeding success on Middle Island.

3. OVERVIEW OF THE 2015-16 MONITORING PROGRAM

3.1. Arrival Counts

Fortnightly arrival counts were conducted at dusk on Middle Island by volunteers from September 2015 to late February 2016. The procedure is based on methods used at Phillip Island Nature Park (Dann, 1992) and as initiated at Middle Island by Overeem and Wallis (2003). Under this methodology volunteers cross to Middle Island and are stationed at six known penguin landing sites (where the adult Little Penguins are known to move from the sea to access their respective nesting sites on the upper surface). . This season, only four of the landing sites were used, with two (site 4 and site 5) (Figure 2) omitted due to safety concerns for volunteers and the observed disturbance caused to penguins moving within these sections of the islands by volunteers.

The dusk counts align with the peak daily time of arrival of adults from foraging at sea. Once the first Little Penguin is observed at a landing point, volunteers count the number of adults arriving for one hour. Studies have shown at least 60% of a little penguin colony comes ashore during this time, as only a proportion of adults belonging to the colony return to their land based nest sites at night (Dann, 1992). These counts were used as a basis to generate the population estimate. The number of sites volunteers were positioned at was reduced from the historical six sites in 2000, to five during the 2012/2013 and 2014/2015 and down to four during the 2013/2014 and current season due to safety reasons (Fig 2). The two landing sites omitted provided few observed penguin arrivals (observed arrivals at sites no longer used), impacting the nightly observed count and population estimates slightly. Studies of the Little Penguins have found that least 60% of a penguin colony comes ashore during the hour long counts, therefore the observed arrivals is used to calculate the population estimate (i.e. arrivals observed/0.6 (60%) = population estimate).

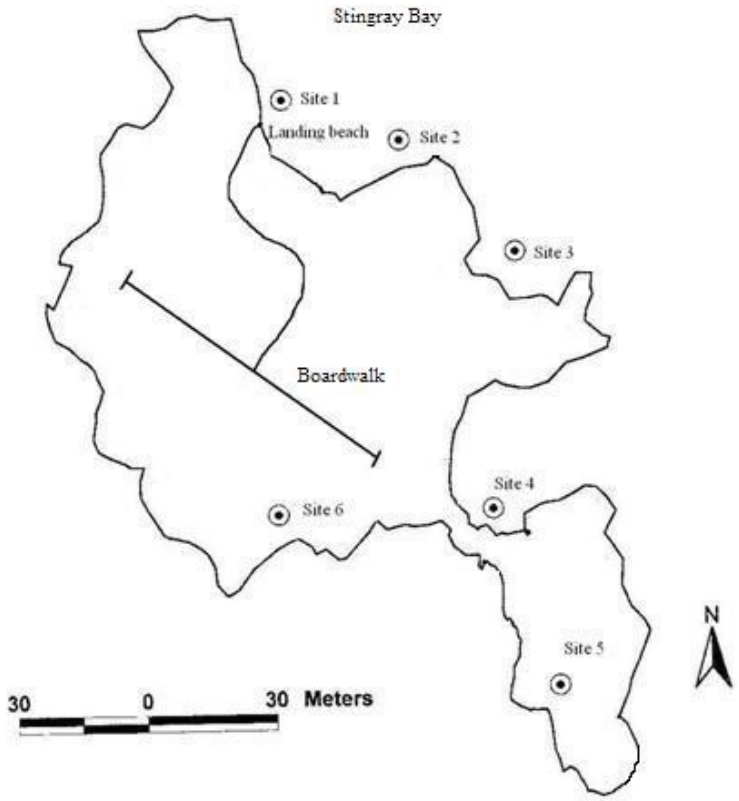

Figure 2: Trace map of Middle Island showing the historical six landing sites (Overeem & Wallis, 2003). During the 2015/16 season sites 4 and 5 were not used due to safety reasons.

There is natural variation in the number of adults expected to arrive throughout the breeding season, based on the timing of key breeding activities, with the current season consistent with this variation (Fig 3). Peak arrival counts are usually observed around December/January when the majority of chicks hatched are old enough to be independent of a parent during the day and both parents travel to and from the island to forage. A decline in arrival numbers after the majority of chicks have fledged is due to adults foraging at sea for longer periods of time to build fat stores in preparation for the annual moult or to feed before attempting a second clutch.

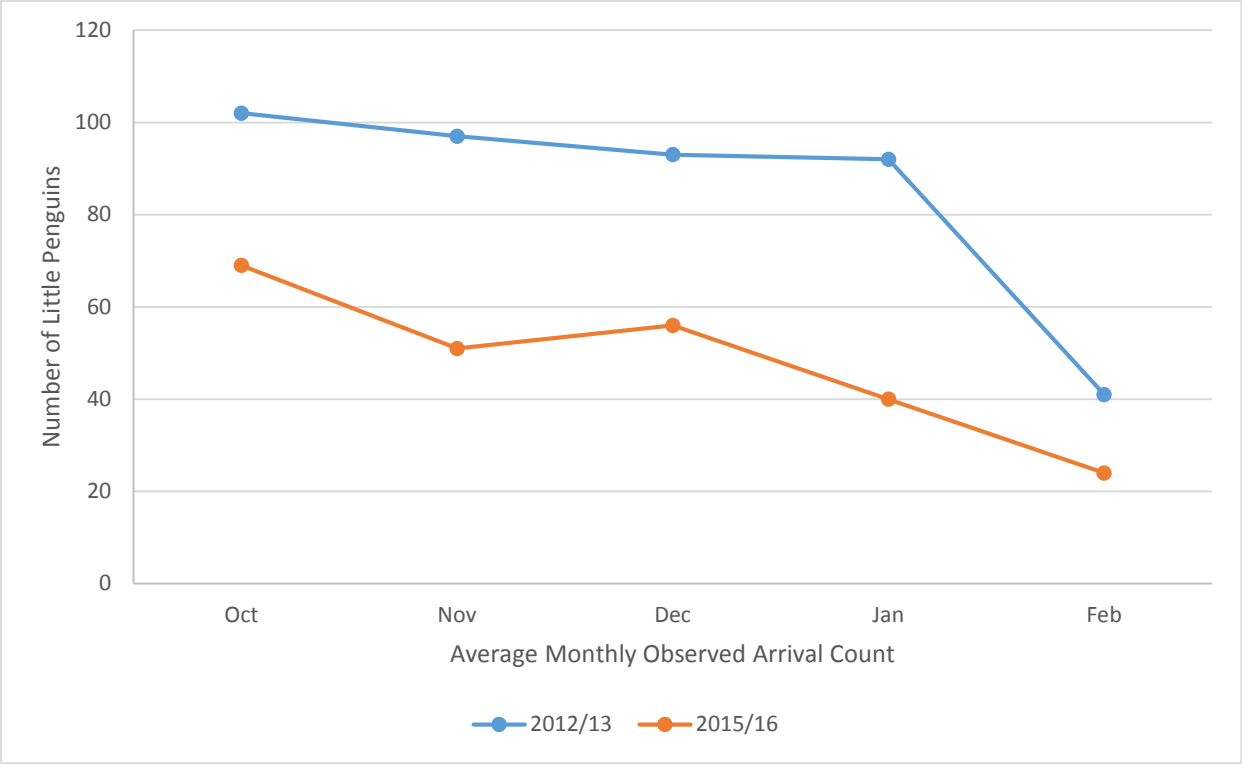

Figure 3: Variation in inter-seasonal arrival counts, in 2012/2013 and 2015/2016 seasons.

During the 2015/16 breeding season nine dusk arrival counts were conducted between 30 September 2015 and 25 February 2016. Two arrival counts (29 December 2015 and 13 January 2016) were cancelled due to adverse weather. There were two peaks in the arrival counts, with 74 arrivals observed on 18 October and 71 arrivals observed on 30 November, giving population estimates of 123 and 118 respectively (Fig 4).

The estimated population of Little Penguins on Middle Island during 2015/16 (123 individuals) is comparable to 2014/15 (130 individuals), with the observed peak number of arrivals 74 in 2015/16 in comparison to 78 in 2014/15 (Fig 5).

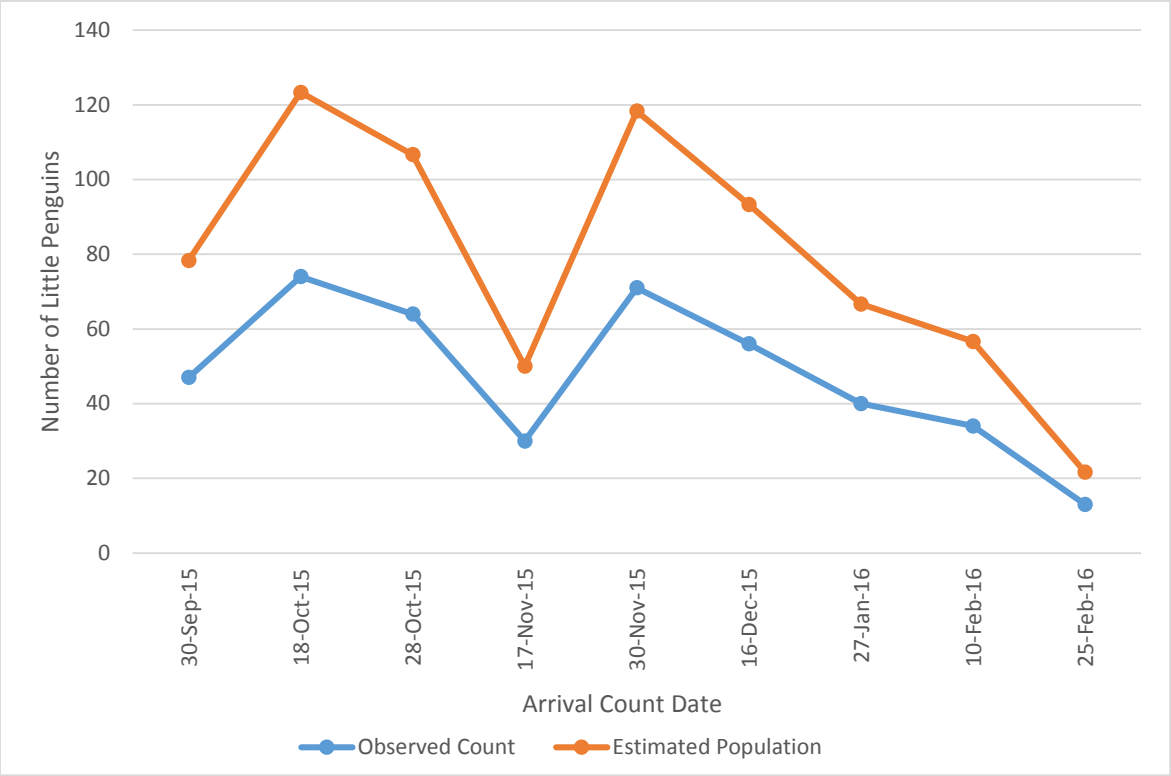

Figure 4: Number of observed arrivals and estimated colony size of *Eudyptula minor* (Little Penguin) at Middle Island over the 2015/2016 breeding season.

An unexpected decrease in the number of arrivals observed occurred mid-season on 17 November 2015, with only 30 individuals counted (Fig. 4). This was attributed to a high level of light and movement disturbance at the landing point (site 6) during presence of a filming crew, where the majority of Little Penguins are normally observed during the dusk counts. As the disturbance occurred during the dusk arrival count immediately prior to the second peak arrival count, it is quite possible that the true peak may have occurred on this night, had it not been for the disturbance.

The omissions of two landing sites for recent seasons (from 2012 onwards) that have been historically counted will affect overall arrival estimates as well as the ability to analyse inter-seasonal trends. Count figures may be proportionally lower than the true arrival estimate as a result. It could suggest, based on available datasets (since 2012-13), the recently omitted sites account for an average variation in total arrival figure of 1.42% (Site 5) and 2% (Site 4). However the lack of available raw data before 2012 currently limits the ability to accurately analyse the impact of omission of these sites from count data.

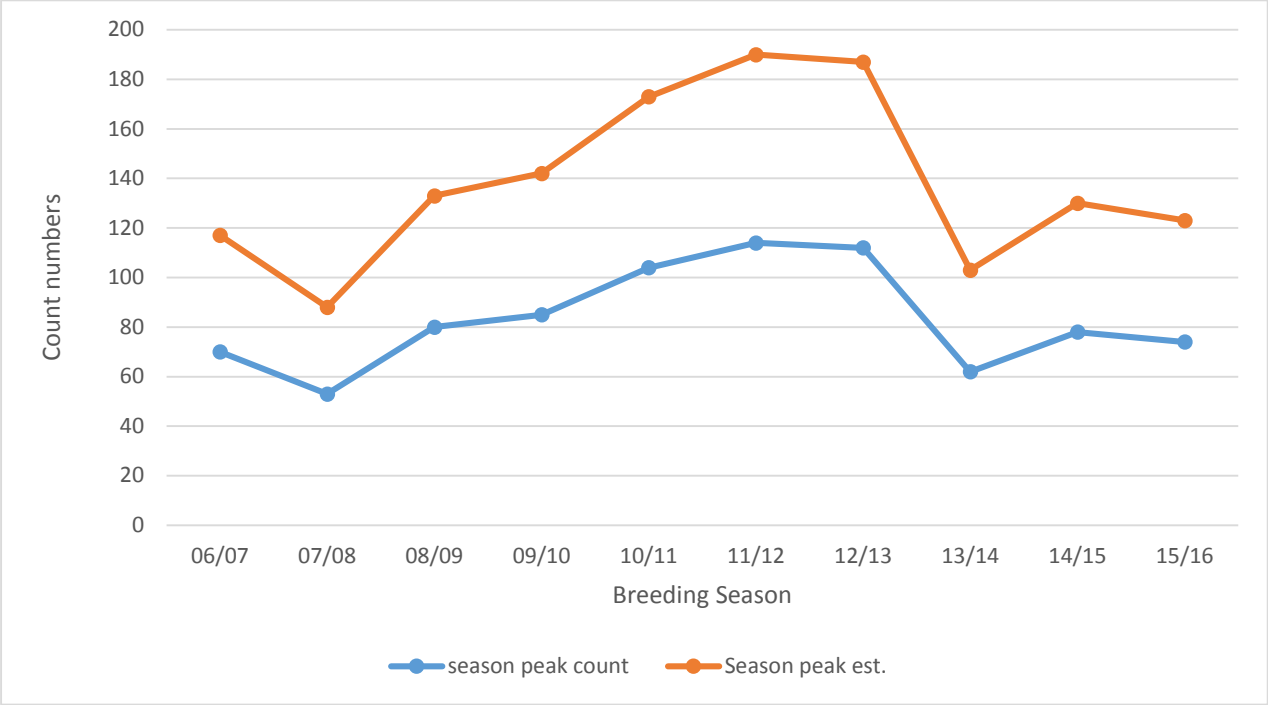

Figure 5: Peak arrivals observed and peak estimated colony size over breeding seasons at Middle Island

The population of Little Penguins at Middle Island appears to still be recovering from the decline during the 2013/14 breeding season (Fig 5). This decline was believed to be due to warm sea surface temperatures (SST) across most of the Australian Coastline, which also caused mass mortality of Short-tailed Shearwaters (*Ardenna tenuirostris)* (Peter & Doley, 2014).

On 17 November of this season a significant human disturbance event occurred during the dusk arrival count, which is thought to potentially explain the low arrival count recorded on the night. This event occurred at a time when historically the peak the arrival counts were observed (Bourchier, 2014), consequently it may have meant that the true peak in observed arrivals was not witnessed in the 2015/2016 season. Therefore, it is conceivable that the population number was potentially be higher than the 2014/15 breeding season and the Little Penguin population is continuing to steadily increase, rather than remaining stable.

3.2. Breeding Surveys

Breeding surveys, aimed at measuring breeding success, were completed by volunteers specifically trained by Phillip Island Nature Park, on a fortnightly basis. A defined area of nesting habitat on Middle Island was routinely checked for the presence of breeding adults (fig. 6).

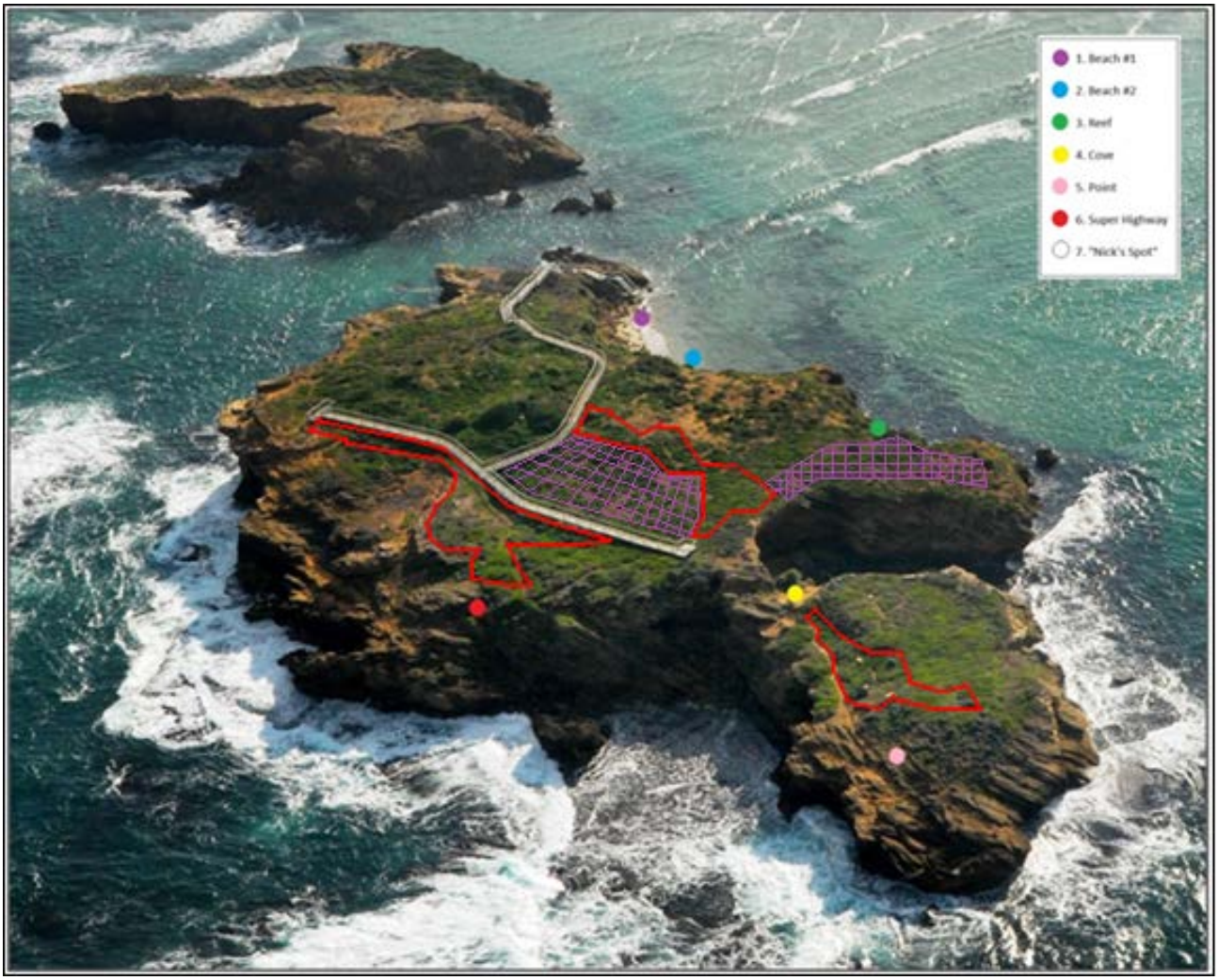

Figure 6: Previous breeding survey area (displayed in red) with additional area (purple) surveyed during the current breeding season.

This survey area included both artificial (nest box) and natural (burrows) breeding sites. While the survey area is relatively consistent over each season, and is selectively chosen in areas safely accessible by volunteers, there is some inter-seasonal variation based on the opportunistic location of active burrows and their accessibility. Data was collected for each identified active burrow on the number of eggs laid and chicks raised and fledged per breeding pair.

Key measures of breeding success for the purpose of this project were defined as:

- ***Hatching success:*** number of chicks hatched / eggs laid
- ***Fledging success:*** number of chicks fledged / chicks hatched
- ***Egg success:*** number of chicks fledged / eggs laid
- ***Fledging rate:*** number of chicks fledged / breeding pairs (range = 0 to 6 including multiple clutches)

The first breeding survey and nest check was carried out on 19 August 2015, inspecting all artificial nest boxes (50) and a large number of natural burrows (at least 61) on the upper vegetated surface of Middle Island. Twenty-five active burrows were recorded containing ten eggs and nine chicks, with one pair of chicks at the post-guard stage (four weeks old) (Table 1). This suggests another early start to the breeding season, with the first egg being laid in late June and the mean date of first clutch (average date first clutch was laid) being 15th July 2015. The mean date of first clutch is comparatively earlier than recorded for other seasons (Table 1).

Berlincourt and Arnould (2015) found that peak-laying at London Bridge (approx. 47km south east of Middle Island) and Gabo Island (eastern Victoria) in the 2011/2012, 2012/2013 and 2013/2014 breeding seasons was associated with local sea surface temperatures and chlorophyll-a concentrations. This suggested that an earlier change in sea surface temperatures and/or sea surface chlorophyll-a initiates earlier breeding. Results showed peak-laying occurring between 14.0°C (±0.3) and 15.2°C (±0.8) at London Bridge. It is suggested that Little Penguins may use the rate of change in water temperature as a cue to commence breeding (Berlincourt & Arnould, 2015). In the current 2015/2106 breeding season at Middle Island sea surface temperatures fluctuated between 14°C and 16°C throughout June, becoming more consistent at 14°C in early July (National Oceanic and Atmospheric Administration, 2016). These temperatures suggested an early breeding season could occur, which was then observed on the island.

A total of 7 breeding surveys were completed for the season, commencing on 19 August 2015. The last breeding survey of the 2015/2016 season was completed on 16 December due to concerns of human disturbance through increased tourist visitation to Middle Island and the handling of Little Penguins. The last two breeding surveys conducted only included the assessment of artificial nesting boxes due to the high risk of burrow collapse around the natural burrows. Opportunistic observations during dusk arrival counts reported a number of post guard chicks on the upper vegetated surface, indicating a larger number of breeding pairs than was recorded. This is also supported by the peak population estimate of 123, suggesting that a greater proportion of breeding pairs may have been present on Middle Island at this time.

In total 26 breeding pairs were recorded, with 46 eggs laid, 43 of which hatched and 17 chicks were recorded as fledged. As the hatching and fledging success of a number of breeding pairs is unknown due to the early cessation of monitoring, data for these hatchlings has subsequently been excluded from analysis. This resulted in the analysis of nine breeding pairs which laid 17 eggs (Table 1).

Table 1: Statistics of Little Penguin breeding surveys conducted on Middle Island for the 1999/00, 2006/07, 2009/10, 2010/11, 2011/12, 2013/14, 2014/15 and 2015/16 breeding seasons (source 1999/2000: Overeem & Wallis, 2003;source 2006-2016; WCLN unpublished data

Breeding Parameters	1999/2000	2006/2007	2009/2010	2011/12	2012/13	2013/14	2014/15	2015/16
Breeding pairs	57	6	17	16	10	2	6	9
Eggs laid	126	15	30	37	16	4	12	17
Eggs hatched	95	13	22	27	12	3	12	17
Chicks failed	7	0	5	6	1	0	0	0
Chicks tagged		6	17		5	3	0	4
Chicks fledged	88	13	17	21	11	3	12	17
Clutches laid					10	2	6	9
Egg/pair	2.2	2.16	1.76	2.31	1.6	2	2	1.88
Eggs hatched/pair	1.67	2.17	1.29	1.29	1.2	1.5	2	1.88
Eggs hatched/egg laid	**0.85**	**0.87**	**0.73**	**0.73**	**0.75**	**0.75**	**1**	**1**
Chicks tagged/pair			1		0.5	1.5	0	0.44
Chicks fledged/egg laid	0.7	0.87	0.57	0.57	0.68	0.75	1	1
chicks fledged/egg hatched	0.93	1	0.77	0.78	0.92	1	1	1
Chicks fledged/pair	**1.49**	**2.17**	**1**	**1.31**	**1.1**	**1.5**	**2**	**1.88**
Mean weight -chicks at tagging	1081		1075		1120			1272.5
s.e.	50.9		51.84		53			
s.d	114		115.9		106			
Mean date of first clutch	(November)				29th September	1st December		15th July
Decimal mean date	11				9.98	12.01	7.8	
number of burrows checked (*n*)	50		41		55	26	40	

Of the 17 eggs laid, all hatched (hatching success 100%), and all fledged, giving a fledging success of 100%, and an egg success of 100%. A fledging rate of 1.88 fledglings per pair was found. The fledging rate is comparable to the previous breeding season (2014/2015) of 2 fledglings per pair, which is quite a high rate that suggests high food availability throughout the season and subsequent early onset of egg laying (Overeem & Wallis, 2003).

The survey effort between seasons has varied and this may introduce some sampling error in relation to estimates outlined in Table 1. Hence, a consistent survey effort across seasons, either by using the same defined survey area, noting and account for the survey effort in statistical analysis (number of burrows checked), or establishing survey transects would improve the robustness of breeding success comparisons between seasons.

3.3. Additional Observations

3.3.1. Chick Abandonment

In early January 2016, opportunistic observations during a 'Meet the Maremma' tour to Middle Island discovered a Little Penguin chick carcass on the beach. The carcass was weighed at 330g and aged at approximately 3 weeks old (Mel Wells, personal communication, 8 January 2016). It was determined the chick had been abandoned by its parents and fallen down the cliff onto the beach. Chick abandonment occurs when adult penguins are triggered to begin their annual moult before completing chick rearing, or experience stress in food availability. During the annual moult parents, must stay at sea to forage for up to three weeks before returning to land to begin the annual moult, and may have commenced foraging instead of returning to the nest to feed chicks. One other penguin chick carcass was found on the upper vegetated surface. It was also determined that this chick had been abandoned.

3.3.2. Trespasses and vandalism

Trespassing and vandalism has been an ongoing issue at Middle Island during past breeding seasons. Middle Island is closed to the public and the local community are very active in calling authorities when they observe potential trespasses on the island. Throughout the monitoring season up to five reports of trespasses were made to authorities, all of which were investigated by police or Warrnambool City Council (WCC) staff. Investigations discovered the trespassers were indeed volunteers conducting monitoring or WCC staff tending to the guardian dogs (Peter Abbott, personal communication, 7 March 2016).

Due to the release of the movie "Oddball" in September 2015, many visitors made their way to the beach area of Middle Island but no vandalism was recorded. Observations by WCC staff reported many locals informed visitors that Middle Island is closed to the public, reducing the chance of trespasses (Peter Abbott, personal communication, 7 March 2016).

3.4. Community Engagement and Media Coverage

Volunteers are essential to the Middle Island Little Penguin monitoring program and this season approximately 300 hours of in-kind time from volunteers was accrued over the arrival counts and breeding surveys. This in-kind support included breeding survey training at Phillip Island Nature Park by four volunteers. This training skilled the attending volunteers in penguin handling and microchipping. Fifteen new subscribers signed on to the email distribution list, where project updates were posted.

The volunteer committee of Warrnambool Coastcare Landcare Network (WCLN) manages the Little Penguin monitoring project. This includes seeking and managing funding, participating on the Middle Island Project Working Group, promoting the opportunity for the community to participate in monitoring counts, marketing the project and keeping project partners informed of project progress and issues.

'Oddball' the movie, which was released in September, is loosely based on the Maremma Project and Little Penguin monitoring program. The Premier of 'Oddball' was held in Warrnambool, co-ordinated by WCC. Movie screenings in Warrnambool were sold out for over 2 months after the premier, reiterating the continual interest in the project by the local community.

Nature Glenelg Trust organised a premiere screening 'Oddball' in Mount Gambier, with 300 people attending. Prior to the screening a background on the Little Penguin monitoring project, conservation challenges faced by the species and Maremma Guardian dogs was provided to the audience. The event stimulated a lot of interest in the project and following the event, a number of attendees were interested in volunteering to assist with dusk arrival counts. School education sessions were also held in Mount Gambier with 5 schools attending over 2 sessions. Over 190 students (ages 5 to 15), teachers and parents were given a presentation about Little Penguins, conservation and the history of the Middle Island project before watching 'Oddball'.

During the current breeding season there were six visits to Middle Island by media crews and volunteers. Two of these visits were made by WCC staff to film stock footage to use for future media enquiries. The remaining visits were made by the BBC, Channel 7 'Sunday', the New York Times and ITV (UK). To arrange these visits a considerable amount of communication to the media crews and MIPWG Working Group was required to ensure human disturbance to the Little Penguins was kept to a minimum. Approximately an additional 30 hours was contributed as part of the volunteer coordinator role to support media related activities and planning.

4. Recommendations

Concerns about human impact induced stress on the Little Penguins on Middle Island were raised during the season. A study conducted at Phillip Island in 2000 found that the stress response in Little Penguins varied with the time of day (Carroll et al., 2015). The stress response caused by the hormone 'corticosterone' was more acute during the day when compared to night, and increased throughout the 30 minute capture period of the study. Penguins that had previous capture and handling exposure showed higher corticosterone concentrations and aggression compared with penguins that had not previously been handled, however, baseline levels of corticosterone across the study sites indicated no evidence of chronic stress caused by research handling or tourism (Carroll et al., 2015). The study suggested that handling necessary for research and monitoring may be best undertaken during the late afternoon or night and areas of a colony that are exposed to tourism may benefit from being excluded from monitoring programs (Carroll et al., 2015). Therefore, it is recommended that the aims, and subsequently the methods, of the Middle Island Little Penguin monitoring program are revisited to ensure the Little Penguins are subjected to minimum stress levels.

Human disturbance was noticed with the presence of a media crew near a landing site during a dusk arrival count, having significant impact on behaviour and the subsequent count of Little Penguins that night. Measures need to be put in place to avoid this occurring in the future. It is recommended that a burrow scope and infra-red motion camera traps be purchased to assist in conducting breeding surveys and arrival counts respectively. This will assist in reducing disturbance to brooding adult penguins and allow for better observation of nesting occupants that may be otherwise difficult or impossible to observe safely.

A review of the monitoring program will also assist with comparing breeding success between years with a defined survey area and consistent survey effort. Comparisons of arrival count data has also been affected by inconsistent survey effort with two Little Penguin landing sites no longer used. These omissions could not be avoided, as volunteer safety is paramount, and continued use of the two landing sites was not feasible. Although these sites provided few penguin arrival observations, reviewing the data to omit these sites would assist with a more accurate inter seasonal comparison.

This season an opportunistic breeding survey was conducted on 19 August 2015 with the use of a boat to gain access to Middle Island. Twenty-five active burrows were recorded, containing ten eggs and nine chicks. This indicates another early start to the breeding season and it would be beneficial to conduct breeding surveys throughout winter. This would provide for a better understanding of the colony population and how it has recovered from the 2006 fox predation event.

Commencing breeding surveys earlier would also reduce the risk of burrow collapse. During the current breeding season, breeding surveys concluded in December due to the high risk of collapse due to the dry conditions on the island. Commencing breeding surveys in winter will allow for a wider area of the island to be surveyed, including the western vegetated area. The use of snow shoes will allow breeding surveyors to access areas of high density burrows by providing a larger area for weight distribution, reducing the risk of burrow collapse. This will ensure breeding surveys are conducted to the end of the breeding season.

Summarised monitoring recommendations:

- Revisit the aims and monitoring methods of the Little Penguin monitoring program prior to the 2016/2017 to ensure that human related stress is reduced to a minimum.

- Invest in specific equipment to increase effectiveness of data collection during monitoring and reduction of potential habitat and Little Penguin disturbance. Consider purchasing a borrow scope to reduce disturbance on brooding adults.

- Revisit the monitoring methods to try and achieve a consistent survey effort across seasons, for example by:
    - using the same defined survey area, or

  - noting and account for the survey effort in statistical analysis (number of burrows checked), or,
  - establishing survey transects would improve the robustness of breeding success comparisons between seasons.
- Commence the 2016/2017 breeding surveys earlier, ideally during winter if possible, to increase survey coverage over the island and capture the increasingly early start to the breeding season.

- Collate and revise current and historical seasonal data estimates for arrival counts given that two sites have recently been excluded from counting due to safety issues as a priority. Amending the datasets to account for the landing site omissions that allows more accurate inter-seasonal comparisons is highly recommended, as access to historical datasets was not available to authors at this time.

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