



PHILLIP ISLAND (MILLOWL) NESTING SHOREBIRD BREEDING REPORT 2022/23



Milowl is the Bunurong name for Phillip Island. It is part of the country recognised as being the traditional land and waters of the Bunurong and is steeped in cultural history dating back tens of thousands of years. We acknowledge the Traditional Owners of the land on which we live, work and learn, the Bunurong. We pay our respects to their Elders past, present and emerging.

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Executive summary

Hooded plovers (*Thinornis cucullatus cucullatus*) are the focus of this report as one of the priority species listed in the Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2022, *Threatened Species Strategy Action Plan 2022–2032*. They are categorised as ‘*Threatened*’ under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* and ‘*Vulnerable*’ under the *Victorian Flora and Fauna Guarantee Act 1988 Threatened List*. Since active management of the hooded plover population on Phillip Island (Millowl) began in 1998, embodied as the ‘Hooded Plover Watch Program’, the population has increased from around 20 individuals to a stable plateau of 44 (± 2) between 2010 and 2019.

Hooded plovers are monitored year-round through quarterly ‘hooded plover and gull counts’. With active management utilising a higher allocation of staffing and resources occurring over the breeding season between September and April.

The 2022/23 hooded plover breeding season saw 14 pairs successfully raise eight fledglings, resulting in a fledged per pair rate of 0.57, exceeding the benchmark provided by BirdLife Australia and marks another successful breeding season with overall trends showing an increasing fledged per pair rate.

Pied oystercatchers (*Haematopus longirostris*), sooty oystercatchers (*Haematopus fuliginosus*) and red-capped plovers (*Charadrius ruficapillus*) are also monitored through the quarterly ‘hooded plover and gull counts’ and via the MyBeachBird portal but to a lesser extent due to limited resources. Eastern curlews (*Numenius madagascariensis*) are also monitored as part of the ‘hooded plover and gull counts’, and fairy terns (*Sternula nereis*) are closely monitored for if and when they breed on Phillip Island (Millowl).



Key Findings

Hooded plovers

- A total of eight hooded plover chicks fledged this season from 14 breeding pairs which is lower than expected when considering previous trends.
 - The number of nests, eggs and chicks were 31, 70, 21 respectively is below the most recent five-year period average (2017-2022) of 40.4, 94.6 and 31.8 nests, eggs and chicks.
 - While this season had a lower percentage of eggs hatch (30%), the higher percentage of chicks surviving to fledge (38.10%) led to a successful fledged per pair rate of 0.57.
- 31.2% of all nests failed due to high tides, which is 44.27% of failed nests, and includes six of the first 10 nests laid.
- Camera traps captured two instances of nest failure
 - A banded raven was recorded with a hooded plover egg in their mouth at Shelly Beach.
 - Evidence of high tides over the nest was recorded at Berrys Beach.
- Quarterly 'hooded plover & gull counts' have recorded lower than the average population over the past 10 years with questions arising as to whether this is due to natural population variance or local population decline.
 - The November 2023 count held a total of 33 compared to the average of 42 seen over the last 10 years.
 - BirdLife Australia's biennial count 2022 noted an overall increase in the hooded plover population in Victoria.

Other shorebirds

- One pair of red-capped plovers was routinely monitored this season having successfully raised one fledgling from 2 nest attempts.
- One pair of sooty oystercatchers was regularly monitored at Whitehorses Bay having also successfully raised one fledgling.
- As a part of the 'Hooded plover & Gull counts' 20 Eastern curlews were seen at Observation Point in February 2023 after two years of no sightings.
- No breeding activity was recorded for fairy terns again this season, with the last successful breeding occurring in the 2019/20 season.

Methods

Hooded plovers are monitored according to the 'BirdLife Australia's guidelines for monitoring nesting success of Hooded Plovers' (2017) with staffing and resources increasing over the peak of the of the breeding season which starts around September and ends around April. The Nesting Shorebird officer position starts in November and lasts for six months monitoring the birds two days a week, as well as the Beach Nesting Birds Intern starting in December and monitoring four days a week for three months.

Quarterly 'hooded plover and gull counts' are conducted by staff and volunteers around the same time each year (February, April, July and November) where all beaches on Phillip Island (Millowl) are surveyed and observations of hooded plovers and gull species recorded. While hooded plovers and gull species are the focus of the counts, staff and volunteers record all observations of birds they can identify, which provide population records for other species including Eastern curlews.

Site protection, also known as refuges, are made of temporary rope fences and signage. They are used to protect hooded plover nesting sites in accordance with BirdLife Australia's 'Important reminders about Hooded Plover site protection' 2021, See figure 1 for an example from Shelly beach. When nests are located on Bass Coast Shire Council (BCSC) managed land, Nature Parks staff and volunteers will monitor the birds and the BCSC Natural Resources Manager will implement site protection.

Site protection is also considered on a case-by-case basis for red-capped plovers, sooty oystercatchers and pied oystercatchers depending on the location of the nest.



Figure 1: Photo of a refuge at Shelly Beach demonstrates signage in the foreground a distance away from the temporary rope fencing in the background.

Hooded plover breeding season 2022/23 Results

Nesting success

This season 14 breeding pairs of hooded plovers laid eggs; this is the lowest number recorded since the 2013/14 breeding season which also had 14, and can likely be explained by the lower population recorded in the quarterly 'hooded plover & gull count' as outlined below. 31 nests were distributed across 15 breeding sites, with nine sites producing chicks, and six of those sites successfully producing fledglings (Figure 2). Detailed summary of each nest can be found at Appendix C.

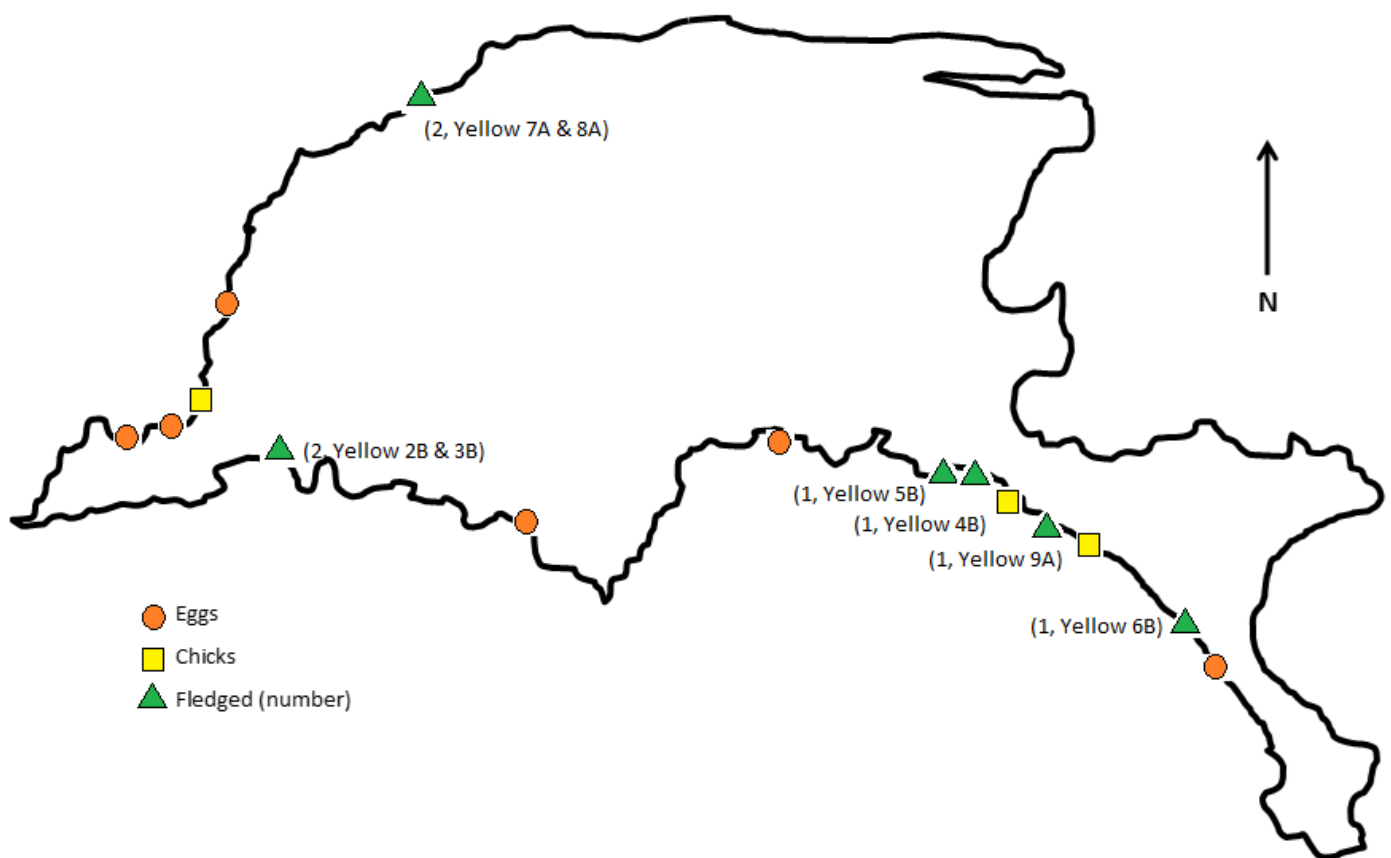


Figure 2: Summary map of hooded plover nesting sites (n=15) distributed on Phillip Island (Millowl) and the breeding outcome at each site (eggs, chicks, or fledged).

The number of nests, eggs and chicks were 31, 70, 21 respectively which was below the most recent 5-year period average (2017-2022) of 40.4, 94.6 and 31.8 nests, eggs and chicks (Figure 3).

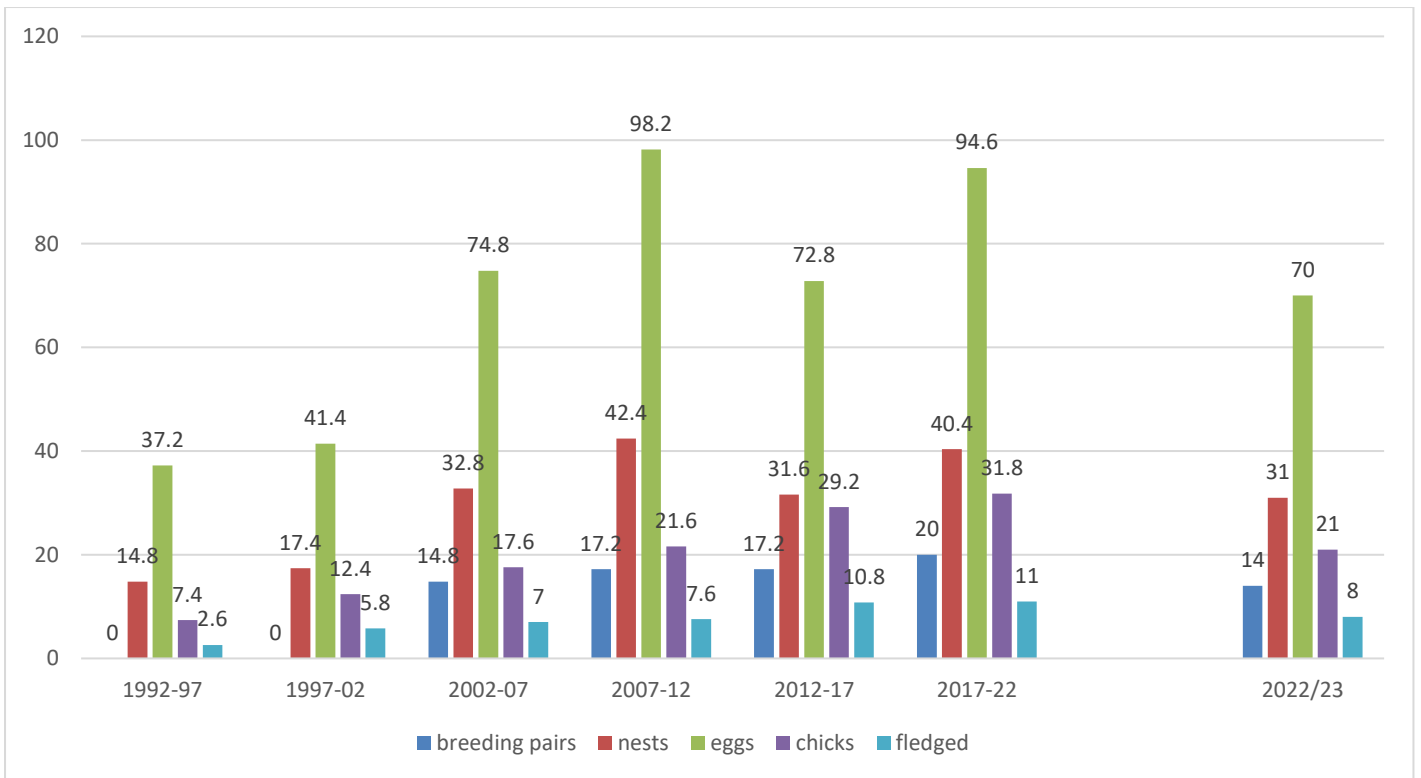


Figure 3: Five-year averages for breeding metrics of Hooded plovers on Phillip Island (Millowl) 1992 – 2022, and the 2022/23 seasons breeding metrics data. Note: number of breeding pairs were recorded from 2002/3 onwards.

Hatching success

This season’s egg to chick survivorship was 30% which is lower than the two previous 5-year period averages (33.62% in 2017-22 and 40.11% in 2012-17). 44.27% (n=9.67) of failed nests, had evidence of severe weather/high tides. 47.33% (n=10.33) of failed nests were cause unknown (compared to 2.27% for severe weather/tides and 66.67% unknown in 2021/22)(Figure 4). The evidence of severe weather was usually the wrack line above the previous position of the nest, and in one case reference points near a nest buried by sand after especially high winds.



Fledging success

The 2022/23 breeding season produced eight hooded plover fledglings from 21 chicks, over six nesting sites (Figure 2). The egg to fledge survivorship was 11.43% in line with the 2017-2022 average of 11.63%, and chick to fledge survivorship 38.10%, above the average 34.59% for that period.

Despite regular monitoring of chicks 100% (n=13) of their failures had an unknown cause (Figure 4). Due to the abundance of different predators and pressures at these sites (human beach use, dogs, ravens, magpies, gulls, cats etc.) there's often such a range of footprints near where the chicks have been occupying we can't narrow down an accurate suspect.

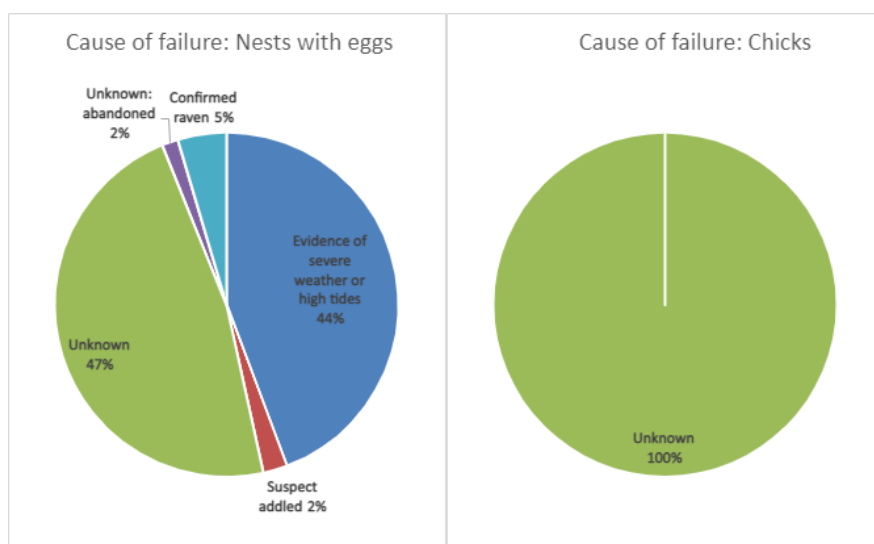


Figure 4: Causes of hooded plover nest and chick failures during the 2022/23 breeding season.

Breeding success

Breeding success (the number of fledglings as a proportion of the total number of breeding pairs of hooded plovers) was 0.57, above both the 2017-2022 average of 0.55 and the historical average of 0.53 (Appendix B). BirdLife Australia's benchmark (0.47 fledglings per pair) for fledgling production to evaluate success and maintaining population numbers over time has been reached again this season (Figure 5).

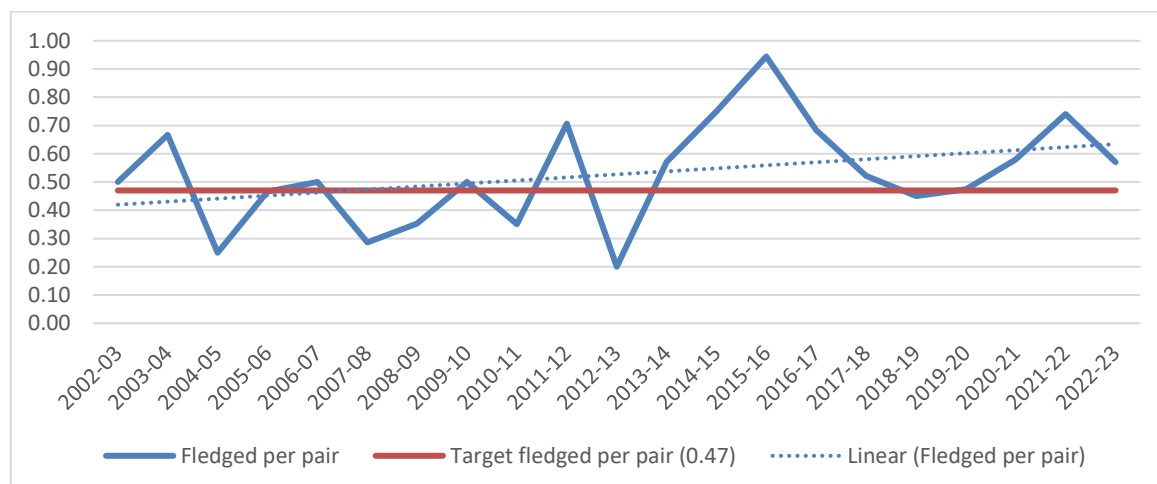


Figure 5: The fledged per pair for each breeding season since 2002/03 with a linear trendline against the target fledged per pair rate of 0.47 suggested by Birdlife Australia.

Banding and flagging

This season nine chicks were biometrically measured, banded, given a unique leg flag and had feather samples taken for sexing. Of these nine just one did not survive to fledge, see appendix D below for a summary of their details

A total of 35 banded adults were recorded during the quarterly 'hooded plover & gull counts' and the MyBeachBird portal over the season, 21 (60%) of those were originally flagged and banded off Phillip Island from other parts of Victoria and 5 (14%) of them were banded in the 2021/22 season. Hooded plover fledglings have a survival rate of 55% (Weston 2000), of the 11 flagged and fledged chicks in 2021/22, 7 or 64% have been recorded in the 2022/23 breeding season around Victoria (Appendix E).

Population count

The results of the quarterly 'hooded plover & gull count' have shown lower results than average (table 1), November 2022's survey of 33 Hooded plovers is the lowest recorded in over 10 years (Figure 6).

	July 2022 - April 2023	Average (July 2012 – November 2022)	Historic average
July	26	38.80	36
November	33	43	35.22
February	40	46.7	41.73
April	29	40.40	38.52

Table 1: Results of the most recent 'hooded plover and gull counts' compared to the average of the previous 10 years and the historic average starting in 2001.

During the November 2022 count Nature Parks staff and volunteers also participated in the BirdLife Australia's Biennial Hooded Plover Count, the results of this count showed more hooded plovers in Victoria than in the 2020 count (761 compared to 710, results not yet published at time of writing). These results also highlight that there are multiple regions experiencing an increase or decrease in hooded plover numbers resulting in an overall increase.

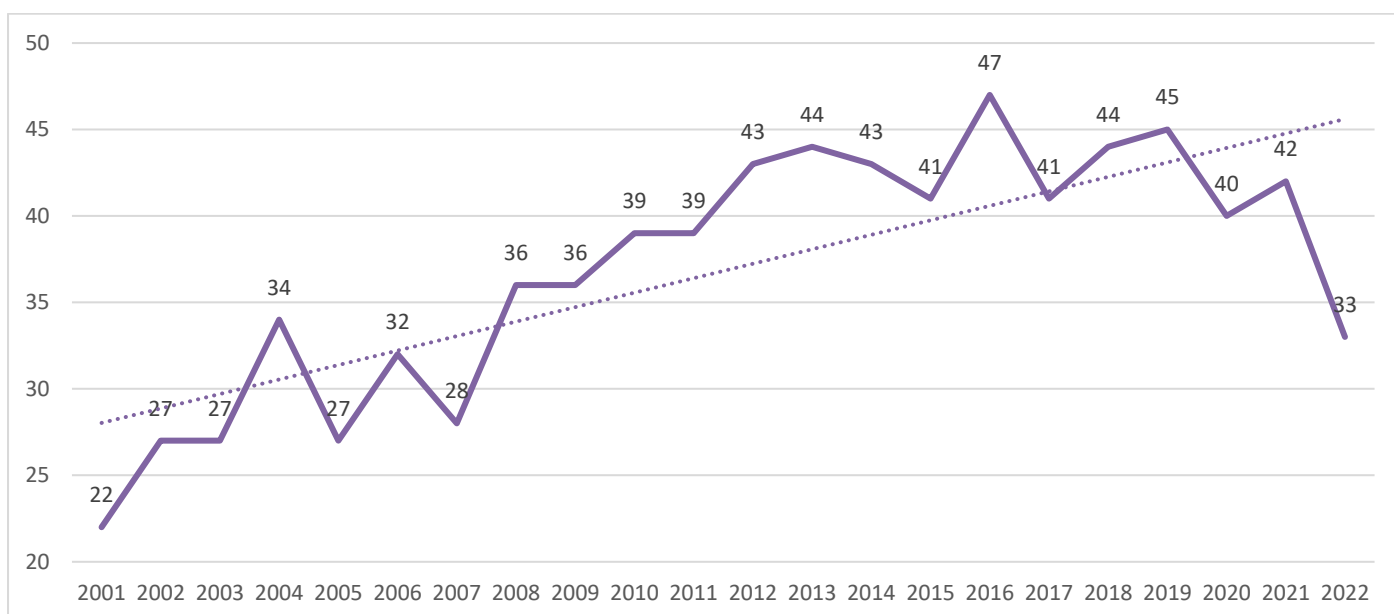


Figure 6: The number of hooded plovers counted during the November survey of the 'hooded plover and gull count' since 2001.

Volunteer activities

Volunteers play a big part in the success of the hooded plover program, with their activities adding up to a total of 205.6 hours (Table 2). These activities included monitoring nesting pairs and participating in the ‘hooded plover and gull count’. Volunteers use the BirdLife Australia MyBeachBird portal and, excluding interns, contributed 31% (281 out of 891) portal entries this season (Figure 7). Volunteer hours while consistent with last season is still a significant reduction from previous years due to the COVID-19 pandemic and resulting suspension of volunteer activities across the Nature Parks (Table 2).

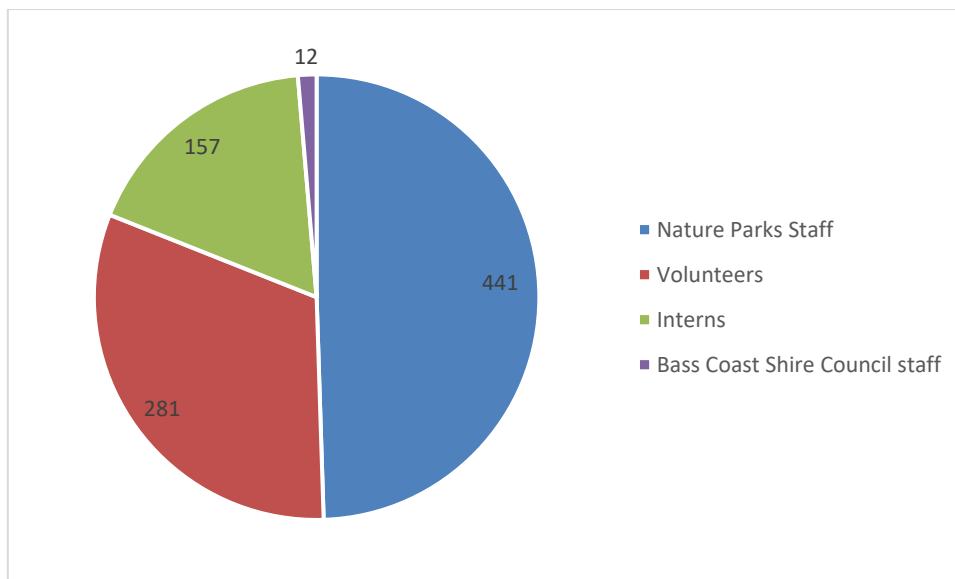


Figure 7: Number of MyBeachBird portal entries by contributors.

Volunteers and members of the community found and reported four nests for Nature parks staff to create or move refuges better protecting them. A volunteer also found chicks on Summerland Beach during the February ‘hooded plover and gull count’ which had remained hidden from staff during routine monitoring of that beach (Appendix C). Nature parks staff cannot check all beaches every day so these contributions are invaluable to informing how staff manage time.

Activity	2022/23	2021/22	2020/21	2019/20
Monitoring	143.77	154.84	75.81	422.76
‘Hooded plover & Gull count’	61.83	45.20	6.5	49.50
Community Engagement	--	--	--	25.5
Events				
Internships*	301.17	228.90	205.25	261.50
Total	205.6	172.84	82.31	748.68

* not included in total volunteer hours

Table 2: Summary of hooded plover related volunteering activity hours for the 2019/20 - 2022/23 breeding season.

Internships and camera trap study

The camera trapping study commenced in the 2020-21 season and was continued for the 2022/23 breeding season with the aim of further clarifying causes of hooded plover nest failures. All five allowable cameras were deployed by Phillip Island Nature Parks intern, Lucy Wotherspoon, to monitor nests during the breeding season. A key aim of this study was to assess the efficacy of camera trapping to better ascertain the reason(s) for nesting failure. Cameras collected 2,513 images over 132 days, many of these images did not contain useful information as vegetation or other natural movement triggered the camera, more careful placement next season will hopefully prevent this issue. We also observed that the salt spray appeared to have reduced the sensitivity of the cameras in at least two instances leaving periods of very little photography being taken. Next season we will clean the sensors weekly, or after high winds and see if there's any improvement.

One instance of egg predation was caught on camera (Figure 8) as a banded Raven is seen with an egg in her mouth. Raven 122 Left (White) (band no. 101-34830) is a female bird captured as an adult by Laura Tan on 23/7/2015 at Point Sambell, Phillip Island as part of a project studying little penguin (*Eudyptula minor*) egg predation by ravens. After predated on the hooded plover eggs this raven returns 10 minutes later where a hooded plover attempts to lead her away, then again 2 hours later and looks under some seaweed close to the previous nest location, and then again for the final time caught on camera the next morning to investigate the nest location again.



Figure 8: Camera trap image of a banded raven with a hooded plover egg in its mouth.

This camera trap study follows the protocols set out by BirdLife Australia. One of the rules of use — ‘do not use a camera on a given breeding pair/ breeding territory more than once within a breeding season.’ — was mistakenly breached this season. The hooded plover pair YLF ‘78’ and OLF ‘YU’ had moved from Berrys Beach to Shelly Beach and during the focus to ensure the cameras were at least 1km apart this detail was missed, and a camera was placed

on their nest twice. (Table 3) The nest at Berrys Beach failed due to high tide, and the Shelly Beach nest due to raven predation. Procedures have been put in place to ensure this doesn't happen again.

Location	Hooded plover pair details	Nest Fate	Camera deployed date	Camera retrieved date
Colonnades West	YLF '31' YLF '49'	1 Chick fledged YLF '0A'	22/12/2022	03/02/2023
Berrys Beach	YLF '78' OLF 'YU'	Nest failed due to high tide	23/12/2022	29/12/2022
Crazy birds	YLF '19' YLF '86'	1 chick fledged YLF '4B'	6/01/2023	16/02/2023
Shelly Beach	YLF '78' OLF 'YU'	Nest failed due to raven (banded 122) predation	13/01/2023	24/01/2023
Anzacs west	M/____ UB	1 chick fledged YLF '6B'	21/02/2023	24/03/2023

Table 3: Summary table of cameras places over nests in the 2022/23 breeding season.

Refuge intrusions (animals entering the roped fence line) can be a threat to the hooded plovers nests through crushing of the eggs, predation and disturbance. A total of 78 intrusions took place, 25 of them while there were eggs and 30 with chicks, the rest happening after the nest had failed. For many (65) of the intrusions the hooded plovers are not in frame to see their response.

In three years of collecting camera trap data there were 12 refuge intrusions where the hooded plover stayed on the nest, the majority of these were where the intruder was not a predator (swamp wallaby, little penguin, masked lapwing, Eastern barred bandicoot, rabbit/hare and an unknown rat species). On just one of these occasions there was a silver gull as well as a masked lapwing in the refuge and the hooded plover was not seen leaving the nest. Comparatively the 15 intrusions where the hooded plover responded through leading, leaving the nest, territorial behaviour and broken wing displays usually occurred when the intruder was a predator (raven, magpie, silver gull, cat or dog). Twice the hooded plover left the nest or was territorial to either a hare or Eastern barred bandicoot, in both instances the intruder got very close to the nest before this happened. This is an interesting pattern of behaviour worth further investigation. (Unpub. Data)



Other shorebirds

Pied oystercatchers

Pied oystercatchers are listed as 'least concern' in the International Union for Conservation of Nature Red List of Threatened Species (IUCN Red List) and are monitored incidentally with 13 of the 891 MyBeachBird portal entries attributed to them. No breeding activity or nests were monitored in the 2022/23 season on Phillip Island (Millowl).

Sooty oystercatchers

Sooty oystercatchers are listed as 'least concern' in the IUCN Red List and are monitored incidentally with 30 of the 891 portal entries attributed to them. One pair of sooty oystercatchers was actively monitored during the 2022/23 breeding season which produced one fledgling at Whitehorses Bay, which is a small beach in the Summerland Peninsula and not accessible by members of the public (Appendix F). This nest was able to be monitored regularly due to proximity to other works being carried out by Nature Parks staff.

Red-capped plovers

Red-capped plovers are listed as *Least Concern* in the IUCN Red List and are monitored incidentally with 32 of the 891 portal entries attributed to them. One pair of red-capped plovers was actively monitored during the 2022/23 breeding season at Elizabeth Cove which produced one fledgling. A banding attempt failed on 21/01/2023 due to the chick fledging earlier than expected. (Appendix F)



Fairy terns

Fairy terns are listed as *Vulnerable* in Australia (*Environment Protection and Biodiversity Conservation Act 1999*), and *Critically Endangered* in Victoria (*Flora and Fauna Guarantee Act*). They were recorded on just one occasion at Observation Point during the 2022/23 breeding season with 3 birds seen on 14/01/2023 flying over the water approximately 200m away from land. No breeding was recorded again this season, with the last successful season recorded in 2019/20. This season showed no indication of potential breeding as no breeding behaviour was observed; such as landing in the dune, courtship display flights, and birds harassing when observer went near the previously used nesting area. Throughout the 2020/21 to 2022/23 breeding seasons Observation Point experienced a higher level of tidal inundation due to topographical changes compared to the previous season perhaps limiting the ability for nesting shorebirds to successfully nest in the area. Marram grass has also taken over much of the previous nesting site.

Eastern curlews

Eastern curlews are listed as *Critically Endangered* in Australia under the *Environment Protection and Biodiversity Conservation Act 1999* and are one of the priority species listed in the DCCEEW 2022, *Threatened Species Strategy Action Plan 2022–2032*. They are a migratory bird living in Australia between August and March during their non-breeding season. As a part of the 'hooded plover & gull count' 20 Eastern curlews were seen at Observation Point in February 2023 after two years of no sightings. Figure 9 shows that the number of Eastern curlews being recorded on Phillip Island (Millowl) is declining over time.

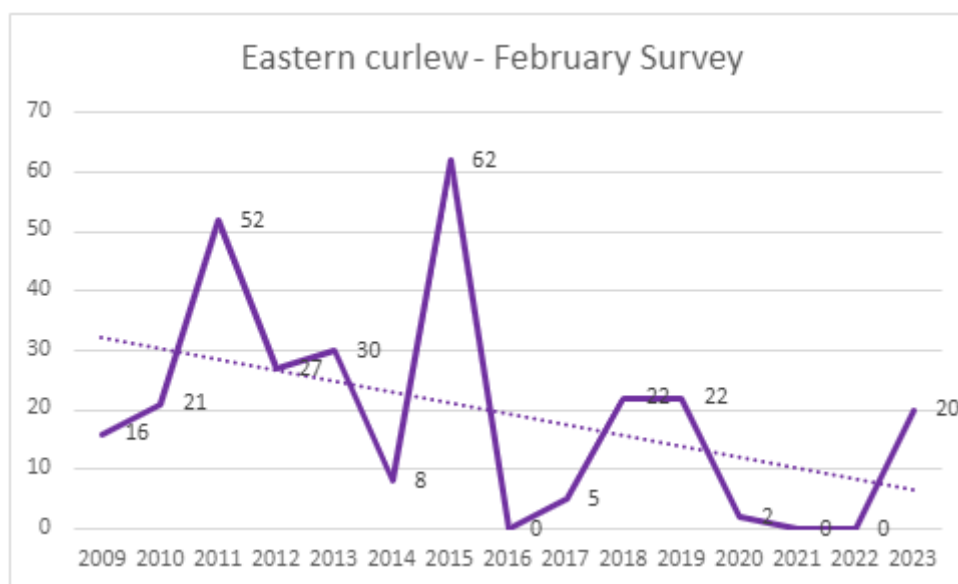


Figure 9. Eastern curlews recorded during the February 'hooded plover & gull counts' since 2009 with a trendline showing a decrease over time.



Discussion

Hooded plovers

The 2022/23 hooded plover breeding season saw fewer breeding pairs nest on Phillip Island (Millowl) than in previous years yet has still followed the desired trend heading towards what would be an ideal breeding season for hooded plovers on Phillip Island (Millowl): a high proportion of eggs laid surviving to successfully fledge (Figure 2).

One of the key threats as listed in the *Threatened Species Strategy Action Plan 2022–2032* is climate change, causing extreme storm events, including high tides washing away nests, and sea level rise causing a loss of habitat and narrowing beaches. The 2022/23 breeding season coincided with the end of a three year La Niña event which can also help explain the high tides and weather pressure causing nest failures, but not the significant differences in breeding success between this season (14 pairs and 8 fledged led to a fledged per pair of 0.57) and last season (19 pairs and 14 fledged led to a fledged per pair of 0.74).

The lower number of breeding pairs (14 compared to the 2017-22 average of 20 pairs) is explained by the lower population counts, but we can't yet know if the change away from the plateau in 2010-20 (Figure 6) is a trend to be concerned about or natural population changes as seen in Bass Coast with localised mortality detected from flagged bird monitoring (BirdLife Australia's Biennial Hooded Plover Count 2020). Phillip Island (Millowl) is home to just a small percentage of the Victorian hooded plover population which has seen an overall increase over time in BirdLife Australia's Biennial Hooded Plover Count.

Overall hooded plovers on Phillip Island (Millowl) recorded a successful breeding season by meeting BirdLife Australia's target of 0.47 fledged per pair as the standardised way of measuring breeding success. While the 0.57 achieved this year is lower than last year's 0.74, it is higher than the historic average of 0.53 and the 2017-22 average of 0.55. (Appendix B)

Other shorebirds

All of the observations of Eastern curlews, with the exception of one bird seen at Thorny Beach in 2018, have occurred at Observation Point, highlighting the importance of that habitat. Having seen two or less Eastern curlews in the previous three years, recording 20 in the February 2023 'hooded plover and gull count' is great news. This is the third year in a row of no breeding activity for fairy terns at Observation Point despite efforts to expand suitable breeding habitat.



Recommendations

Hooded plovers

- It is recommended that Nature Parks continue to monitor the hooded plover population of Phillip Island (Millowl) through the 'hooded plover and gull counts'.
- It is recommended site assessment is undertaken at all current and historic breeding sites to investigate habitat suitability (e.g. abundance of food source, pest plants and the dune profile, presence of predators etc) to inform targeted management strategies.
- The BirdLife Australia MyBeachBird portal remains a vital tool in the management of Phillip Island's (Millowl) hooded plover population. Threat related data are vital to the tailoring of management strategies implemented for Phillip Island's hooded plover population, so it is recommended that training days are organised by Nature Parks or Birdlife staff for staff and volunteers who use the Birdlife portal to reiterate the importance of collecting these data and what to record.
- Data from the nest camera trap study over the past three years demonstrated the efficacy and validity of remote camera traps at nesting sites to capture evidence of nest failure causes. This evidence supports proactive predator management, which has been noted as a useful management strategy in the past. It is recommended that this study continues along with opportunities for interns to participate.
- Identifying the causes of hooded plover chick failure remains an important yet challenging task (Lees et al. 2019). Despite the difficulties in definitively determining chick failure causes, it should remain a high priority for staff and volunteers into the future to be extra attentive whilst chicks are around. Frequent checking of nest sites where chicks are active is imperative, and where it is suspected a chick has failed, extra attention to details/evidence/tracks should be exercised around the area and any/all data recorded in the Birdlife portal.
- Volunteers and the community make important contributions through identifying nests and informing resource allocation. It is recommended that the volunteering program continues with consideration of recommending Community events – dogs breakfasts, Turn the Tide - stall included Parks Vic – Summer by the Seas Volunteering program walk and talk, community open day etc, Clean Up Australia Day.
- Partnering with RMIT University, a social research study was initiated in 2019 to better understand compliance behaviours and motivations of beach users across Phillip Island (Millowl). This behavioural science study may assist in targeted management and campaign decisions in future. It is recommended that the study continues once it is safe to do so, with Phillip Island Nature Parks interns driving the research.

Other shorebirds

- It is unknown if or how the effects of climate change are impacting pied oystercatcher, sooty oystercatcher and red-capped plover nesting behaviours or recruitment on Phillip Island (Millowl). Furthermore, the current extent and status of their populations on the island largely remains unknown as well. It is, therefore, recommended that active and continued monitoring of these species' nesting sites be continued for subsequent breeding seasons.
- Though fairy terns did not breed on Phillip Island (Millowl) in 2022/23, ongoing monitoring of the 2019/20 breeding site is recommended. If the birds return, signage and covert monitoring should be implemented.
- Continued monitoring of Eastern curlews through the 'hooded plover and gull counts' is recommended alongside consideration of targeted management strategies.

- Observation Point remains important habitat and management efforts should continue including pest plant and feral cat control.

Acknowledgements

We would like to firstly acknowledge and thank Phillip Island Nature Parks volunteers for their dedication which contributed to the successful outcomes of the 2022/23 breeding season on Phillip Island (Millowl).

Lucy Wotherspoon for conducting the nest camera trap study for this season as an intern for the Nature Parks and for assisting with all facets of the hooded plover monitoring program.

David Martin (Bass Coast Shire Council) for his help in managing the hooded plovers nesting activities on Bass Coast Shire beaches.

The Beach Nesting Bird team at BirdLife Australia for their support and for access to the MyBeachBird portal.

Bunurong Land Council Aboriginal Corporation for their contributions to the 'hooded plover and gull counts' and many hours of habitat restoration, thank you for your partnership as we work together on Bunurong.

Phillip Island Nature Parks staff for their contributions towards logistics, banding, research, marketing and communications and quarterly hooded plover counts as well as the Nature Park Board of Management for their continuing support of threatened species conservation on Phillip Island (Millowl).

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Appendices

Appendix A: Summary statistics of the hooded plover breeding seasons from 2013/14 to 2022/23

	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
<i>First nest</i>	7/10/2013	46/9/2014	7/9/2015	5/9/2016	26/9/2017	11/9/2018	26/9/2019	31/8/2020	05/9/2021	20/9/2023
<i>Last nest</i>	8/2/2013	18/2/2015	11/2/2016	7/3/2017	13/3/2018	28/2/2019	21/2/2020	12/2/2021	24/2/2022	27/2/2023
<i>No. nests</i>	21	28	40	33	41	45	41	46	29	31
<i>No. eggs</i>	50	70	93	76	101	111	90	101	70	70
<i>No. chicks</i>	22	23	51	32	44	38	24	28	25	21
<i>No. fledglings</i>	8	12	17	13	12	9	9	11	14	8
<i>No. breeding pairs</i>	14	16	18	19	23	20	19	19	19	14
<i>Av. nests per pair</i>	1.05	2.00	2.50	1.83	1.78	2.25	2.16	2.42	1.53	1.63
<i>Av. eggs per nest</i>	2.38	2.50	2.33	2.30	2.46	2.47	2.20	2.20	2.41	2.26
<i>No. nests hatched</i>	9	9	22	14	18	16	11	14	12	10
<i>Egg to chick survivorship</i>	44.00%	32.86%	54.80%	42.11%	43.56%	34.23%	26.67%	27.72%	35.71%	30%
<i>Egg to fledge survivorship</i>	16.00%	17.14%	18.28%	17.11%	11.88%	8.11%	10.00%	10.89%	20%	11.43%
<i>Chick to fledge survivorship</i>	36.39%	52.17%	33.33%	40.63%	27.27%	23.68%	37.50%	39.29%	56%	38.10%
<i>Fledged per clutch</i>	0.38	0.43	0.43	0.39	0.29	0.20	0.22	0.24	0.48	0.26
<i>Fledged per pair</i>	0.57	0.75	0.94	0.68	0.52	0.45	0.47	0.58	0.74	0.57

Appendix B: Summary statistics of the averages for each five-year period from 1992-2022

	1992-97	1997-02	2002-07	2007-12	2012-17	2017-22	Historic
<i>No. nests</i>	14.8	17.4	32.8	42.4	31.6	40.4	29.94
<i>No. eggs</i>	37.2	41.4	74.8	98.2	72.8	94.6	68.87
<i>No. chicks</i>	7.4	12.4	17.6	21.6	29.2	31.8	20.03
<i>No. fledglings</i>	2.6	5.8	7	7.6	10.8	11	7.48
<i>No. breeding pairs</i>	--	--	14.8	17.2	17.2	20	17.19
<i>Nests per pair</i>	--	--	2.22	2.47	1.84	2.02	2.19
<i>Eggs per nest</i>	2.51	2.38	2.28	2.32	2.3	2.34	2.36
<i>Egg to chick survivorship</i>	20%	30%	24%	22%	40.11%	33.62%	29.55%
<i>Chick to fledge survivorship</i>	24%	47%	40%	35%	36.99%	34.59%	39.31%
<i>Egg to fledge survivorship</i>	7%	14%	9%	8%	14.84%	11.63%	10.67%
<i>Fledged per clutch</i>	0.18	0.33	0.21	0.18	0.34	0.27	0.25
<i>Fledged per pair</i>	--	--	0.47	0.44	0.63	0.55	0.53

Appendix C: Hooded plover nesting site summary table

Nest	Location	Find Date	Adult Bands	Clutch No.	Eggs	Chicks	Fledged	Chick Bands	Comments
1	Crazy Birds	20/09/2022	YLF '19' YLF '86'	1	3	1		failed	Found as 3 egg nest, will need to float. 1 chick sighted 16/10/2022. No chick sighted 30/10/22
2	Flynns Reef	20/10/2022	YLF '12' UB	1	2			failed	Found as 2 egg nest. No eggs 30/10/2022 with new scrape. Evidence of high tides that would have washed away the old nest. New scrape is much higher.
3	Smiths Beach far east	23/10/2022	UB UB	1	3			failed	Found as 3 egg nest, will need to float. Evidence of high tides that would have washed away the nest.
4	Colonnades (west)	25/10/2022	YLF '31' YLF '49'	1	3			failed	Found as 3 egg nest, will need to float. Evidence of high tides and mudslide from rain that would have washed away/buried the nest.
5	Woolamai SLSC	26/10/2022	WLF 'JL' WLF 'RL'	1	2			failed	Found as 2 egg nest. No eggs or evidence of failure 29/10/22
6	Anchorage Rd	07/11/2022	OLF 'EZ' WLF 'EL'	1	3	3	2	YLF '6A' YLF '8A'	found as two egg nest, 3 eggs seen 10/11/22. 3 chicks seen 06/12/22, 2 chicks 21/12/22 unknown cause, 2 chicks banded 6/01/23. chicks seen fly on 10/01/23, one flew less confidently than the other confident flying on 12/01
7	Colonnades west	11/10/2022	YLF '31' YLF '49'	2	3			failed	found as 3 egg nest, no eggs 17/11/22 evidence of high tide
8	Smiths Beach far east	13/11/2022	UB UB	2	1			failed	found as 1 egg nest, no eggs seen 17/11/22 evidence of high tides
9	Crazy Birds east	25/11/2022	YLF '19' YLF '86'	2	2			failed	Found as 2 egg nest 25/11/22 no nest 01/12/22 nest spot covered in rocks from tides

10	Flynns Beach - centre	27/11/2022	YLF '12' UB	2	2	2		failed	Found as 2 eggs nest 27/11/22. Still 2 eggs 9/12/2022. 2 chicks sighted by MOP (unconfirmed) 18/12/2022. No chicks sighted 20/12/2022
11	Colonnades (west)	29/11/2022	YLF '31' YLF '49'	3	3			failed	Found as 3 egg nest by member of public on 29/11/22. No eggs found 10/12/2022, dog prints right past nest location - no other evidence apparent.
12	Smiths Beach far east	06/12/2022	UB UB	3	1			failed	Found as 1 egg nest 6/12/2022. no eggs 15/12/22 no evidence
13	Woolamai SLSC (west)	10/12/2022	WLF 'JL' WLF 'RL'	2	1			failed	Found as 1 eggs nest 10/12/2022. no eggs 15/12/22 whole area buried by sand but digging found nothing
14	Colonnades	10/12/2022	YLF '03' UB	1	2			failed	Found as 2 egg nest 10/12/2022. no eggs 15/12/22 no evidence
15	Colonnades (west)	22/12/2022	YLF '31' YLF '49'	4	3	3	1	YLF '9A' YLF '0A'	Found as 3 eggs nest on 22/12/22 3 chicks 17/01/2023 2 chicks 07/02/2023. 2 chicks banded 16/02/23. only one chick seen 21/02/2023 possible dog, possible nankeen? OA flew confidently 23/02/2023. Spoke to a couple regular dog walkers who said they saw 2 chicks on the Fri 17th and 1 chick Sat 18th
16	Smiths Beach far east	22/12/2022	UB UB	4	1			failed	Found as 1 egg nest by Vol BH 22/12/2022, no eggs 28/12/22
17	Berrys Beach centre	23/12/2022	YLF '78' OLF 'YU'	1	2			failed	Found as 2 eggs nest on 23/12/2022. nest gone high tides with seaweed around camera stake
18	Colonnades	29/12/2022	YLF '03' UB	2	3	2		failed	Found as 3 egg nest 29/12/2022, 2 eggs 19/01/2023, 1 chick 23/01/2023, 2 chicks seen 24/01/2023 1 chick 25/01/2023 no chicks 31/01/2023

19	Anzacs East	30/12/2022	WLF 'WE" OLF 'CH"	1	1			failed	Found as 1 egg nest 30/12/2022 gone 07/01/2023
20	Fynns Reef	30/12/2022	YLF '12' UB	3	2			failed	Found as 2 egg nest by MOP on 30/12/2022 no eggs 03/01/2023 possible Pacific gull
21	Forrest Caves west	03/01/2023	OLF 'BR' UB	1	3			failed	Found as 3 egg nest on 03/01/52023 no eggs 20/01/2023
22	Crazy birds centre	06/01/2023	YLF '19' YLF '86'	3	2	1	1	YLF '4B'	Found as 2 egg nest by vol BH on 06/01/2023, 1 chick + 1 egg 26/01/2023 and again 03/02/2023. Banded 02/03/23
23	Shelly Beach	09/01/2023	YLF '78' OLF 'YU'	2	2			failed	Found as 2 egg nest on 09/01/2023. No eggs found 16/01/2023
24	Woolamai SLSC (west)	10/01/2023	WLF 'JL' WLF 'RL'	3	3			failed	Found as 1 eggs nest 10/01/2023 2 eggs seen 12/01/2023, 3 eggs 24/01/2023 eggs gone 07/02/2023 evidence of tides
25	Surf Beach (Park St)	16/01/2023	WLF 'CU' UB	1	3	2	1	YLF '5B'	Found as 3 eggs nest on 16/01/2023, 2 eggs 20/01/2023, 2 chicks, one chick 22/02/2023, 16/03/2023 banded and flagged, confidently flew 20/03/2023
26	Flynns beach west	17/01/2023	YLF '12' UB	4	3			failed	Found as 2 egg nest with one abandoned egg <1m away on 17/01/2023 eggs gone 07/02/2023 evidence of tides
27	Farm Beach	02/02/2023	TBC (UB UB or UB and Y93)	1	2			failed	Found as 2 eggs nest by Stu on 02/02/2023
28	Summerland Beach centre	02/02/2023	YLF '39' UB	1	2	2	2	YLF '2B' YLF '3B'	2 chicks (~2-3 week old) found by Kay A and Andrea L on Hoodie Gull Count. 2 chicks banded 16/02/23. flying confidently 21/02/2023
29	Forrest Caves west	09/02/2023	OLF 'BR' UB	2	2	2		failed	2 eggs high in the dunes found 09/02/2023, 2 chicks found 27/02/2023, 1 chick 01/03/2023, chick not found when we went to band 1/04/2023

30	Anzacs west	17/02/2023	m/___ UB	1	3	3		found as 3 egg nest 17/02/2023, Lucy suspected a nest on the 9/02/23 so it could be up to a week old. 3 chicks on 17/03/23
31	Colonnades	27/02/2023	YLF '03' UB	3	2		failed	found as one egg nest 27/02/2023, 2 eggs 02/03/2023 No eggs 10/03/2023, evidence of severe weather and suspect buried by the wind.

Appendix D: Summary of hooded plover chick band and flag details 2022/23

<i>Date</i>	<i>Nesting site</i>	<i>Band no.</i>	<i>Band location</i>	<i>Leg flag details</i>	<i>Flag location</i>	<i>Bird status</i>	<i>Weight (g)</i>	<i>Notes</i>
01/06/2023	Anchorage Rd	05268697	Left tarsus	Yellow 6A	Left tibia	Chick	54	
01/06/2023	Anchorage Rd	05268698	Left tarsus	Yellow 8A	Left tibia	Chick	54	
16/02/2023	Colonnades West	05268699	Left tarsus	Yellow 9A	Left tibia	Chick	55	Did not successfully fledge
16/02/2023	Colonnades west	05268700	Left tarsus	Yellow 0A	Left tibia	Chick	57	
16/02/2023	Summerland Beach	05278601	Left tarsus	Yellow 2B	Left tibia	Chick	71	
16/02/2023	Summerland Beach	05278602	Left tarsus	Yellow 3B	Left tibia	Chick	70	
02/03/2023	Crazy Birds	05278603	Left tarsus	Yellow 4B	Left tibia	Chick	59	
16/03/2023	Surf Beach	05278604	Left tarsus	Yellow 5B	Left tibia	Chick	60	
18/04/2023	Anzacs West	05278605	Left tarsus	Yellow 6B	Left tibia	Chick	59	

Appendix E: Band details of birds recorded in MyBeachBird portal and in 'Hooded plover and Gull count' in the 2022/23 season on Phillip Island (Millowl) as well as fledglings from 2021/22 who have been sighted elsewhere

Date banded	Band number	Location seen	Colour combination	Location banded	Age at banding	Sex	Partner details
13/02/2013	05248057	Colonnades	03 Left (Yellow)	Silverleaves	Juvenile	Unknown	Unbanded partner
05/01/2015	05268605	Flynns Beach	12 Left (Yellow)	Anchorage Rd	Juvenile	Female	Unbanded partner
29/07/2015	05268612	Crazy birds	19 Left (Yellow)	Surf Beach	Adult	Male	Partner of 86 Left (Yellow)
29/10/2019	05268613	Kitty Miller Bay	21 Left (Yellow)	Elizabeth Cove	Juvenile	Male	Non breeding
23/11/2015	05268615	Ventnor, Devon Av	23 Left (Yellow)	Red Rocks	Juvenile	Male	Unbanded partner
23/01/2017	05268623	Colonnades west	31 Left (Yellow)	Surf Beach	Juvenile	Male	Partner of 49 Left (Yellow)
31/01/2017	05268625	Woolshed bight	33 Left (Yellow)	Belavista Rd	Juvenile	Female	Partner of TZ Left (White)
24/02/2017	05268631	Summerland bay	39 Left (Yellow)	Elizabeth Cove	Juvenile	Male	Unbanded partner
27/12/2017	05268636	Flynns reef	44 Left (Yellow)	Smiths Beach	Juvenile	Male	Non breeding
24/01/2018	05268641	Colonnades West	49 Left (Yellow)	Woolshed Bight	Juvenile	Female	Partner of 31 Left (Yellow)
11/02/2019	05268656	Kitty Miller Bay	64 Left (Yellow)	Colonnades	Juvenile	Female	Non breeding (seen flocking)
22/02/2019	05268658	Cape Woolamai	66 Left (Yellow)	Surf Beach	Juvenile	Male	Non breeding (seen flocking)
27/10/2020	05268670	Berrys Beach, Shelly Beach	78 Left (Yellow)	Anchorage Rd	Juvenile	Female	Partner of YU Right (Orange)
08/12/2020	05268676	Kitty Miller Bay	84 Left (Yellow)	Ventnor, Devon Av	Juvenile	Male	Non breeding
29/12/2020	05268677	Forrest caves, Red rocks	85 Left (Yellow)	Cape Woolamai	Juvenile	Female	Partner of PX Right (Orange)
14/01/2021	05268678	Crazy birds	86 Left (Yellow)	Crazy Birds	Adult	Female	Partner of 19 Left (Yellow)
18/01/2022	05268685	Multiple locations	93 Left (Yellow)	Anchorage Rd	Juvenile	Unknown	Non breeding
02/02/2022	05268688	Flynns Reef	97 Left (Yellow)	Smiths Beach	Juvenile	Unknown	Non breeding

02/02/2022	05268690	Multiple locations	99 Left (Yellow)	Ventnor, Devon Av	Juvenile	Unknown	Non breeding
02/02/2022	05268691	Multiple locations	1A Left (Yellow)	Ventnor, Devon Av	Juvenile	Unknown	Non breeding
04/03/2022	05268692	Multiple locations	1B Left (Yellow)	Kitty Miller Bay	Juvenile	Unknown	Non breeding
04/04/2014	05306135	Forrest caves	BR Right (Orange)	Boags Rocks	Juvenile	Male	Unbanded partner.
14/10/2011	05248079	Anzacs east	CH Left (Orange)	Woolamai SLSC	Adult	Unknown	Partner of WE Right (white)
20/03/2017	05280592	Surf Beach	CU Right (White)	Cape Patterson	Juvenile	Male	Unbanded partner
18/02/2011	05248036	Anzacs west	Gm/YR (m/_ _)	Crazy Birds	Juvenile	Unknown	Unbanded partner (we suspect the green has worn off to just metal. Based on nest location in dunes making it the same bird)
05/03/2020	05287991	Anchorage Rd	EL Right (White)	Rye Big Rock	Juvenile	Unknown	Partner of EZ Left (Orange).
		Cape Woolamai	EU Left (White)				Non breeding (seen Flocking)
29/12/2012	05268883	Anchorage Rd	EZ Left (Orange)	Pea Creek Estuary	Juvenile	Unknown	Partner of EL Right (White)
13/02/2019	05287997	Cape Woolamai	JL Right (White)	Gunnamatta Fingal Track	Juvenile	Female	Partner of RL Left (White).
12/02/2020	05306194	Anzacs beach	KB Left (White)	Williamsons Beach west	Juvenile	Unknown	Unbanded partner
26/07/2010	05245490	Forrest Caves, Red Rocks	PX Right (Orange)	Forrest Caves	Sub Adult	Unknown	Partner of 85 Left (Yellow)
07/02/2018	05306191	Cape Woolamai	RL Left (White)	Twin Reefs	Juvenile	Male	Partner of JL Right (White)
08/01/2016	05280577	Anzacs east	WE Right (White)				Partner of CH Left (Orange)
		Berrys Beach, Shelly Beach	YU Right (Orange)	Sandy Waterhole	Juvenile	Male	Partner of 78 Left (Yellow)
31/01/2023		Cape Woolamai	ZT Left (White)	San Remo	Adult	Male	Partner of 33 Left (Yellow)

2021/22 fledglings recorded off Phillip Island (*Millowl*)

02/02/2022	05268687	Cape Patterson	96 Left (Yellow)	Smiths Beach	Juvenile	Unknown	Non breeding
24/03/2022	05268694	Cape Patterson	3A Left (Yellow)	Farm Beach	Juvenile	Unknown	Non breeding

Appendix F: Summary of nesting sites for red-capped plovers, pied oystercatchers and sorry oystercatchers. Note: this is not a comprehensive list as not all sites were monitored regularly throughout the season

Species	Nest	Location	Find Date	Adult Bands	Clutch No.	Eggs	Chicks	Fledged	Notes
<i>Red-capped plover</i>	1	Elizabeth Cove	18/10/2022	UB UB	1	2			Failed 11/11/2022
<i>Red-capped plover</i>	2	Observation Point	21/12/2022	OLF 'A4' UB	1	1			Nest spotted by BZ, suspect failed but not sure at what stage
<i>Red-capped plover</i>	3	Elizabeth Cove	03/01/2023	UB UB	2	2	2	1	Only 1 chick 3/2/23, fledged on day of banding attempt 21/02/23
<i>Sooty oystercatcher</i>	1	Whitehorses Bay	14/12/2022	UB UB	1	1	1	1	Chick seen 3/01/23 by PW and MT. Fledged chick sighted on 21/03/23 by MT