

Seven seasons of monitoring Hooded Plover breeding success on the Fleurieu Peninsula, South Australia 2009/2010 - 2015/16

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birds are in our nature

Front cover photo: Lance Gray.

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Executive Summary

Hooded Plover conservation on the Fleurieu Peninsula ramped up in 2009 when citizen scientists started to record standardised data on both the birds breeding and the threats detected during site visits made during the breeding months (August to March) as part of a national monitoring program. This report examines this incredible data set of over 5,000 observations, contributed by 136 participants, across breeding seasons between 2009 to 2016. This high participation in Hooded Plover monitoring and recovery is testament to the high level of investment from the Adelaide and Mount Lofty Ranges Natural Resources Management Board from 2008 onwards.

The number of breeding pairs has increased on the Fleurieu Peninsula over this time, and site use revealed that very few sites had breeding pairs recorded every season over the entire seven years, highlighting higher than usual variation compared to elsewhere on the southern coast of Australia. Hooded Plovers on the Fleurieu Peninsula can sometimes use multiple beaches in a season for breeding. In total 39 sites have had breeding Hooded Plovers in the seven seasons monitored. Hatching success has varied between 27% and 61%, and chick survival rates between 30% and 47% across seasons. A total of 70 fledglings have been produced. These were produced at 22 sites, while a further 17 sites have had no breeding success despite breeding attempts recorded in the seven seasons of monitoring.

Sites varied greatly in their threat profiles and in their breeding success in relation to the degree of human use of sites. While a total of 35% of all nests hatched, pairs nesting on beaches with low human use had a 46% chance of hatching, compared to 31% of nests hatching on beaches with very high human use. Similarly, 35% of chicks successfully fledged, with the greatest chick survival occurring for pairs occupying beaches with low human use (52% of chicks fledged on these beaches), compared to the lowest chick survival (23%) occurring on beaches with high human use. When we explore the influence of management on breeding success at sites, we see an increase in the proportion of nests that hatch from 23% when no management occurs, to 46% where fencing and signage is installed. The overall benefits of management are significant; at sites with no management in place only 0.28 fledglings were produced per pair, while at managed sites 0.58 fledglings per pair were produced.

Conservation recovery targets set at fledgling production rates of between 0.4-0.5 fledglings per pair were met across all seven seasons. The lowest level of breeding success (0.46 fledglings/pair) occurred in the 2009/10 season, when 19 pairs produced 9 fledglings. In the 2015/16 season, the highest levels of breeding success were experienced, with 19 fledglings produced by 22 pairs (0.86 fledglings/pair). This was the result of unusually high hatching success that season, but chick survival was lower than any other season. Recommendations for threat mitigation at sites are presented.

Introduction

Hooded Plovers (*Thinornis cucullatus*) are a threatened beach-nesting bird, endemic to southern Australian beaches. They preferentially select ocean beaches, particularly wide beaches with a wide wave-wash zone backed by dunes and with large amounts of beach-washed seaweed (Weston 2003). Beaches with creek mouths or inlet entrances are also preferred. The entire worldwide population of Hooded Plovers (found only in Australia) is estimated at 5,500 individuals: 3,000 in the eastern subspecies and 2,500 in the western subspecies (Garnett et al. 2011). Under both National legislation (*The Environment Protection and Biodiversity Conservation Act*) and under South Australian state legislation (*The South Australian National Parks and Wildlife Act*), the Hooded Plover (eastern) is listed as Vulnerable. At the time of writing at least 716 Hooded Plovers occur in South Australia, these were counted in a mainland population census in November 2018, where 91% of the 1,641.4 kilometres of potential suitable habitat (Ehmke et al. 2016) were surveyed (Adams et al. 2018).

The Hooded Plover breeding season extends from August to March, but can include July and April dependent on climatic and tidal conditions (Weston 2000; Baird and Dann 2003; BirdLife Australia data). Hooded Plovers generally lay between one and three eggs in a simple scrape of sand, on the beach above the high tide mark or into the dune. They prefer open areas with sparse to no vegetation for nest placement, providing a broad view of potential threats to minimise predator ambush.



Photo: Sue and Ash Reed

Once laying of the clutch is complete, the birds incubate for 28 days. They use passive nest defence and camouflage of the eggs to reduce the chances of a predator finding the nest. Their nest defence strategy is to leave the nest when a predator approaches and stay distant from the eggs until the predator leaves and it is safe to return. After hatching it takes 35 days until the chicks can fly. During this period they are active on the beach finding their own food and being warned into hiding by calls from their parents. Once a chick reaches 35 days and its wings are strong enough for flight, it is less likely to go into hiding and will more commonly fly from danger. Fledglings can be evicted from the territory once they are capable of flying, especially if there is still time in the season for additional nesting attempts by the pair. In other cases, more commonly later in the season, the fledglings can remain on territory with the family unit for months. Within one breeding season a pair can have multiple nesting attempts, increasing their chance of successfully producing young in such dynamic environments.

The breeding season coincides with peak human recreational use of beaches, so that there are many human related threats these birds must overcome. These threats include direct crushing of eggs or chicks, as well as disturbance to the nesting birds. Disturbance can result in parent birds leading or distracting threats away from the nesting habitat. When frequent or prolonged disturbance occurs the eggs or chicks are left vulnerable and placed under greater threat. The key threats types are discussed in further detail in the 'Threats' section of this report (pp. 43-49).

Hooded Plover Recovery Program

The introduction of multiple threats to breeding Hooded Plovers and the escalation in the extent and intensity of these threats across the species range has resulted in plummeting breeding success rates and resultant declines in Hooded Plover population numbers from 1980. Prior to 1980, there was no formal quantification of Hooded Plover population numbers so that it is unclear as to the full extent of these declines and population trajectories prior to this.

In 2006, BirdLife Australia (then Birds Australia) initiated the Beach-nesting Birds (BNB) Program to address the escalating human-related threats to beach-nesting birds and to build coexistence between beach users and this threatened suite of birds. The Hooded Plover was used as a flagship for the program, starting with the establishment of monitoring of 70 breeding pairs across the coast of Victoria and the training of citizen scientists to collect detailed nest success and threat data. The first three years of this program explored the effectiveness of different management strategies for

improving breeding success and led to the development of best practice breeding site protection actions (Maguire, 2008).

In 2006 monitoring and nest management began on a selection of beaches on the Fleurieu Peninsula and from 2008, the BirdLife Australia BNB program extended officially into South Australia with support from the Australian Government's Caring for our Country program and investment from the Adelaide and Mount Lofty Ranges Natural Resources Management (AMLR NRM) Board. The collaboration between BirdLife Australia and AMLR NRM was aimed at aligning recovery efforts with national aims and methodologies developed by BirdLife Australia, and through the significant investment from the AMLR NRM Board over time, this would ensure that priority recovery actions on the Fleurieu Peninsula and the foundations of monitoring and volunteer participation, could be supported and effectively achieved.

Hooded Plover recovery on the Fleurieu Peninsula takes a multi-faceted approach and includes regular monitoring of breeding success, on-ground management of nest and chick sites, and education and public awareness campaigns. In the absence of an approved recovery plan (the South Australian Recovery Plan for the Hooded Plover, Baker-Gabb and Weston 2006, still remains in draft form), recovery efforts on the Fleurieu Peninsula align with national priorities that are guided by research and an adaptive management approach established by BirdLife Australia. The specific aims of Hooded Plover recovery in South Australia are to:

1. Improve breeding success and population resilience of Hooded Plovers in South Australia through:
 - On-ground threat mitigation at priority sites
 - Research to overcome key knowledge gaps and to evaluate and adapt best practice actions for Hooded Plover recovery
 - Education to shape sustainable beach use behaviours
2. Protect and restore critical habitat so that the current distribution is maintained and protected
3. Develop tools, resources, capacity and supportive policy to ensure sustainability and consistent delivery of recovery actions over time – the species is likely to be perpetually 'conservation dependent', that is, dependent on conservation efforts to prevent it from becoming threatened with extinction.

On the Fleurieu Peninsula specifically, our aims are expanded into the following detailed actions:

- 1. Improve breeding success and population resilience of Hooded Plovers:**
 - i. Monitor the breeding status of all known pairs on the Fleurieu Peninsula during the breeding months (August-March). Seek to maintain monitoring of sites over time to quantify improvements in breeding success related to management investment;
 - ii. Ensure all sites where birds are monitored, have potential threats being simultaneously monitored. This is to assess changes in the occurrence and severity of threats over time, to detect new and emerging threats, and to assess the impact of threats on breeding outcomes;
 - iii. Implement on-ground protection of individual breeding sites assessed as vulnerable, following best practice management protocols outlined in 'A practical guide to managing beach-nesting birds in Australia' (Maguire 2008);
 - iv. Implement an adaptive management approach, by investigating the effectiveness of nest site protection and modifying where appropriate (and following best practice) in subsequent seasons. For example, management techniques can be adapted to local geomorphological and beach user specifications;
 - v. Install remote cameras at nest sites where nests repeatedly fail to detect and identify nest predators. This is done following strict protocols and there are strict limits on the frequency of use of remote cameras to avoid any predator associations between cameras and nests;
 - vi. Band a sample of Hooded Plovers on the Fleurieu Peninsula and maintain a database of future sightings to track movements, survival rates and site and pair fidelity. This will lead to better knowledge about the exchange of birds between the Fleurieu Peninsula and other regions of South Australia, and possibly other states, enabling a better idea of what we consider a population. Blood samples are taken to contribute to a collaborative study of population genetics carried out by Museums Victoria, Deakin University and BirdLife Australia, and;
 - vii. Increase awareness and engagement of communities in Hooded Plover conservation via media, social media, and organised events and activities such as the biennial count, scope viewing, dogs' breakfasts, school visits and craft stalls. Awareness raising and opportunities to participate are carried out with the aim of changing beach user behaviour to promote long-term coexistence and minimise human impacts.

- 2. Protect and restore critical habitat so that the current distribution is maintained and protected**
 - i. Maintain a current distribution map and database of the location of breeding pairs of Hooded Plovers on the Fleurieu Peninsula;

- ii. Participate in the Hooded Plover eastern mainland census (Biennial Count) every two years (e.g. November 2016, November 2018) to inform population trend and high level threat trend analyses;
- iii. Using threat assessments from the Biennial Count, coupled with local volunteer knowledge of intensively monitored sites, identify sites where habitat is being degraded by invasive or introduced weeds and target these sites for weed control;
- iv. Identify sites at risk of tidal inundation and investigate potential for habitat retreat or habitat improvements to create longer-term resilience to adapt to rising sea levels;
- v. Protect sites from habitat modifications that will impact suitability for nesting, foraging, roosting or flocking, and;
- vi. Seek to understand impacts of climate change on population distribution and to prioritise sites for habitat protection, including protection from future coastal armouring projects.

3. Develop tools, resources, capacity and supportive policy to ensure long-term sustainability and consistent delivery of recovery actions.

- i. Establish 'Friends of the Hooded Plover' regional groups on the Fleurieu Peninsula to encourage community ownership and long-term sustainability of the program;
- ii. Develop new resources and materials to support and improve participation of volunteers and land managers in monitoring and recovery actions for the Hooded Plover;
- iii. Hold regular meetings, workshops and training opportunities and support communications between volunteers, land managers and program coordinators so that all participants share feedback and work collaboratively toward improved recovery outcomes;
- iv. Ensure all data is entered in to BirdLife Australia's MyBeachBird portal to contribute to the national program;
- v. Work in partnership with land managers to deliver consistent on-ground recovery actions, signage and messaging, and;
- vi. Engage with local, state and federal government policy and decision makers to ensure threats to Hooded Plovers and their habitat are acknowledged and managed accordingly. This may for example include influencing local bylaws, statewide threatened species or coastal planning legislation, tourism or events management, beach renourishment projects, etc.

For the period covered by this report, at a regional level, two Coastal Action Plans within the Adelaide and Mount Lofty Ranges Natural Resources Management (AMLR NRM) region applied to the sites covered by this project: the Southern Fleurieu Coastal Action Plan and the Metropolitan Adelaide and

Northern Coastal Action Plan. The plans outline key conservation priorities along the coast, provide suggested actions and identify key players to be involved. These plans are used to assist in priority setting of coastal management actions for the AMLR NRM Board, councils and DEWNR. The AMLR NRM Board resources the local implementation of actions identified in the Coastal Action Plans including local initiatives to conserve Hooded Plovers, which is a focal species in the plan.

Program Partners

There are many active stakeholder groups involved in Hooded Plover recovery on the Fleurieu Peninsula. From 2008, BirdLife Australia and the AMLR NRM Board have worked collaboratively to implement the recovery program. The main roles of the different groups working on this project are as follows:

- BirdLife Australia Staff provide strategic direction for recovery of Hooded Plovers across the Eastern mainland, register and induct volunteers, maintain ethics and permit approvals, provide advice, workshops, training and technical support, as well as data analysis and maintenance of the national MyBeachBird database. BirdLife Australia staff also carry out research to improve recovery efforts, analyse and review data to maintain an adaptive management approach, and maintain a national network for information sharing and support for the recovery of the Hooded Plover.
- On the Fleurieu Peninsula, Marine and Estuary managers and officers from AMLR NRM, coordinate and support the Hooded Plover recovery project and the volunteers.
- Staff from local councils (during the time of this report: City of Onkaparinga, District Council of Yankalilla, City of Victor Harbor and Alexandrina Council) and the Department for Environment and Water (previously the Department of Environment, Water and Natural Resources) assist with on-ground breeding site protection efforts and work closely with BirdLife Australia, AMLR NRM and community volunteers to ensure coastal policy and regulations are appropriate for the protection of Hooded Plover habitat. After the period covered by this report, the Hooded Plover population extended its range and additional councils have become involved including City of Marion, City of Holdfast Bay, City of Charles Sturt.
- Local volunteers in this region formed the Friends of the Hooded Plover Fleurieu Peninsula, and play an important role in delivering the recovery plan for the Hooded Plover through their involvement in nest monitoring and assisting with on-ground conservation actions. Volunteers also play a key role in raising awareness in their local communities and engaging beach users

to assist in shaping positive beach use behaviours. The Fleurieu Peninsula is geographically large and during the time period covered by this report was divided into three zones, each with their own Volunteer Regional Coordinators. These Coordinators could provide more support to volunteers in their given region and increase community ownership of the program. These three zones are the “Onkaparinga Beaches”, “Myponga Beach to Cape Jervis”, and “South Coast (see Figure 1).



Figure 1: Regions covered by the Friends of the Hooded Plover Fleurieu Peninsula during the period of this report

Aims of this report

From 2006 onwards, there has been significant research focused on Hooded Plover ecology, conservation management and even the social facets of managing this threatened species. This report aims to build on our understanding of Hooded Plover conservation management, by collating and reviewing seven years of nesting and threat data collected by volunteers, land managers, BirdLife Australia and NRM staff on the Fleurieu Peninsula. Specifically, the objectives of this report are to:

- investigate how survey effort may have changed over time,
- examine trends in breeding parameters,

- determine patterns in breeding success within and between seasons,
- explore changes in breeding success in relation to the intensity of beach use,
- assess the effectiveness of nest protection management,
- collate threat profiles for breeding sites in the region, and
- provide management recommendations for sites based on these threat profiles.

Methods

From 2009, standardised monitoring of breeding pairs was introduced to the region, with high investment from the Adelaide and Mount Lofty Ranges Natural Management Board (AMLR NRM) in the training of citizen scientists to follow strict protocols for monitoring the birds over the breeding season (August to March), as well as an NRM-funded coordinator through the Coast, Estuary and Marine Officer position hosted by City of Holdfast Bay. Given the small size of the Hooded Plover population in this region and the accessibility of pairs for volunteers to monitor, the entire population was selected for intensive monitoring with the aim of gaining a better understanding of breeding success across a range of sites experiencing different threat types and intensities. Members of local birding groups such as Birds SA and the previous Fleurieu Birdwatchers were highly active across the region, so that any new locations where the birds occurred were quickly detected, extending the number of monitored sites over time.

During each visit to a Hooded Plover site, the observer/s thoroughly searched the length of the beach or the known territory for the breeding pair. When birds were absent, a report would be submitted saying 'no birds sighted'. If this continued for a period of time, the search area was extended to include nearby beaches. When birds were sighted, the observer/s would look for key behaviours indicative of nesting or having chicks, and experienced observers would search for an active nest if there was evidence indicating a potential active nest. Each breeding attempt would be followed through time with the aim of determining the success of each attempt, specifically, to establish the fate of the egg and the chick phases. Visitation rates varied, but the ideal frequency was at least a fortnightly visit over the breeding season, and when nesting, at least weekly to detect the stage of failure if this occurred. Observer/s aimed to visit more frequently around estimated hatching and fledging dates to more accurately determine success or failure at the different stages.

In 21 cases, nests were not located and chick/s sightings were the first evidence of that breeding attempt. This was more common in early seasons when there were fewer volunteers and less frequent visits. For those situations, the median clutch size (3) was used for that breeding attempt in analyses. Fledging was assessed based on multiple criteria including: reaching 35 days post hatching and/or observed as flying independently in a sustained flight over several hundred metres, and being adult sized and average 'fledging appearance'. Note that there have been a few occasions (e.g. at Victor Harbor) where chicks did not develop at the usual rate. These were significantly smaller than average and, although the chicks reached day 35, they were not classified as fledged until they reached the average size/developmental stage to support independent flight.

In the field, observers would simultaneously carry out a rapid threat assessment when collecting Hooded Plover data. This was a critical component of the data collection, enabling us to identify threats at sites, assess trends in these threats over time and their response to mitigation efforts. It also allowed the interpretation of breeding success and failure in relation to these threats. Threat assessments included threats present as well as evidence of threat having been present, through prints and tracks. The latter were critical for detection of threats that were more temporally restricted (e.g. nocturnal foxes) or rarer, due to varied frequency of site use for some purposes (e.g. vehicles and horses).

From 2012 onwards, a subset of birds was flagged with unique engraved leg flags on the upper leg. Flags were orange with black engraving, or white with black engraving, with two alpha-alpha combinations (e.g. HV). Sightings of flagged birds enabled us to better understand site movements, recognise cases of divorce and partnership changes, to identify floaters in the population and to identify disappearances of longer-term individual birds (suspected to have died).

All data used in this report were heavily vetted by BirdLife Australia Hooded Plover experts for accuracy, and breeding summaries were generated using standardised decision-making rules including minimum sample sizes for inclusion. These are noted in the relevant sections below.

Results

Volunteer Monitoring Effort

BirdLife Australia's Hooded Plover nest monitoring on the Fleurieu Peninsula began in 2009, with monitoring occurring at 15 Hooded Plover sites in the first season (between one and 36 observations per site). The number of monitoring sites increased each year with a total of 44 Hooded Plover sites monitored over the 7 years. In some years, the territory of a breeding pair of Hooded Plovers would overlap two sites and therefore be combined and classified as one during this report. Sites that have been monitored but where no Hooded Plovers have been recorded, have not been included in this report. In 2015/2016, there were 42 sites monitored with between 3 and 213 observations per site (Figure 2).



Photo: Renee Mead

A total of 32 volunteers were involved in monitoring Hooded Plovers in the 2009/2010 season. Recruitment of volunteers occurred every year through a range of avenues - print and social media, community awareness events, volunteer training workshops and word of mouth. Each year between 10 and 28 new volunteers began monitoring and in the 2015/2016 season, 56 nest monitors were involved in the project, the largest number for the period of this study (Figure 3).

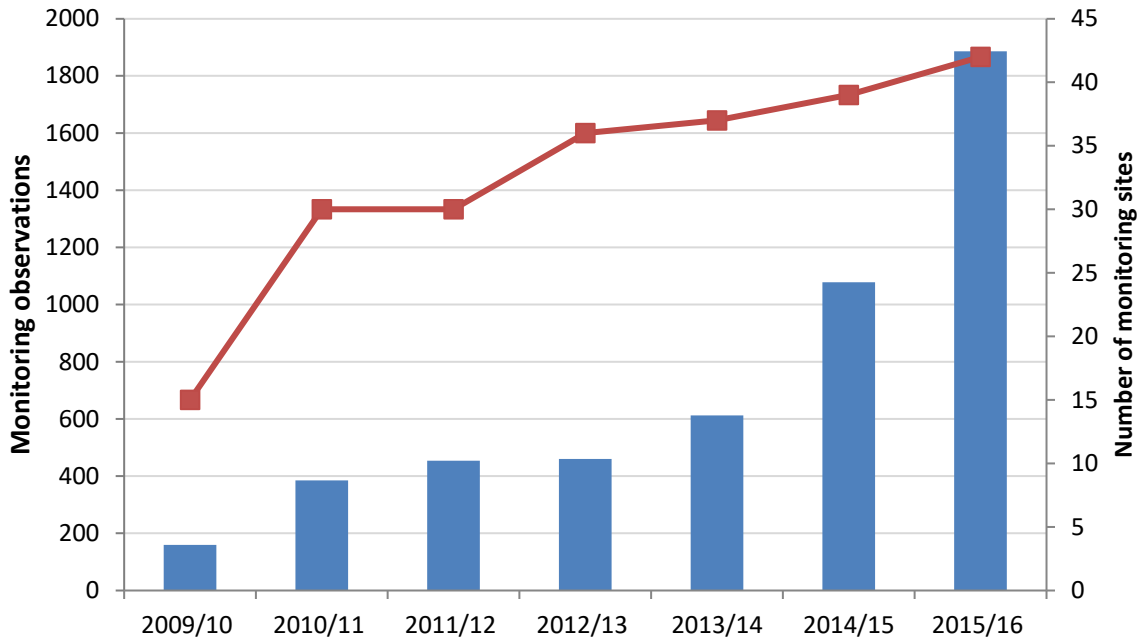


Figure 2. The number of sites monitored per season (red line) and the number of monitoring observations reported (blue column) during each of the 7 breeding seasons on the Fleurieu Peninsula.

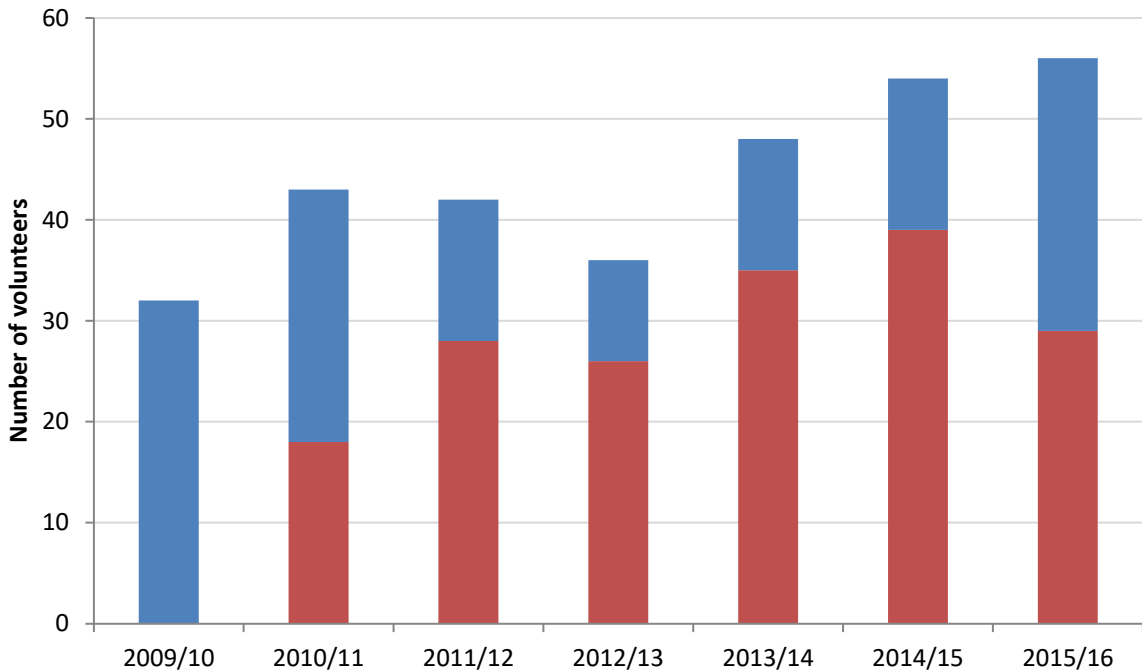


Figure 3: The number of new (blue) and returning (red) volunteers involved in monitoring beach-nesting birds on the Fleurieu Peninsula over 7 breeding seasons.

In the first season of monitoring, volunteers reported 159 observations overall; this number has increased every year since, with the greatest number of observations, 1,885, occurring in the 2015/2016 breeding season (Figure 2). A total of 5,033 observations were analysed in this report covering the seven breeding seasons. The frequency of observations varied within a season, largely in relation to the breeding activities of the birds. The average number of reported observations increased from 32 observations in August, peaked in December and January and dropped back to 15 in May, once breeding activity had ceased. The error bar reflects the degree of variability between seasons (Figure 4).

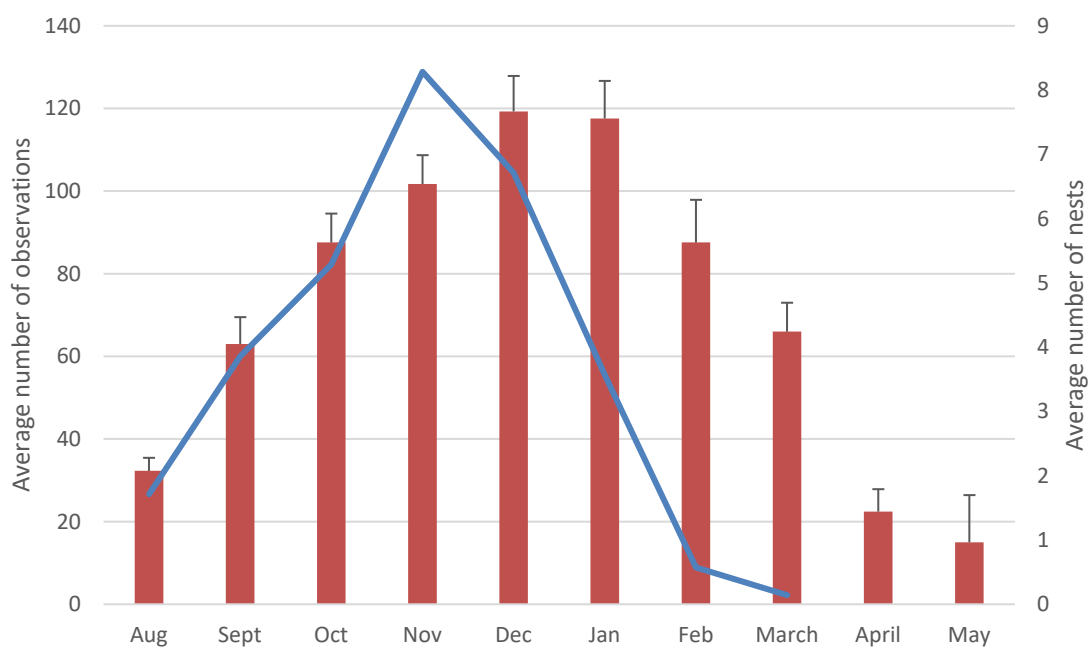


Figure 4. The mean number of observations (+se) reported during each of the Hooded Plover breeding months over the seven years (red column), with average number of nests (blue line).

Nesting summary

Population size and occupancy of breeding pairs

Population counts estimate 30-50 adult Hooded Plovers on the Fleurieu Peninsula (Adams et al. 2018, Driessen and Maguire, 2014, Ekanayake et al. 2016, Mead et al. 2012). Over the seven breeding seasons documented in this report, there has been some variation in the number of known breeding pairs. The lowest number of known breeding pairs (13) occurred in the 2009/2010 season, this was due to the smaller number of sites that were monitored as the project was just beginning in South Australia. The number of sites being monitored almost doubled the following year and lifted the

number of known breeding pairs to 19. An interesting pattern occurred in the 2011/2012 season where the overall number of sites monitored was similar, however the number of known breeding pairs dropped to 14. This was strongly influenced by the results coming from the Tunkalilla territories, with four pairs being recorded in 2010/2011 dropping to only one pair in 2011/2012 (Table 1).

In the four remaining years the number of sites monitored slowly increased, as reports came in from birdwatchers and the general public, or during structured surveys like the biennial population count, that Hooded Plovers were recorded using new beaches, such as Yilki and Olivers Reef (Table 1). The number of Breeding Hooded Plover pairs increased, resulting in 22 known breeding pairs in the 2015/2016 season (Figure 5).

The increase in the breeding population that has occurred over these seven years is extremely encouraging and is a result of the recovery efforts that have occurred both locally and across the geographic range of the Hooded Plover more broadly.

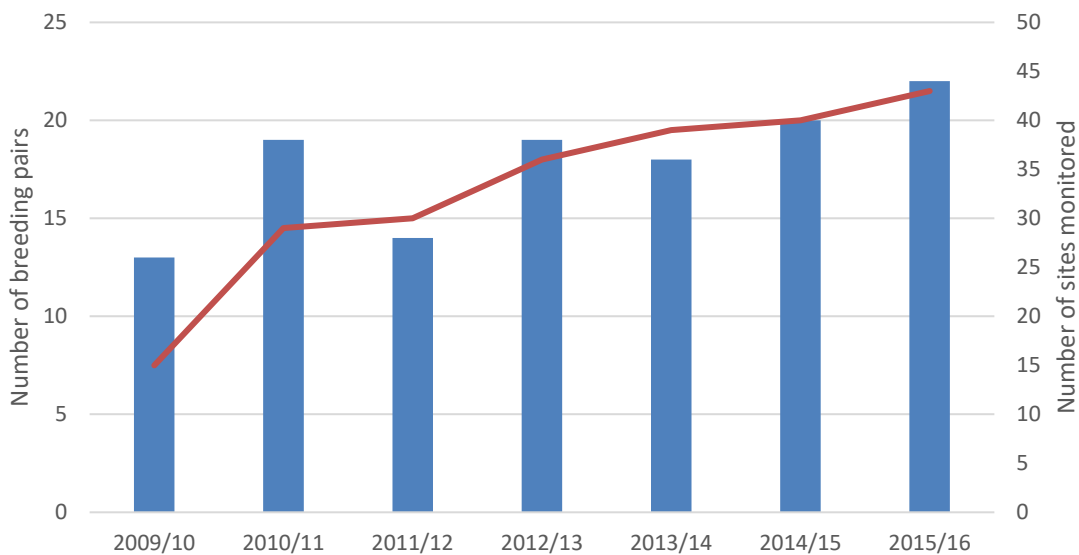


Figure 5: The number of breeding pairs recorded (blue column) and the number of sites monitored (red line) per season.

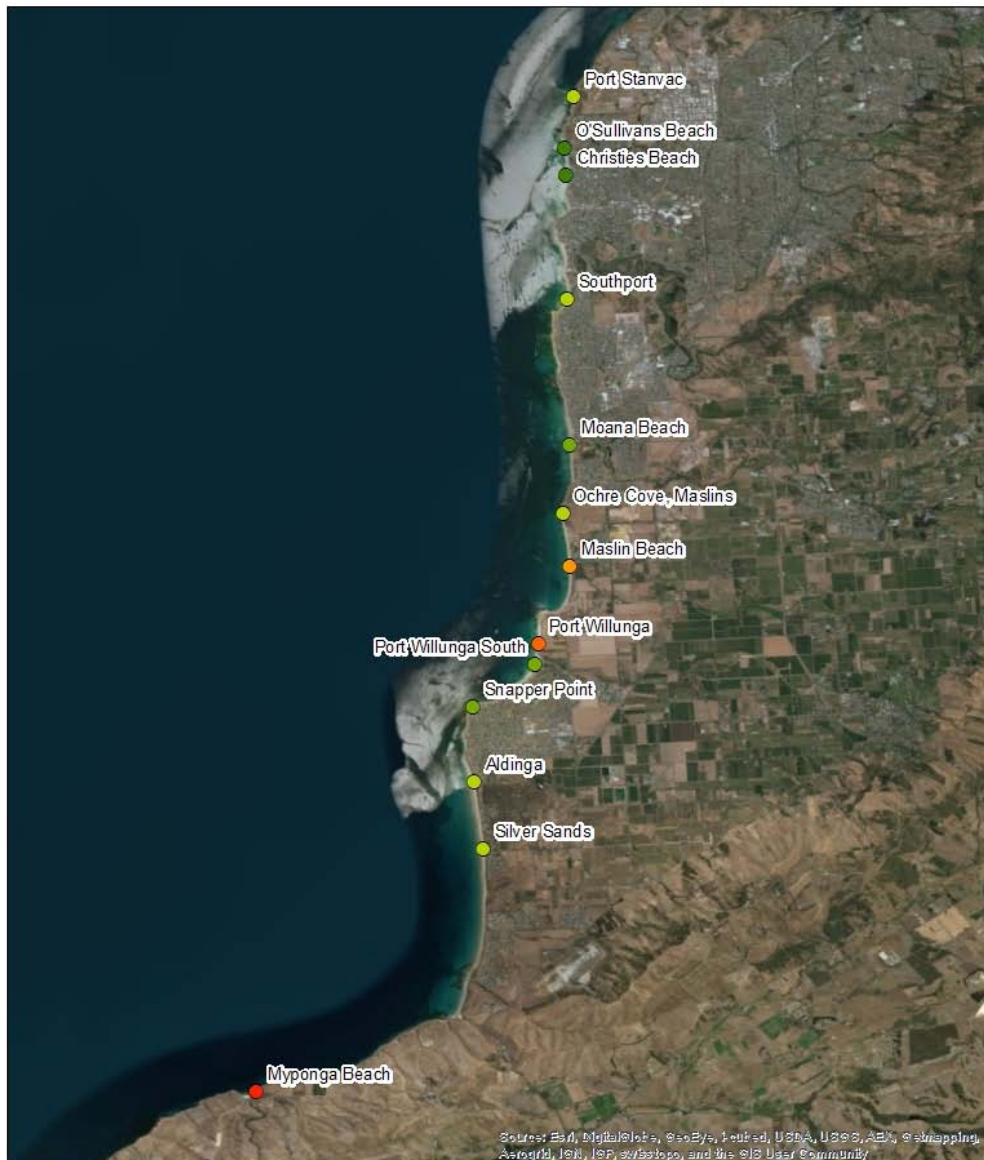
Table 1: The number of nests (N), chicks (C) and Fledglings (F) recorded in each of the seven seasons across all monitored sites on the Fleurieu Peninsula. Human use categories occur in parenthesis following each site name (L=low, M=medium, H=high, VH=very high), see beneath table for further key.

Site	2009/10			2010/11			2011/12			2012/13			2013/14			2014/15			2015/16		
	N	C	F	N	C	F	N	C	F	N	C	F	N	C	F	N	C	F	N	C	F
Aldinga (VH)	*	*	*	#	#	#	#	#	#	#	#	#	#	#	#	1	1	0	1	2	0
Ballaparudda (L)	*	*	*	*	*	*	*	*	*	2	0	0	1	0	0	3	2	0	1	2	2
Bashams Beach (M)	3	0	0	2	2	2	2	0	0	#	#	#	#	#	#	1	2	0	3	0	0
Callawonga (L)	*	*	*	*	*	*	*	*	*	^	^	^	2	3	1	#	#	#	1	0	0
Carrickalinga Estuary & South (H)	1	0	0	#	#	#	#	#	#	*	*	*	#	#	#	1	2	0	2	0	0
Carrickalinga North (H)	1	0	0	2	0	0	1	0	0	#	#	#	#	#	#	1	0	0	#	#	#
Carrickalinga Rotunda (VH)	#	#	#	3	2	1	2	0	0	1	0	0	1	1	0	2	0	0	3	2	2
Christies Beach (VH)	*	*	*	*	*	*	#	#	#	^	^	^	^	^	^	^	^	^	^	^	^
Coolawang (L)	^	^	^	^	^	^	^	^	^	#	#	#	^	^	^	#	#	#	#	#	#
Goolwa Beach (VH)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	#	#	#	^	^	^
Hindmarsh River Mouth (H)	1	0	0	6	3	0	1	0	0	3	2	0	#	#	#	5	2	0	#	#	#
Inman River Outlet (M)	1	2	2	2	3	1	3	4	0	2	2	0	5	0	0	#	#	#	#	#	#
Lands End (L)	*	*	*	#	#	#	#	#	#	#	#	#	#	#	#	1	2	2	2	5	3
Maslin Beach (H)	2	6	2	3	6	0	3	3	2	4	1	0	5	0	0	#	#	#	#	#	#
Middleton Beach (VH)	*	*	*	^	^	^	#	#	#	^	^	^	^	^	^	^	^	^	1	3	0
Moana Beach (VH)	*	*	*	1	0	0	^	^	^	^	^	^	^	^	^	^	^	^	#	#	#
Morgans Beach (H)	1	1	0	#	#	#	#	#	#	#	#	#	#	#	#	^	^	^	#	#	#
Myponga Beach (H)	1	2	0	2	5	2	1	2	2	1	0	0	2	0	0	4	0	0	1	2	1
Normanville North (VH)	1	0	0	3	0	0	#	#	#	#	#	#	1	0	0	#	#	#	#	#	#
Normanville South (VH)	*	*	*	1	0	0	1	0	0	1	0	0	^	^	^	^	^	^	2	6	3
Ochre Cove, Maslins (L)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	2	6	1	3	9	1
Olivers Reef (H)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	#	#	#	3	3	0
O'Sullivan's Beach (VH)	*	*	*	*	*	*	#	#	#	^	^	^	^	^	^	^	^	^	^	^	^
Parsons Beach (M)	1	0	0	#	#	#	#	#	#	1	0	0	2	0	0	#	#	#	2	0	0

Site	2009/10			2010/11			2011/12			2012/13			2013/14			2014/15			2015/16		
	N	C	F	N	C	F	N	C	F	N	C	F	N	C	F	N	C	F	N	C	F
Port Stanvac (L)	*	*	*	*	*	*	*	*	*	#	#	#	1	2	0	3	0	0	#	#	#
Port Willunga South (VH)	1	1	0	*	*	*	*	*	*	^	^	^	^	^	^	^	^	^	^	^	^
Port Willunga (H)	2	3	0	1	1	1	2	5	3	3	4	0	2	2	0	#	#	#	1	2	1
Sheepies Beach (L)	*	*	*	^	^	^	1	3	0	#	#	#	1	0	0	3	0	0	#	#	#
Shelley Beach (lady bay) (M)	*	*	*	1	2	0	3	0	0	2	0	0	2	2	0	1	2	1	1	0	0
Silver Sands (VH)	*	*	*	1	0	0	^	^	^	#	#	#	^	^	^	^	^	^	1	2	0
Snapper Point (M)	*	*	*	*	*	*	*	*	*	*	*	*	#	#	#	^	^	^	2	4	1
Southport (VH)	*	*	*	#	#	#	1	2	0	1	0	0	#	#	#	^	^	^	#	#	#
Tunkalilla far west (L)	*	*	*	1	3	2	#	#	#	2	5	5	1	3	2	~	~	~	#	#	#
Tunkalilla west estuary (L)	*	*	*	*	*	*	*	*	*	3	0	0	1	1	1	3	0	0	^	^	^
Tunkalilla mid west estuary (M)	*	*	*	1	1	0	*	*	*	1	1	1	1	2	2	3	1	1	#	#	#
Tunkalilla 1st house east (L)	*	*	*	1	0	0	^	^	^	1	0	0	#	#	#	~	~	~	1	2	1
Tunkalilla shed caravan (L)	*	*	*	^	^	^	*	*	*	#	#	#	#	#	#	~	~	~	#	#	#
Tunkalilla 3rd house east (L)	*	*	*	2	0	0	#	#	#	1	2	2	~	~	~	~	~	~	~	~	~
Tunkalilla Heysen (L)	*	*	*	*	*	*	1	0	0	1	2	0	3	1	1	3	5	4	1	1	1
Waitpinga Beach East (M)	*	*	*	1	0	0	#	#	#	2	0	0	1	2	2	1	1	1	3	2	1
Waitpinga Beach West (M)	*	*	*	*	*	*	*	*	*	*	*	*	#	#	#	2	0	0	#	#	#
Watsons Gap (M)	2	3	2	1	0	0	2	1	1	1	3	1	3	4	0	^	^	^	3	8	0
Yankalilla River Mouth (M)	*	*	*	*	*	*	*	*	*	*	*	*	#	#	#	3	0	0	#	#	#
Yilki (H)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	3	6	0	3	8	2
Grand Total	18	18	6	35	28	9	24	20	8	34	23	9	35	23	9	46	32	10	41	63	19

*No monitoring recorded # Birds sighted no confirmed nesting ^ No birds recorded ~ Site used by a pair from another site and thus combined

Very few of the sites had breeding pairs recorded every season over the entire seven years, highlighting that there is variation in site use over time. Figure 6 displays the number of breeding seasons where a pair has been present at each site across the Fleurieu Peninsula, and highlights only five sites, Myponga, Port Willunga, Carrickalinga Rotunda, Shelly beach and Watsons Gap, as hosting breeding for six or seven of the seven seasons. On the Fleurieu Peninsula, pairs can use multiple sites within a given season, and this has only been detected through the targeted leg flagging of individuals.



Number of breeding seasons

North

2009 / 2010 - 2015 / 2016



Number of Breeding Seasons

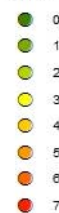






Figure 6: The number of breeding seasons a pair was present at a site over the seven breeding seasons (north, west, south west and south east regions).

Egg laying and nests

Information was collected on a total of 211 nests throughout the seven breeding seasons. An additional 22 ‘assumed’ nests were included in some data analyses. Nests were assumed in cases where chicks were sighted but there had been no prior sighting of a nest (this relates to the high crypsis exhibited by some pairs).

On the Fleurieu Peninsula, Hooded Plovers began nesting in August and new nests were reported as late as March, however most commonly, new nests were not found any later than January or February (Table 2). The average number of nests laid (based on first report) in August is 1.7 over the seven seasons, this number increased through to November where on average 8.3 nests were laid. Nesting rates then declined again through to the end of the season (Figure 7).

Table 2: The earliest and latest dates that nests were detected each season and their respective sites.

Season	First recorded observation	Earliest Nest Date	Earliest Nest Site	Latest Nest Date	Latest Nest Sites
2009/10	01/07/09	21/08/2009	Watsons Gap	31/12/2009	Normanville North
2010/11	26/07/10	21/08/2010	Maslin Beach	7/03/2011	Tunkalilla 3rd house east
2011/12	05/08/11	8/08/2011	Hindmarsh River Mouth	18/01/2012	Inman River Outlet
2012/13	01/08/12	11/08/2012	Hindmarsh River Mouth	19/01/2013	Tunkalilla west estuary
2013/14	03/08/13	24/08/2013	Port Willunga	7/02/2014	Tunkalilla Heysen
2014/15	07/07/14	22/08/2014	Ochre Cove, Maslins	11/02/2015	Ballaparudda
2015/16	04/07/15	18/08/2015	Ochre Cove, Maslins	20/01/2016	Watsons Gap

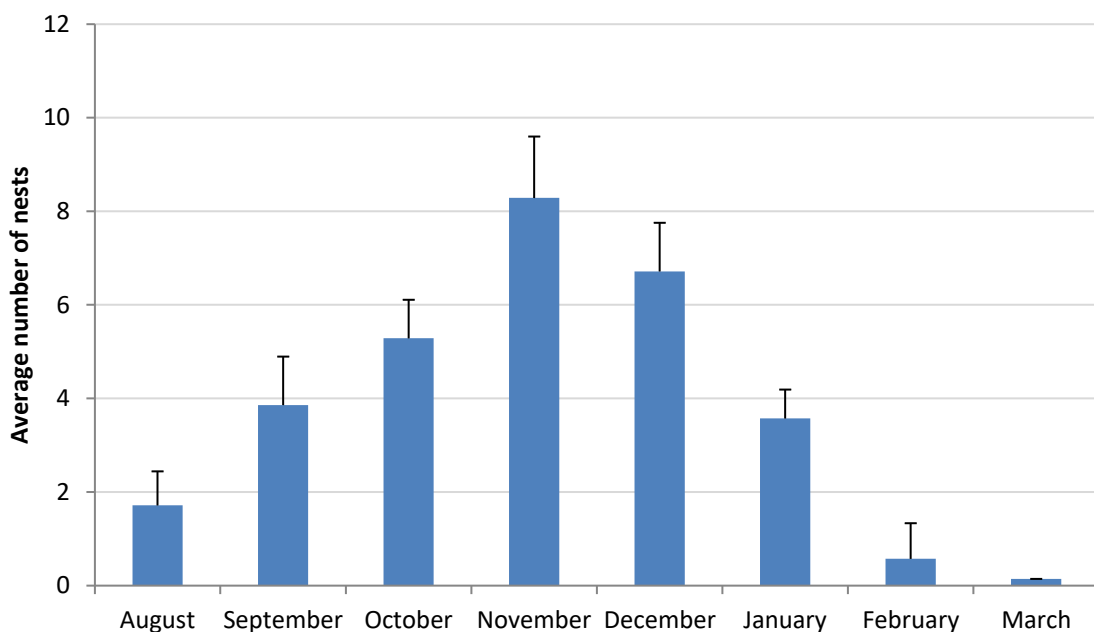


Figure 7: Average number of nests (date first detected) per month (+se) over the 7 breeding seasons.

Hooded Plovers can lay multiple clutches during a single breeding season. Throughout both Victoria and South Australia, the largest number of clutches one pair of birds has laid in a season is seven. The greatest number of clutches laid by one pair on the Fleurieu Peninsula was six. This has only been recorded once within the seven years, occurring in the 2010/2011 season at the Hindmarsh River

mouth (Table 1). The average number of nests per pair within a season ranges from 1.3 in 2009/2010 to 2.3 nests in 2014/2015 (Figure 8). The lower value recorded in 2009/2010 is likely to be influenced by the fact that this was the first year of the monitoring program and the number of observations recorded was significantly lower than in subsequent years. There is therefore a greater chance that nests failed prior to being recorded due to the length between visits. In subsequent seasons, the data is more reliable due to frequent visits and training and increasing experience of volunteers.

The number of eggs laid per nest (known as clutch size) varies typically between one and three for Hooded Plovers. There are many different theories that provide reasoning for why birds have different clutch sizes, for example clutch size has been linked to the age of the parents, food availability, the timing of breeding and even the risk of nest predation (e.g. Winkler & Walters, 1983, Nol et al., 1997, Harmackova & Remes, 2017). Due to the high energy requirements involved in nesting it was thought that clutch size of the Hooded Plover might decrease as the season progresses. We therefore examined clutch size in relation to the nesting attempt number (e.g. first nesting attempt) and in relation to the month of the year, and while earlier nests had slightly higher clutch sizes than later nests, the difference across breeding attempts or months was not substantial (Figures 9 & 10).



Hooded Plover nest up close; Hooded Plover nest at Tunkalilla beach from afar. Photos Grainne Maguire.

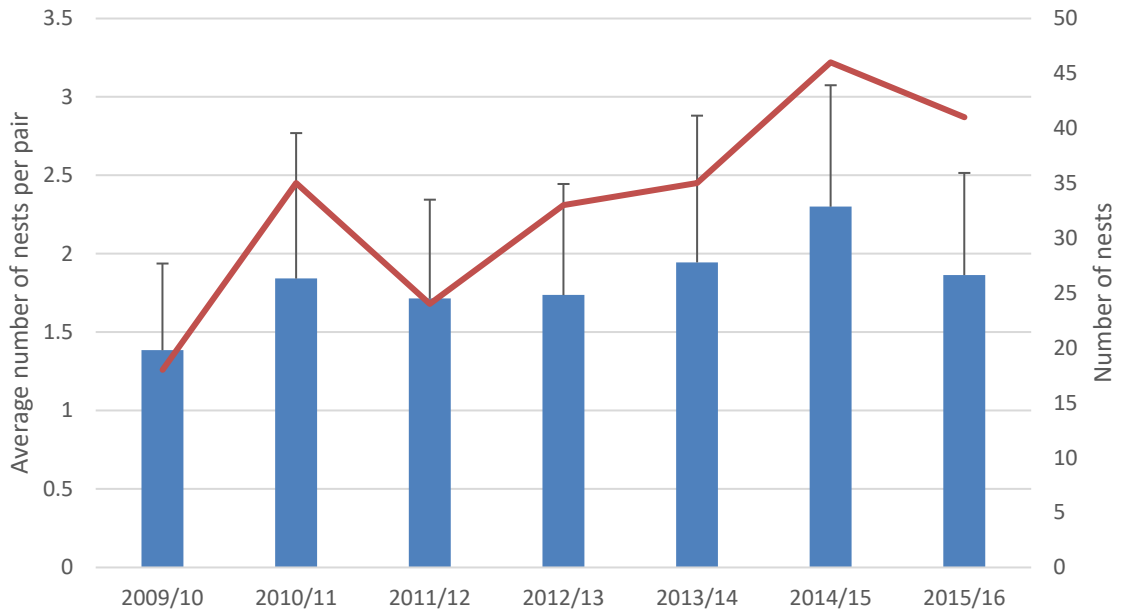


Figure 8: The mean number of nests laid per pair (+se) (blue) and the total number of nests (red) across each of the seven breeding seasons.

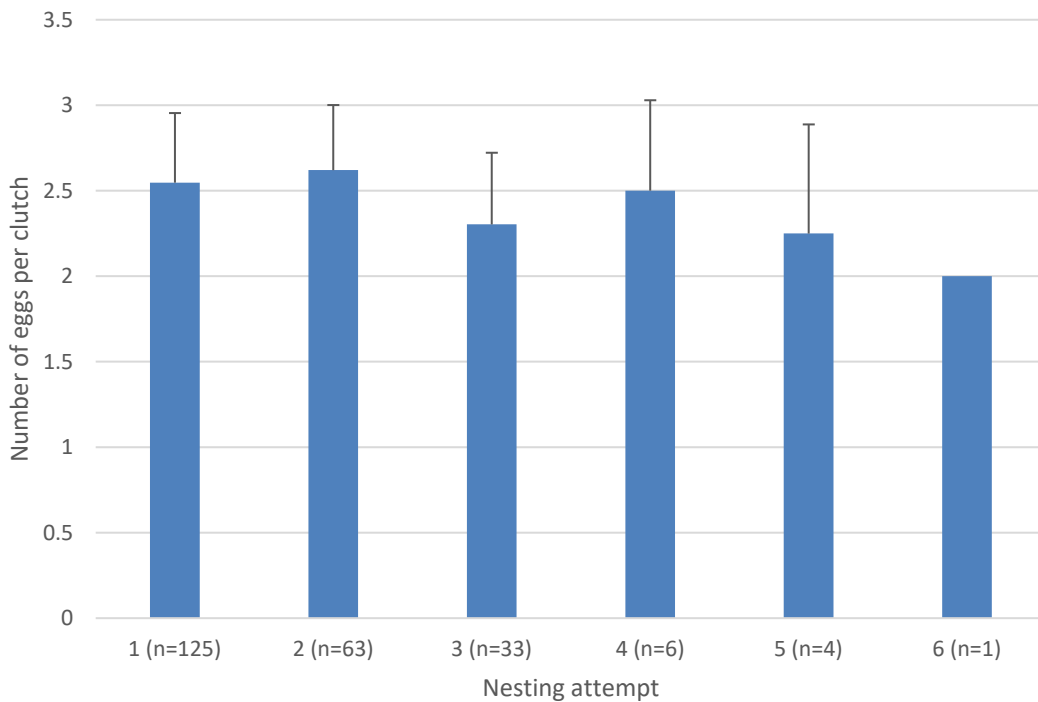


Figure 9. The average number of eggs per clutch (+se) based on the nesting attempt number over a given season (n = the number of nests within each nesting attempt category).

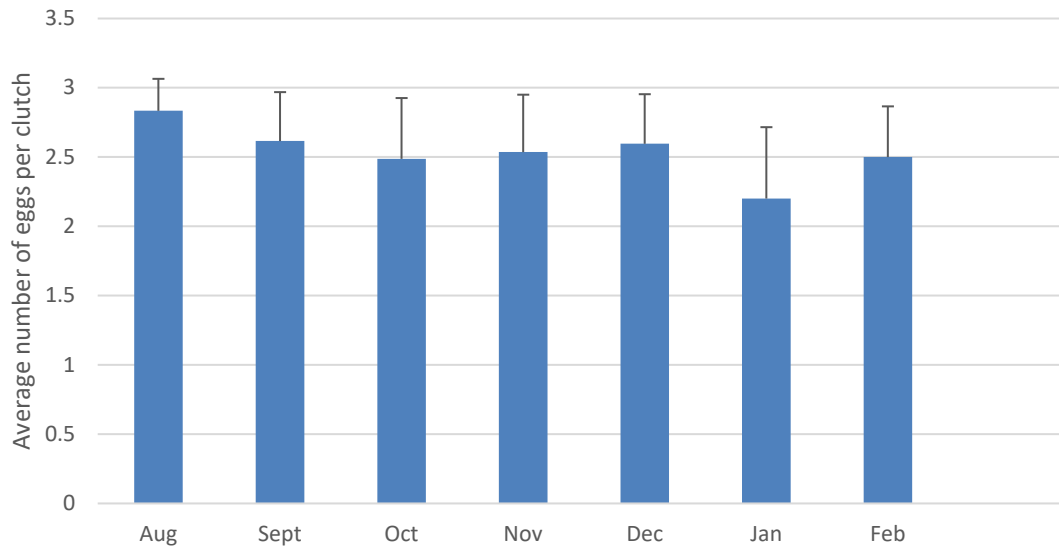


Figure 10. The average number of eggs per clutch (+se) within each of the months of the breeding season, across the seven seasons.

Hooded Plover monitors also recorded the habitat in which a nest is located, that is, dune, foredune, beach, estuary or rocks. On some beaches there were limited options for nesting due to natural morphology, but on some occasions this related more to human-related modifications such as weeds, beach/dune management techniques (e.g. dune matting) or the presence of infrastructure. Some examples of habitat and habitat modifications are shown in Figure 11.



Figure 11: An example of estuary habitat at Carrickalinga sands (top left) and an example of dune habitat at Normanville North beach (top right). An example of dune management at Normanville which would temporarily reduce nesting habitat (bottom left) and an example of vegetation and morphology at Moana beach resulting in an absence of dune nesting habitat (bottom right).

The most common habitat in which nests were recorded was on the beach, with 16.9 nests on average per season occurring on the beach (Figure 12). The next most common nesting habitat type was the foredune (5.6 nests per season), followed by dune (3.9 per season), estuary (1.4 nests per season) and finally, on rare occasions, Hooded Plovers also nested in rocky habitat (0.14 nests per season) (Figure 12).

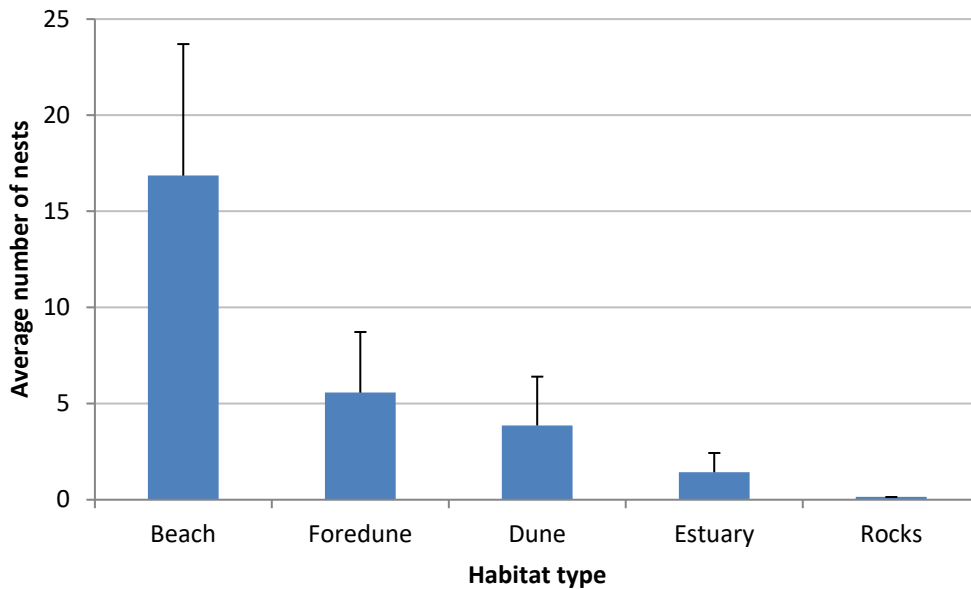


Figure 12: The average number of nests per season recorded in each habitat type.

Nesting success

Of the 211 nests recorded over the seven breeding seasons, a total of 35% hatched, 60% failed and 5% of nests were classified as “inconclusive” as a result of insufficient observations made during the nest period. Across the majority of breeding seasons, the number of failed nests significantly outnumbered those that hatched, with the exception of the 2015/2016 breeding season where this pattern was reversed (Figure 13).

We examined the success rates of nests throughout the breeding season (Figure 14). An interesting pattern emerged, where in the first and last months of nesting, August and February, the number of nests that hatched outnumbered those that failed (Figure 14). This could be due to the low number of nests during this time, meaning that the sample size is lower than in the other months, but could also be because volunteers were able to focus on the smaller number of nests and put in more effort to protect these nests than during the busy peak months. Another factor possibly effecting this pattern

is that human beach use may be lower during these months, as they fall outside of school holidays and peak beach use times.

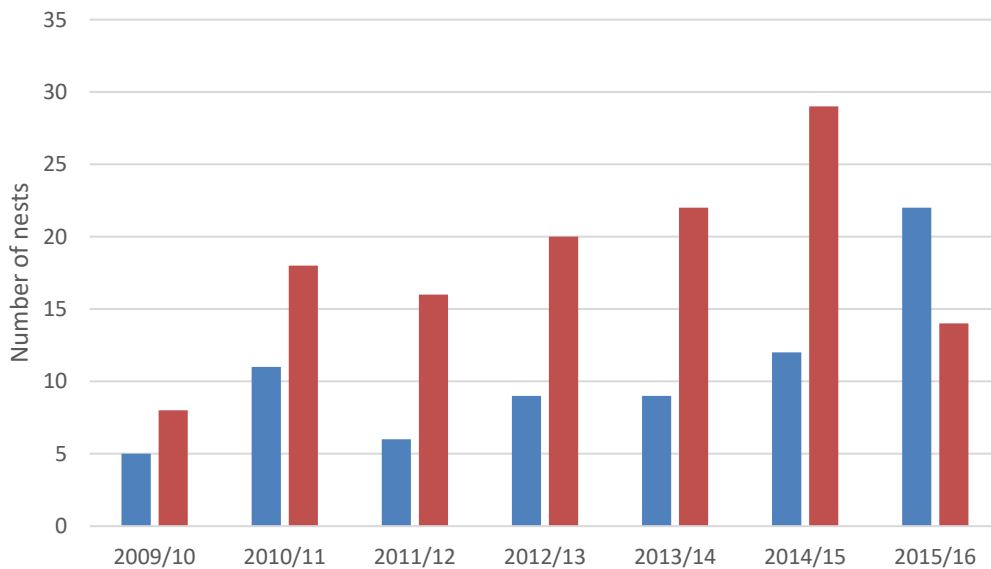


Figure 13: The number of nests that hatched (blue) and failed (red) over each of the seven seasons.

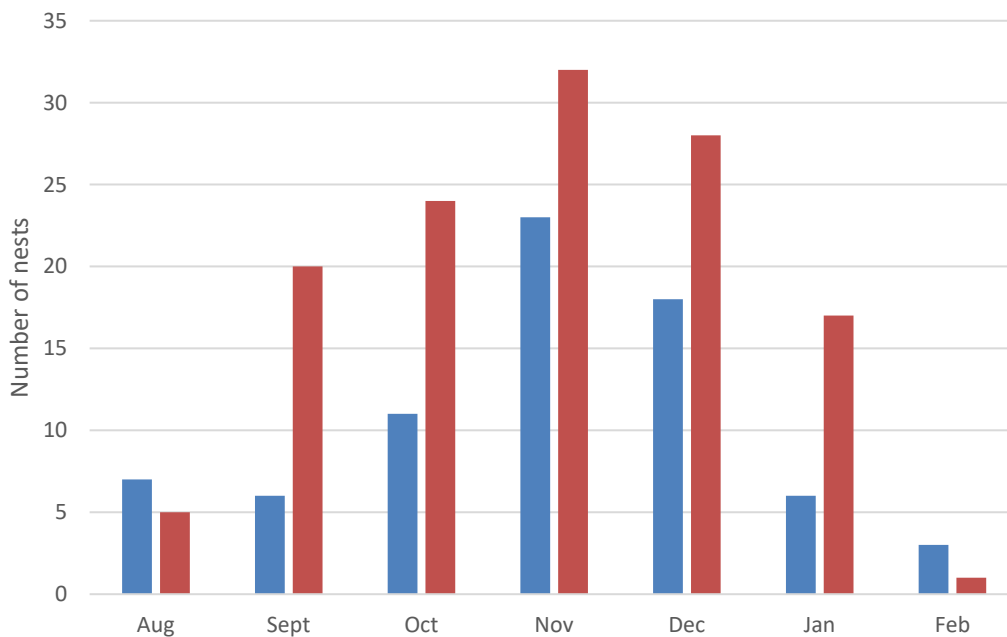


Figure 14: The total number of nests that hatched (blue) and failed (red) per month across all seasons.

We examined the percentage of nests which hatched and failed on beaches experiencing different levels of human recreational use. Human use categories were based on the average number of people and the coverage rating of human footprints recorded during a monitoring visit. This information was collected as part of the threat assessments carried out during nest monitoring over the seven seasons

and is discussed in more detail later in the report (pp. 50-52). An example of a low human use site was Lands End, which had on average 1.2 people and zero to light footprint cover, while Watsons Gap was considered a medium human use site with on average 3.7 people and light footprint cover. Carrickalinga North was rated as a high use site with 8.4 people observed on average and medium footprint cover, while a very high human use site was Southport with 31.7 people on average and medium footprint cover. Table 1 indicates the human use category identified for each of the breeding sites.

The highest percentage of hatched nests occurred at beaches with low levels of human use (46%), and the lowest percentage of hatched nests occurred at beaches with very high levels of human use (31%; Figure 15).

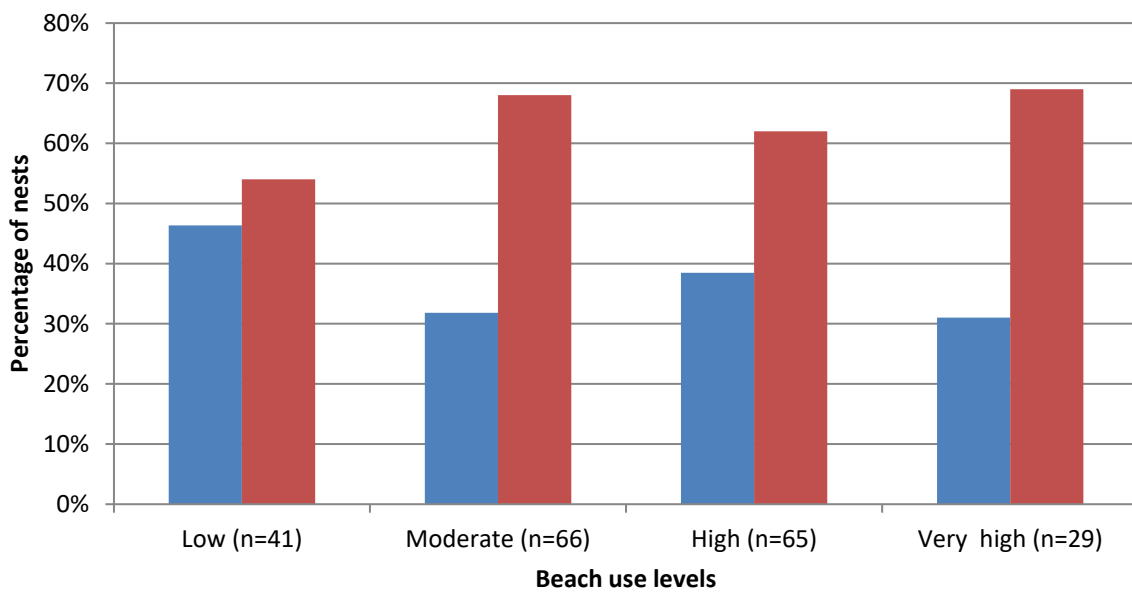


Figure 15: The percentage of nests that hatched (blue) or failed (red) at beaches across four categories of human use, with n denoting total number of nests in that category.

When hatching rates were explored in relation to management investment levels, only 23% of nests hatched when no on-ground management interventions were carried out (Figure 16). If only signage was in place (either around the nest or temporarily installed at the nearest access), the hatching rate increased to 25%, that is only by 2% (Figure 16). However, if temporary fencing was installed in addition to signage at the nest and/or access (see Figure 17), then the percentage of nests that hatched increased to 46% (double the rate of unmanaged nests, Figure 16). If we then consider human

use categories and management investment together, the importance of management is further highlighted (Figure 18). We know that hatching rates can be higher on beaches with low human use (Figure 15), however when fencing and signage were used to protect nests on even these beaches, the percentage of nests that hatched rose from 40% to 78% (Figure 18). On beaches with very high human use, not a single nest hatched unless both fencing and signage were put in place (although note that sample sizes were low). When fencing/signage management occurred, the hatching rate at these beaches was 39%, bringing it almost to the equivalent level of success that occurred on low use beaches in the absence of management (Figure 18).

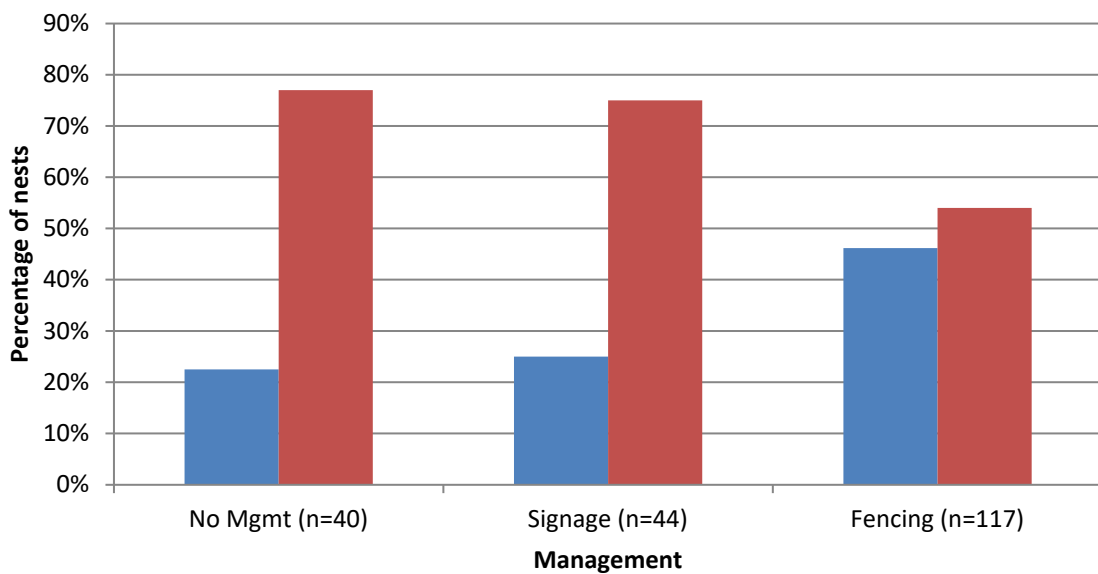


Figure 16: The percentage of nests that hatched (blue) and failed (red) based on three level of management, No Mgmt = no signage or fencing, Signage = either nest signage, access signage or both, fencing = fencing with or without signage at nest or access, with n denoting total number of nests.



Figure 17: Example of nest protection fencing with signage at Maslin beach, photo supplied by Sue and Ash Read.

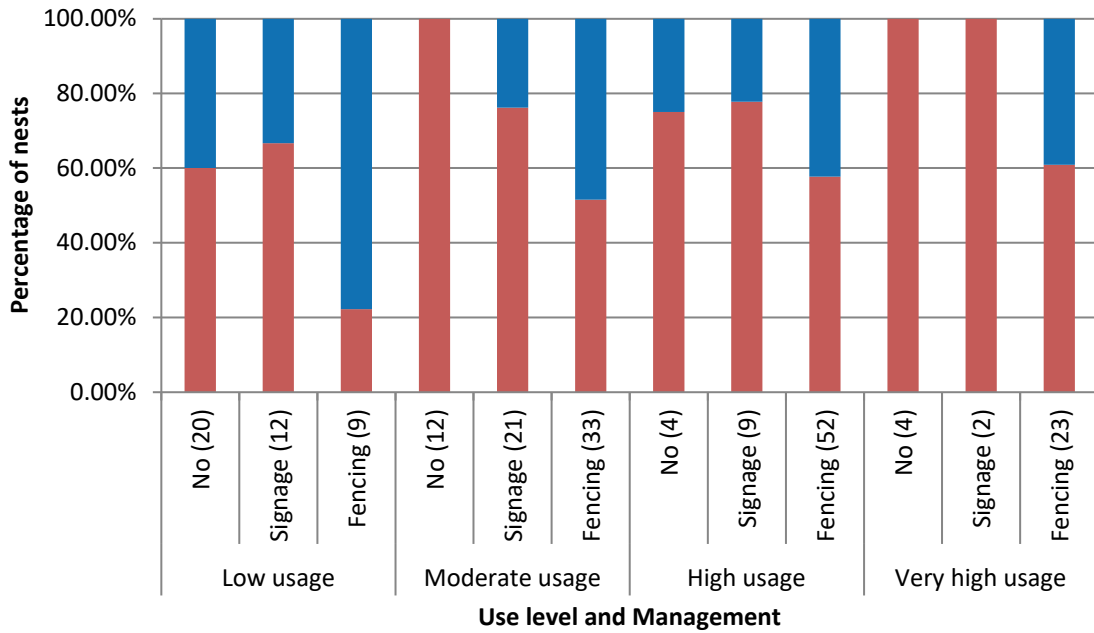


Figure 18: The percentage of nests that hatched (blue) and failed (red) according to the level of human use and management investment. No Mgmt = no signage or fencing, Signage = either nest signage, access signage or both, fencing = fencing with or without signage at nest or access, with n denoting total number of nests.

It is difficult to determine the cause of nest failure in observational studies and to accurately identify sources of nest failure, remote cameras at the nest are the most reliable method (Weston et al. 2017). In this study, almost 79% of nest failures were to an unknown cause (Figure 19). The most commonly identified cause of failure was the inundation of nests by high tides or storm surges (16% of failed nests; Figure 19). The remaining identified causes of failure included suspected fox depredation (3 nests), crushing (2 nests), dog disturbance (1 nest) and raven depredation (1 nest).

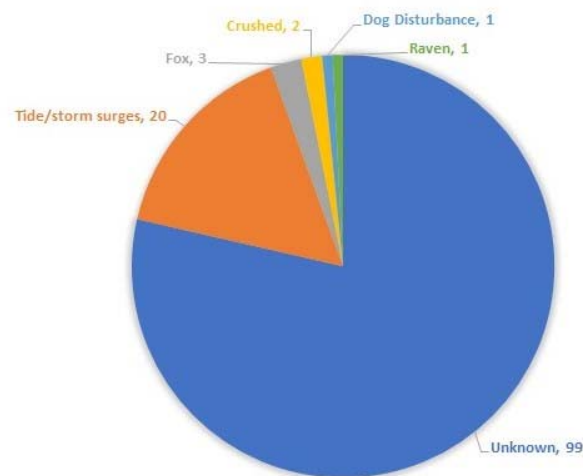


Figure 19. Causes of nest failure. The number of nests per category is shown.

Chicks

A total of 206 chicks have hatched on the Fleurieu Peninsula over the seven breeding seasons considered in this study. The number of chicks per season ranged between 18 and 63, however, more typically, between 20 and 30 chicks were produced per season (Figure 20). The highest number of chicks observed was in the 2015/2016 season (Figure 20). This significant increase is not explained by the two extra pairs monitored that season (compared to 2014/2015 season), but more so by the highest hatching success rates experienced compared to any other season. The average number of chicks produced per breeding pair was almost double that of any other season (Figure 20).

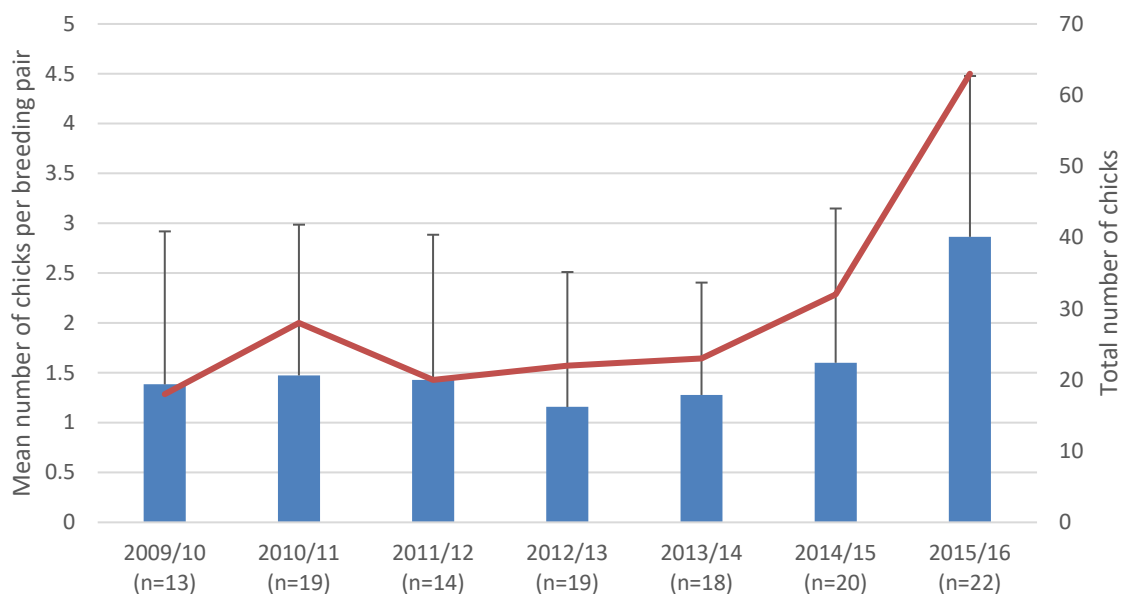


Figure 20: Average number of chicks that hatched per breeding pair (blue) and total number of chicks (red line) observed over the seven breeding seasons, where n denotes the total number of breeding pairs monitored per season.

The average number of chicks that were observed during each month of the breeding season is represented in Figure 21, with the error bars representing the variation across the seven breeding seasons. Average chick numbers peaked in December, which is in line with the November peak in nesting. The number of chicks per month is a reflection of the survival of nests across the season (see Figure 14), whereby early season nests appear more likely to fail and later season nests, more likely to hatch.

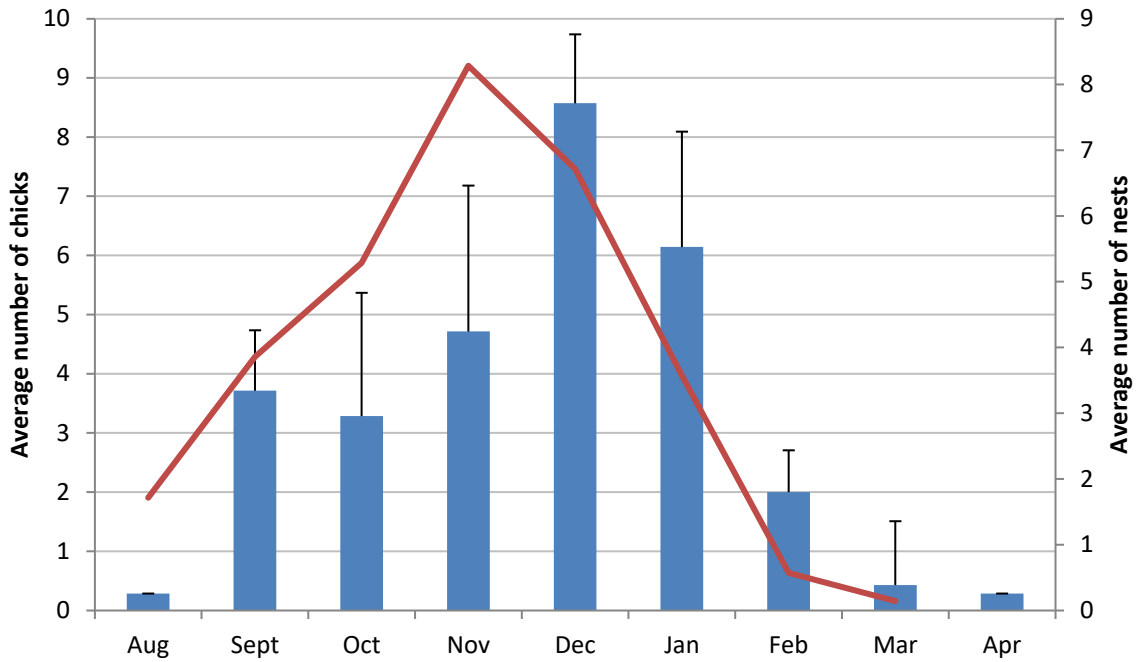


Figure 21: The average number of chicks first observed (+se) (blue) with the average number of nests (red line) per month throughout the breeding season.

Fates of chicks

To determine the survival rate of chicks, we used information collected on 200 individual chicks, as the outcome of the remaining six chicks was unknown due to insufficient data collection. Of the 200 chicks regularly monitored, 35% successfully fledged, that is, reached flying age. This occurs at approximately 35 days after hatching for Hooded Plovers. This resulted in a total of 70 fledglings produced on the Fleurieu Peninsula over the seven breeding seasons.

When examining the patterns in the fates of chicks across the breeding months, both the greatest number of fledglings, and the highest percentage of chicks that fledged, occurred for chicks that were first recorded in December. When a chick was first recorded in December, it had approximately a 42% chance of surviving to fledge. This probability of chick survival is much lower in the earlier part of the breeding season, and tends to increase at the peak of the breeding season (December/January), while the number of chicks on the ground in March and April is too low to adequately interpret patterns (Figure 22).

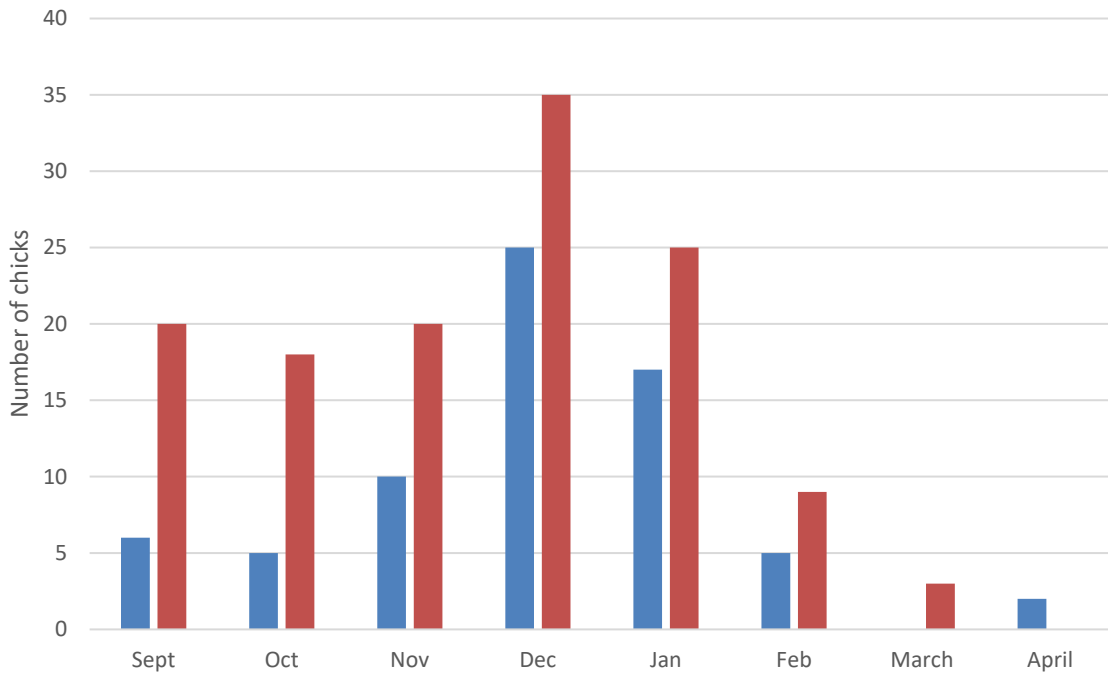


Figure 22: Total number of chicks that fledged (blue) and failed (red) based on the month when the chicks were first recorded, pooling data across seven breeding seasons.

Each season, the number of chicks that successfully fledged was always lower than the number of chicks that failed (Figure 23). However, in some seasons the proportion of fledged chicks versus failed chicks was not so disparate, for example, in the 2011/2012 season, 47% of chicks fledged. The overall number of fledglings produced on the Fleurieu Peninsula was relatively steady across the majority of breeding seasons, with the exception of the final season where the numbers doubled, with 19 successful fledglings in 2015/2016 (Figure 23). This result was driven by the hatching success that occurred that season, but the chick survival rate that season was unfortunately incredibly poor, with only 30% of chicks surviving, the lowest rate recorded over any season. It would be interesting to better understand the threat environment in 2015/16, given conditions obviously suited hatching, but chick mortality rates were high. It is likely related to a greater number of sites having success than any other season, thus presenting new challenges both for the birds themselves at protecting their chicks, but also for the beach users in understanding the conservation needs of free roaming chicks.

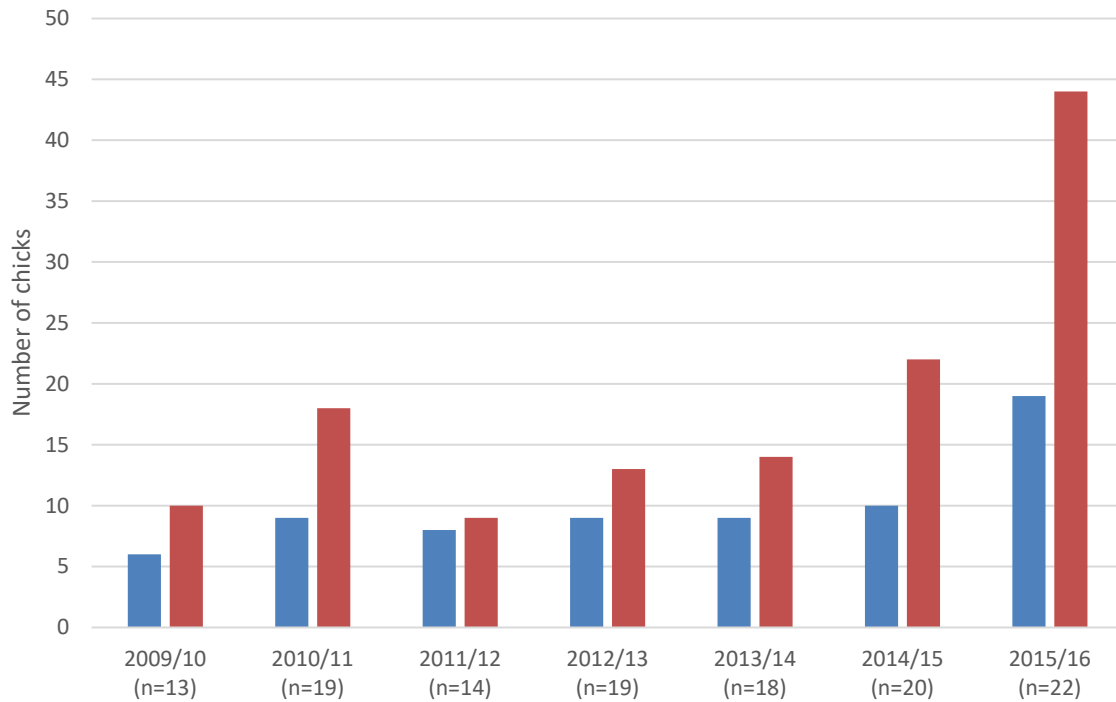


Figure 23: Total number of chicks that failed (red) or fledged (blue) across the seven breeding seasons, where n denotes the total number of breeding pairs monitored per season.

Fledglings came from a total of 22 sites over the seven breeding sites monitored. There were 17 sites where breeding was recorded, that never produced any fledglings during this time. Figure 24 maps the number of successful fledglings that have been produced from each site over the seven breeding seasons.



Number of successful fledglings

North

2009 / 2010 - 2015 / 2016



Fledgling_numbers

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 9





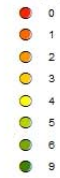
Number of breeding seasons

West

2009 / 2010 - 2015 / 2016



Fledgling_numbers



Number of fledglings

South west

2009 / 2010 - 2015 / 2016



Fledgling_numbers

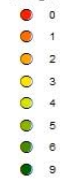




Figure 24: The number of fledglings produced from each site (pair) over the seven breeding seasons.

Of the 200 chicks observed in this study, the greatest proportion of chicks that fledged occurred at beaches with low human use (52% of chicks fledged; Figure 25). At these low human use beaches, a chick had a slightly better chance of fledging than it did of failing. This pattern however was reversed for all the other categories where the chance of fledging was substantially lower, between 23% and 27% for high and very high human use beaches, respectively (Figure 25).



Hooded Plover fledgling. Photo Sue and Ash Read.

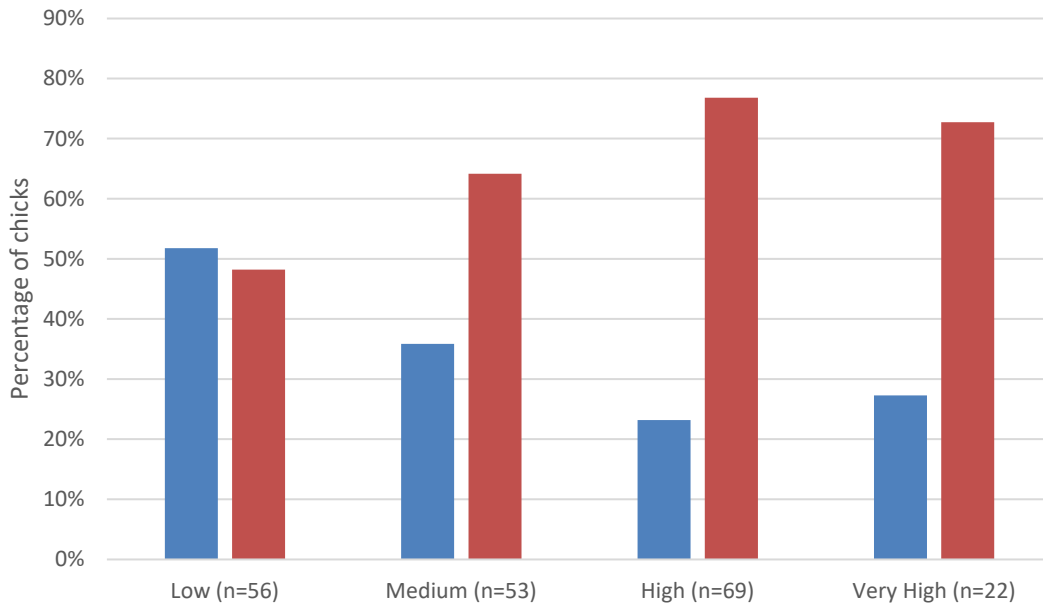


Figure 25: The percentage of chicks that fledged (blue) or failed (red) at beaches within the four categories of human use, with n denoting the total number of chicks.

During the earlier years of the project it was difficult to determine if management occurred during the chick phase and/or if management was adapted between the nesting and chick stage of breeding (that is, fencing often needs moving as the birds typically use a different area to where the nest was). This means that we have not been able to specifically analyse the impact of management in relation to the human use categories, for chick survival.

Breeding success

The breakdown of the number of nests, chicks and fledglings at each of the sites across the seven breeding seasons can be seen in Table 1. Of the 44 sites where Hooded Plovers were recorded, five sites have had no breeding attempts recorded across the seven seasons, and 17 of these sites have recorded breeding attempts but have never successfully produced a fledgling during the seven seasons. There have been two outstanding sites in relation to breeding success, Tunkalilla Heysen has produced six fledglings from three separate breeding seasons, and Tunkalilla far west has produced nine fledglings, also from three separate breeding seasons.

The total number of nests, chicks and fledglings per breeding season are presented in Figure 26. In order to compare breeding success in a standardised way that overcomes the variation in the number

of pairs monitored over time, we examined the number of fledglings produced per breeding pair. Figure 27 displays the number of fledglings per pair produced across successive seasons. As the Beach-nesting Birds Program aims to improve the breeding success of Hooded Plovers by reducing the human related threats and to maintain a stable or increasing population trajectory overall, the program has set a target of a breeding success rate of between 0.4-0.5 fledglings per pair. This breeding target is derived from average breeding success rates of Hooded Plovers in remote regions of Victoria and thus considered to be a baseline breeding success rate which you would expect from pairs significantly less impacted by human-related threats. For each of the seven breeding seasons on the Fleurieu Peninsula, Hooded Plovers have produced fledglings per pair rates that meet or exceed the target, with the 2015/2016 breeding season exhibiting the greatest fledgling per pair rate of 0.86 (Figure 27).

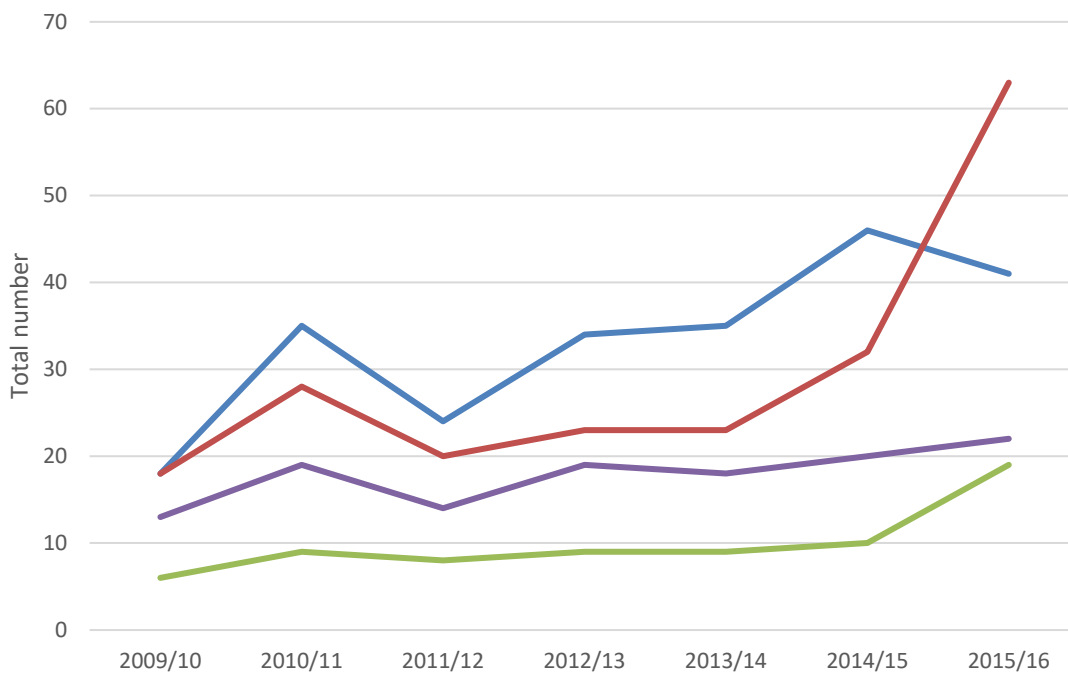


Figure 26: Total number of nests (blue), chicks (red), fledglings (green) and breeding pairs (purple) within each breeding season.

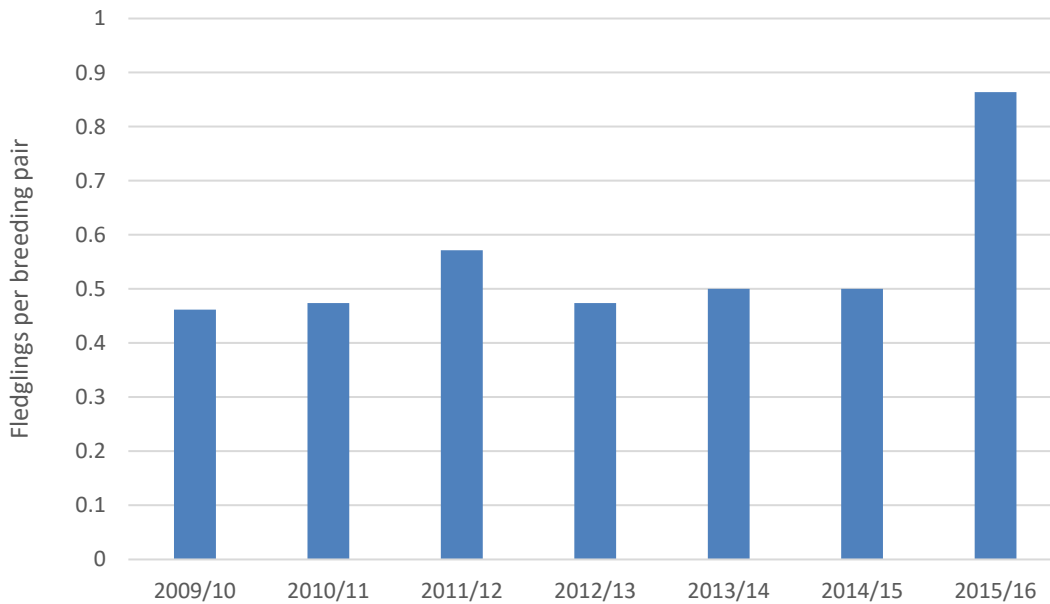


Figure 27: The number of fledglings per breeding pair across the seven breeding seasons.

Breeding success of Hooded Plovers is not simply interpreted, as it is related to a combination of the threat levels experienced and the level of management invested to mitigate these threats. This can be a very complex relationship. We looked at overall breeding success on beaches with different human use levels and the presence or absence of management to mitigate human-related threats. Management can include different actions; fencing (temporary or permanent), signage (at the access and/or nesting site and maybe different styles and sizes), chick shelters and volunteer wardens, and it can occur and change at different time periods during each breeding attempt. Therefore, we have simply categorized breeding attempts by whether they were managed in any form (managed), or not managed using any of these methods (not managed).

Breeding success (that is fledglings per pair) relative to human use of beaches and management is displayed in Figure 28, and suggests that on beaches with low human use, management played a less important role than it did when human use of beaches increased. That is, fledgling success seems high regardless on these beaches. However, types of management ('signage only' or 'signage and fencing') were not evenly used across nests within each of the human use categories. At low use beaches, 57% of the managed nests were 'signage only', while at medium human use beaches 39% of managed nests were 'signage only'. The frequency of using 'signage only' was even lower at high (15% of managed nests) and very high human use (8% of managed nests) sites (Figure 18). As fencing has been demonstrated to be more successful in improving hatching rates than signage alone, the limited use

of fencing at low use sites may not accurately portray the importance of management at low human use beaches (Figure 28).

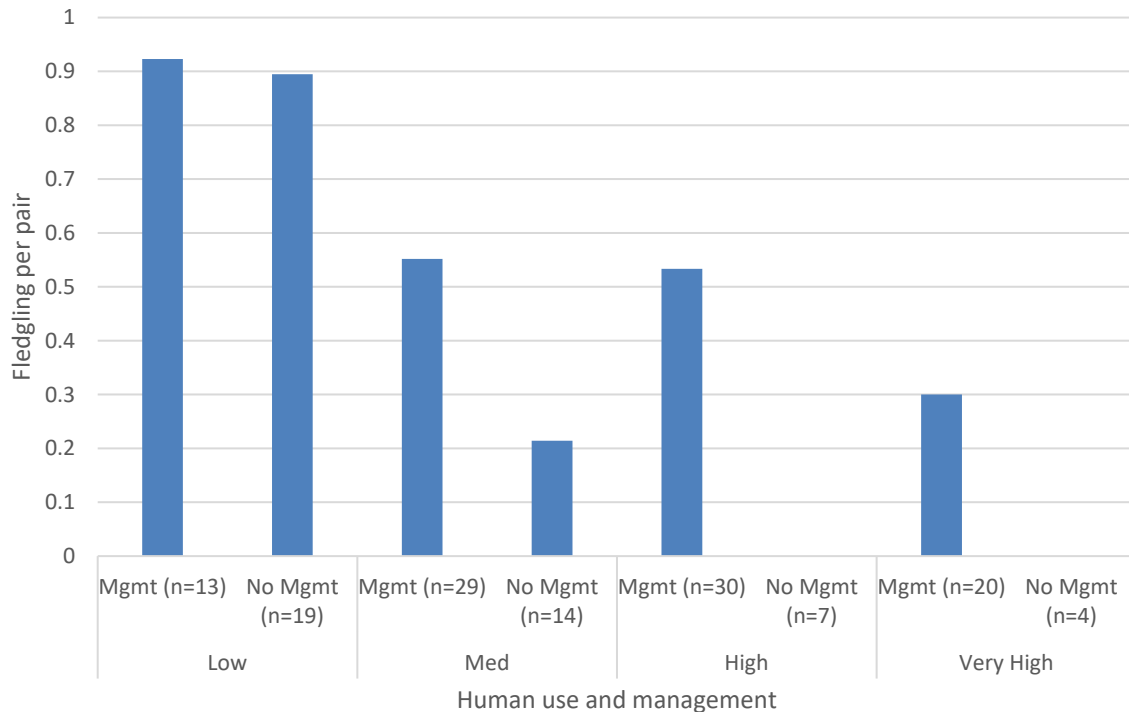


Figure 28: Breeding success, represented by fledglings per pair, at sites with and without management, across the four human use categories, with n denoting the number of pairs within each category.

These breeding success results strongly highlight the importance of managing breeding sites (with nests and chicks) on beaches particularly where human use is at medium, high or very high levels, this typically includes sites which record an average of more than 3.7 people per visit. Breeding success on medium human use beaches is only 0.2 fledglings per pair when no management is in place, but with management this increases to 0.5 fledglings per pair and meets the conservation recovery target. On high and very high human use beaches, there was no breeding success at all unless management was put in place. While sample sizes were low for unmanaged breeding attempts at high and very high human use sites, we can estimate that without the management to protect nests and chicks on these beaches it is likely that a significant number of nests and/or chicks would have been lost before they fledged, which would have resulted in conservation targets not being met.

Threats

A comprehensive review of threats to the Hooded Plover can be found in Maguire (2008). A short summary of the key threats occurring on the Fleurieu Peninsula during the seven breeding seasons considered in this report and how these impact breeding Hooded Plovers appear below. Table 3 provides an overview of way each threat operates (directly or indirectly) and on what life stage, it also rates the severity of each threat based on the extent to which the threat impacts the breeding success and survival of Hooded Plovers.

Coastal development results in habitat loss or modification of habitat. Coastal infrastructure in the primary dune limits available nesting habitat. Formalising access increases use of habitat by recreationists. Lack of access when new developments occur close to the dune leads to creation of informal access points by residents, trampling habitat (and nests and chicks in situ) and then leading to erosion control measures which further reduce habitat availability. To protect coastal assets placed within the primary dune system, armouring of the coast is carried out by placing rocks on the beach, dune matting, brush matting, sea walls - all of which destroy nesting habitat or alter the beach dynamics, impacting nearby nesting sites.

The peak in **recreational beach use** coincides with the Hooded Plover breeding season (warmer months of spring and summer). Eggs are well camouflaged and placed on upper beach or dunes in bare sand making them very susceptible to being stepped on by walkers. Chicks are also well camouflaged and will crouch down when threats are near - this can be anywhere on the beach including below the high tide mark and into the dune. Chicks are easily crushed in their first few weeks of age by human feet. Disturbance of incubating birds results in the birds coming off the nest and distancing themselves from the eggs to give the impression that they are not nesting (ie. to fool a potential predator). For frequent mobile recreationists (i.e. walkers) or static recreationists (sunbaking, fishing) who spend prolonged periods of time in the one location, disturbance can reach lethal levels (Weston et al., 2011). Eggs can be exposed to temperatures where the embryo inside dies and on hot days where birds encounter disturbance, the time frame for this lethal impact can be within half an hour or less (Weston and Elgar, 2007; Maguire, 2008). When the adult is disturbed away from the nest and the birds are being vigilant of the people nearby, this leaves the eggs more vulnerable to avian predators which the birds would naturally chase off or distract in undisturbed environments. At the chick stage, disturbance results in the chicks crouching on the spot so as to

hide from the potential threat, or running to cover nearest the dunes to hide. The parents will distract and 'lead' away the person/people, and will wait until the environment is clear of danger before calling the chicks out of hiding. For frequent or prolonged disturbances, this can become lethal to chicks in terms of thermal exposure (in their first two weeks when they require brooding) and leading to starvation and dehydration (Weston and Elgar, 2005). Predators also take the opportunity to ambush chicks when the parents are preoccupied with other threats present.

Dogs off lead use more of the beach and dune than an average person accessing a beach (Schneider et al. 2019) and therefore they are more likely to encounter eggs and chicks, increasing the likelihood of crushing or predation. Weston and Elgar (2007) reveal that when an off-lead dog approaches a nesting area, the birds react from more than double the distance and spend longer periods away from the nest, compared to a walker or walker with an on-lead dog. This is further confirmed by Glover et al. (2011) in their work on Flight Initiation Distances of Shorebirds where repeated standardised approaches were made using a walker and a walker with a dog. This difference in response by the birds to the presence of an off lead dog is thought to relate to the greater speed and the irregularity of direction that unleashed dogs take (see Schneider et al. 2019); they are more likely to explore and to move onto the upper beach (Burger 1986), while walkers more commonly choose to move linearly along the hard sand (and a leashed dog moves predictably alongside of them). Dogs have been observed preying on eggs of the Hooded Plover and while records of chick fates are rare (as observers are rarely present when the chicks die), Schmidt (2017) determined the fate of three chicks through radio tracking and one out of those three confirmed as being killed by a dog.

Vehicle use of coastal environments has the potential to be devastating to the breeding success of beach-nesting birds, to the survival of adults and to the physical environment. Vehicles on beaches include: 4-wheel drives (4WDs), trail bikes, quad bikes, kite cars, horse drawn carts and sulkies, as well as management or research vehicles. Direct impacts include collisions with birds and nest crushing. In the Coorong, South Australia, 81 % of experimentally deployed nests on beaches were crushed by 4WDs within the length of a typical month long incubation period (Buick and Paton 1989). In western Victoria, illegally driven vehicles (trail bikes) crushed 18 % of Hooded Plover nests (Weston and Morrow, 2000). Buick and Paton (1989) also report that Hooded Plover chicks shelter in wheel ruts and this probably accounts for the high rate of chick crushing by vehicles on the Coorong

(30 % of chick mortalities). In addition to directly impacting breeding success of beach-nesters, vehicles can significantly impact invertebrate fauna as well as the physical environment. Schlacher et al. (2008) in Queensland revealed that driving on beaches reduced both the diversity and abundance of the invertebrate (macrobenthic) fauna, thus reducing food availability for resident as well as migratory shorebirds.

Horses ridden on beaches and dunes can have major impacts on the breeding success of beach-nesting birds. While most equestrian use of beaches occurs on the wet sand, during high tide periods, horse riders are forced to ride above the high-tide mark. Horses can crush nests if ridden above the high-tide mark or in the dunes (horses ridden along the base of the foredune have been observed to crush Hooded Plover nests in western Victoria (Maguire pers. obsv.)); they can crush chicks, particularly if ridden swiftly along the beach, as chicks cannot move as quickly out of their path, and; they could potentially collide with and injure or kill adults. Excessive disturbance by horse riders can also contribute to nest failure through exposure of eggs and chicks to thermal extremes, predators and energetic stress. Horses, being large, hoofed animals, also have an impact on the physical environment.

Introduced predators are a direct threat to Hooded Plovers. Foxes, cats and dogs will prey on adults, chicks and eggs, and rats will predate on chicks and eggs. In a study by Mead (2012) in Victoria using motion-triggered remote nest surveillance cameras, foxes accounted for 26% of 38 nests with eggs that were depredated (of 64 nests that were monitored by cameras).

Superabundant native predators such as ravens, magpies and gulls, pose a major predatory threat to the eggs and chicks of Hooded Plovers. Gull populations have undoubtedly increased since European settlement (Blakers et al., 1984). Raven (Australian Ravens *C. coronoides* and Little Ravens *C. mellori*) populations are thought to have increased since European settlement (Blakers et al., 1984; Schulz and Bamford, 1987; Schulz, 1992). Increases in food resources, such as coastal tips and urban rubbish bins, may sustain artificially high populations, and ravens are attracted to the dunes when coastal shrubs are fruiting (Weston and Morrow 2000). Mead (2012) used motion triggered remote nest surveillance cameras at 64 nests and identified ravens and magpies as major Hooded Plover egg predators, accounting for 24% and 16% of nest failures, respectively. Silver Gulls predated 19% of experimentally deployed nests of quail eggs along beaches in Western Victoria (Stojanovic,

2008). Silver Gulls have also been observed attacking and predated a two-day old Hooded Plover chick (Burke et al., 2004).

Weeds, such as Sea Spurge, Sea Wheat Grass, Pyp Grass and Marram Grass have been identified as key species that reduce native vegetation cover and change the structure of beach and fore-dune habitats (Caton et al. 2007; Caton et al. 2009; Cousens et al., 2013). These structural changes in turn alter the resources available (foraging, nesting etc) to the Hooded Plovers, leading to either direct impacts (increased predation, mortality or abandonment of beaches) to more indirect impacts such as reduced breeding success in sub-optimal habitat. For example, Mead (2012) found that of the 18% of nests across Victoria lost to tide, most of these were in far west Victoria and this is in line with Cousens et al. (2013) reporting that the most extensive Marram grass infestations occur in Victoria.

Stock on beaches can have direct impacts on nesting birds resulting in the trampling or burying of nests, disturbance of incubation and erosion of dune and beach habitats. This issue has been rectified in many areas, but is still occurring on south coast beaches like Tunkalilla.

There are also natural threats to the breeding success of Hooded Plovers and these include:

- **High tides** have been recorded washing out eggs (16% of 64 nests monitored by remote camera across Victoria, Mead 2012) and drowning chicks.
- **Storms and extreme weather** result in washing out or burying eggs, egg and chick exposure.
- **Avian predators** such as raptors (e.g. Nankeen Kestrel), and ravens, magpies and gulls in locations where they are at pre-European settlement abundances. Avian predators can depredate eggs and chicks, and larger raptors and ravens can prey upon adult birds. There have been at least 3 records of Nankeen Kestrels preying upon Hooded Plover chicks (Weston, 1998; Duivenvoorden, 2007). Habitat modification makes the Hooded Plover more susceptible to natural predation as cover (e.g. driftwood) is removed (Duivenvoorden, 2007).
- **Reptilian predators** (monitors, goannas, snakes) are also known to depredate Hooded Plover eggs or chicks. There is no evidence to suggest that natural rates of reptilian predation have increased; for example, on Kangaroo Island, goanna numbers have remained stable over time (Dennis and Masters, 2006).

Table 3. Summary of threats to Hooded Plovers, grouped as human-related threats and natural threats. Threats appear in order of impact. The impact of each is categorized as direct or indirect, and the life stage at which the threat operates is specified. The severity of impacts is rated as high, moderate or low, and further rated with a number from 1 (lowest) to 6 (highest). The spatial distribution, across the Fleurieu Peninsula coastline, and the temporal distribution, over the seven seasons, is also included.

SOURCE OF THREAT	IMPACT (D= DIRECT, I=INDIRECT)	LIFE STAGE (H=HABITAT, S= ADULT SURVIVAL, R=REPRO. SUCCESS)	SEVERITY (RATING)	SPATIAL DISTRIBUTION	TEMPORAL DISTRIBUTION
<i>Human-related threats</i>					
Coastal development	Loss or modification of habitat (i); increases in predator numbers or predator use of habitat (i); increases in recreational pressure (i)	H, R	High (6)	Widespread	Constant
Oil spills	Oiling and death of chicks and adults (d); consumption of contaminated food items (d); reduction in food items (i); beach cleaning impacts of crushing/disturbing eggs/chicks (d, i)	S, R, H	High (6)	Highly localised	Stochastic
Vehicles on beaches	Crushing of eggs or chicks (d); collisions with and death of adults and juveniles (d); disturbance (i); modification of habitat (i)	R, S, H	High (5)	Widespread	Constant, seasonal peaks
Coastal weeds	Loss or modification of habitat (i)	H	High (5)	Widespread	Constant
Dogs off lead	Crushing of eggs or chicks (d); depredation of eggs or chicks (d); disturbance (i)	R	High (4)	Widespread	Constant
Introduced Foxes	Depredation of eggs, chicks or adults (d)	R, S	High (4)	Widespread	Constant
Recreationists – static activities (e.g. fishing)	Crushing of eggs or chicks (d); disturbance (i)	R	High (4)	Widespread	Constant, seasonal peaks

SOURCE OF THREAT	IMPACT (D= DIRECT, I=INDIRECT)	LIFE STAGE (H=HABITAT, S= ADULT SURVIVAL, R=REPRO. SUCCESS)	SEVERITY (RATING)	SPATIAL DISTRIBUTION	TEMPORAL DISTRIBUTION
Superabundant native predators: Ravens	Depredation of eggs or chicks (d)	R	High (4)	Widespread	Constant
Horses	Crushing of eggs or chicks (d); collisions with and death of adults and juveniles (d); disturbance (i); modification of habitat (i)	R, H, S	High (4)	Localised	Constant, seasonal peaks
Stock (cattle, sheep, goats, camels)	Crushing of eggs or chicks (d); modification of habitat (i)	R, H	High (4)	Localised	Constant
Cats (feral and domestic)	Depredation of eggs, chicks or adults (d)	R, S	High (4)	Localised	Constant
Dune stabilization works	Loss or modification of habitat (i)	H	High (4)	Highly localised	Constant
Recreationists – Mobile activities (e.g. walking)	Crushing of eggs or chicks (d); disturbance (i); modification of habitat (i)	R, H	High (3)	Widespread	Constant, seasonal peaks
Dogs on lead	Crushing of eggs or chicks (d); disturbance (i)	R	High (3)	Widespread	Constant
Superabundant native predators: Silver gulls	Depredation of eggs or chicks (d)	R	High (3)	Widespread	Constant
Superabundant native predators: Magpies	Depredation of eggs or chicks (d)	R	High (3)	Widespread	Constant
Litter including fishing line	Entanglement and death of chicks or breeding adults (d); increases in predator numbers or predator use of habitat (i); disturbance to incubating adults (i)	S, R	High (3)	Widespread	Constant, seasonal peaks

SOURCE OF THREAT	IMPACT (D= DIRECT, I=INDIRECT)	LIFE STAGE (H=HABITAT, S= ADULT SURVIVAL, R=REPRO. SUCCESS)	SEVERITY (RATING)	SPATIAL DISTRIBUTION	TEMPORAL DISTRIBUTION
Natural threats					
High tides	Washing out eggs (d); drowning chicks (d); modification of habitat (i)	R, H	High (4)	Widespread	Cyclic, often influenced by storm surges (see below)
Storms and extreme weather	Washing out or burying eggs (d); egg/chick exposure (i)	R, H	High (4)	Widespread	Variable, often seasonally related
Avian predators: Ravens	Depredation of eggs or chicks (d)	R	High (4)	Widespread	Constant
Avian predators: Birds of Prey	Depredation of chicks or adults (d)	R, S	Moderate (2)	Widespread	Constant
Avian predators: Magpies	Depredation of eggs or chicks (d)	R	Moderate (2)	Localised	Constant
Avian predators: Gulls	Depredation of eggs or chicks (d)	R	Moderate (2)	Widespread	Constant
Native rodents	Depredation of eggs (d)	R	Low (1)	Highly localised	Constant
Reptilian predators	Depredation of eggs or chicks (d)	R	Low (1)	Highly localised	Seasonal peaks

Threat assessments conducted

When observers monitored Hooded Plovers, they also assessed the threats present at the time and evidence of threats that occurred at the location through an assessment of prints/tracks in the sand. There were several sites for which we did not have a minimum number of threat assessments to be able to accurately interpret the data (35 assessments are required), and these were omitted from particular threat analyses carried out in this report. Where these sites were able to be included in broader summaries of key threats, this has been noted in the tables/figures. These results however must be interpreted with caution, as threats can vary greatly in their detectability and intensity, for example, related to time of day or the day of the week of the observation, and thus a high number of assessments are needed to capture this variation.

Figure 29 presents the number of visits where observers recorded threat assessments, relative to the total number of monitoring observations submitted over seven breeding seasons. It reveals that the number of threat assessments have increased dramatically over time. The number of threat assessments peaked in December and January, with the pattern mimicking that of survey effort (Figure 30). Table 4 further breaks this down by showing the number of threat assessments per site over each of the seven breeding seasons. Each site varied in the number of threat assessments carried out over time; Yilki had the most assessments with 290 in total. Thirteen of the 44 sites had assessments carried out consistently every year across the seven seasons.

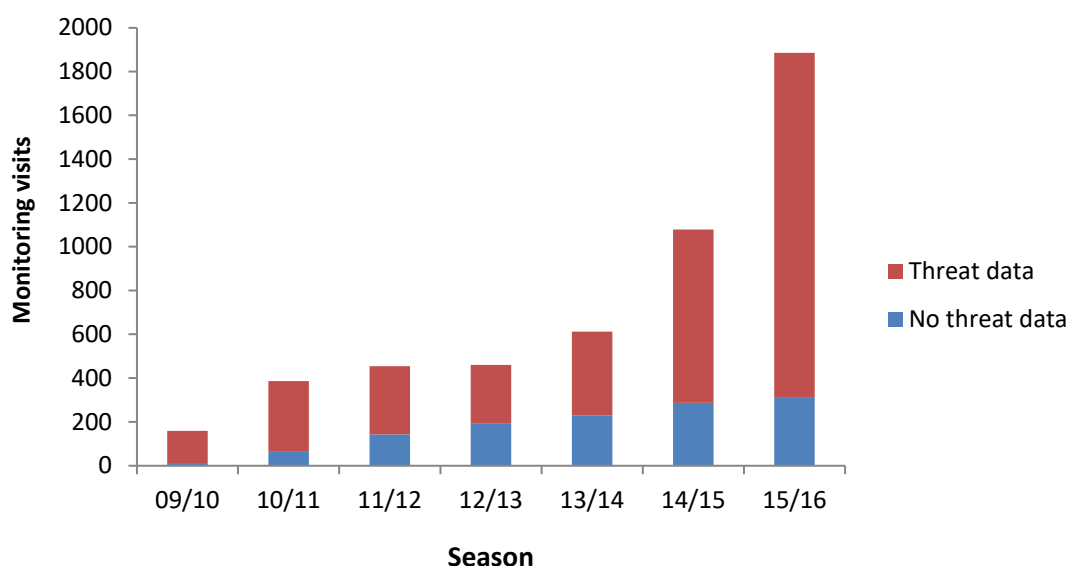


Figure 29: Number of visits where threat assessments were recorded (red) and not recorded (blue) of the total monitoring visits.

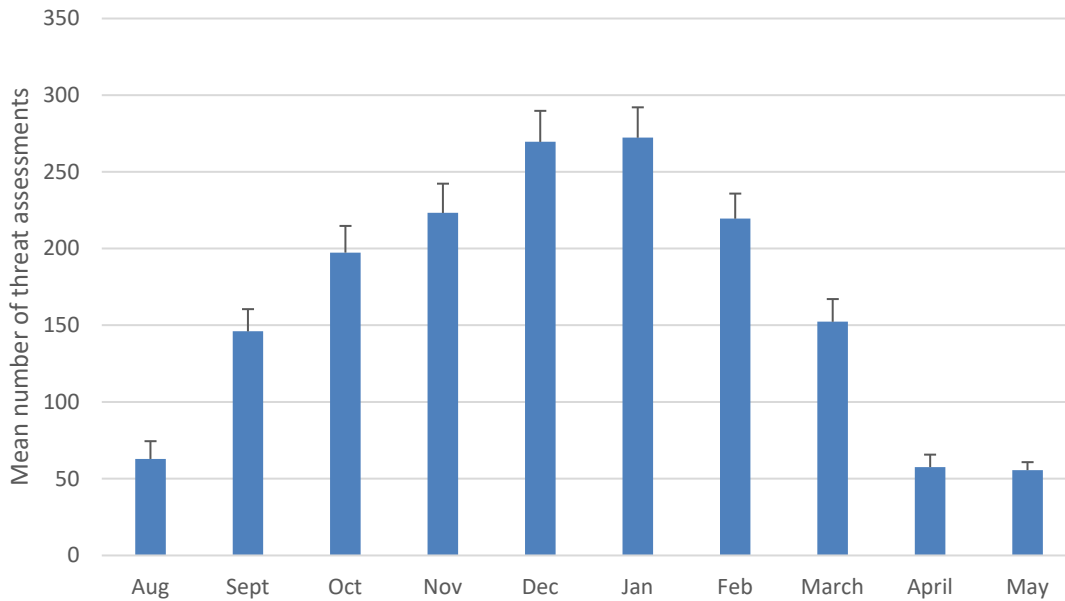


Figure 30: Number of threat assessments (with standard error) carried out on average per month across each of the seven breeding seasons.

Table 4: Number of threat assessments per site across seven seasons.

Site	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Aldinga	0	1	7	3	4	4	67
Ballaparudda	0	0	0	7	12	13	6
Bashams Beach	12	28	10	11	1	92	74
Callawonga*	0	0	0	1	18	10	4
Carrickalinga Estuary & South	3	2	2	0	0	14	33
Carrickalinga North	2	14	16	1	2	10	17
Carrickalinga Rotunda	1	29	9	5	14	22	35
Christies Beach*	0	0	4	4	0	0	3
Coolawang	1	4	1	0	1	16	15
Goolwa Beach*	0	2	0	0	0	0	2
Hindmarsh River Mouth	14	27	2	10	1	98	51
Inman River Outlet	26	28	54	31	44	15	12
Lands End	0	8	5	5	9	11	28
Maslin Beach	36	36	28	18	44	17	11
Middleton Beach	0	1	8	2	1	0	38
Moana Beach	0	11	13	5	2	11	27
Morgans Beach	5	4	16	15	8	4	5
Myponga Beach	0	13	3	4	14	22	14
Normanville North	3	19	2	2	6	4	23
Normanville South	0	3	5	2	1	1	76

Site	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Ochre Cove, Maslins	0	0	0	0	0	54	112
Olivers Reef	0	0	0	0	0	24	123
O'Sullivans Beach*	0	0	7	4	0	0	3
Parsons Beach	8	10	10	9	16	31	31
Port Stanvac*	0	0	0	2	10	10	1
Port Willunga	10	13	43	41	26	10	45
Port Willunga South*	20	0	0	0	0	0	0
Sheepies Beach	0	0	8	4	13	22	24
Shelley Beach (lady bay)	0	20	15	3	17	23	18
Silver Sands	0	14	9	0	0	2	111
Snapper Point	0	0	0	0	5	5	125
Southport	0	13	13	9	22	10	22
Tunkalilla 1st house east*	0	1	1	5	9	0	4
Tunkalilla 3rd house east*	0	2	2	5	0	0	0
Tunkalilla far west*	0	3	2	10	11	0	4
Tunkalilla Heysen	0	0	3	11	14	20	4
Tunkalilla mid west estuary	0	1	0	8	11	19	4
Tunkalilla shed caravan*	0	1	0	4	9	0	4
Tunkalilla west estuary	0	0	0	11	11	18	3
Waitpinga Beach (east)	0	9	8	8	10	34	35
Waitpinga Beach (west)	0	0	0	0	0	32	27
Watsons Gap	6	6	5	6	8	3	124
Yankalilla river mouth	0	0	0	0	10	19	8
Yilki	0	0	0	0	0	91	199
Total	147	323	311	266	384	791	1,572

* Denotes sites where <35 combined threat assessments were completed.

Types of threats

We examined the number of sites where each threat was recorded to explore the overall occurrence rates of threats on the Fleurieu Peninsula (Table 5). Unsurprisingly, people, dogs and silver gulls were recorded at every site across the seven-year period. Avian and mammalian predators were recorded at the majority of sites, all at more than 88% of sites. The less widespread threats recorded were horses, stock and cats; all were recorded at 50% or fewer sites.

Table 5: Proportion of sites where threats were observed across seven breeding seasons. Excludes sites with < 35 total threat assessments.

THREAT	% SITES PRESENT (34 SITES)
People (prints and/or sightings)	100.00%
Dog prints	100.00%
Silver Gulls	100.00%
Pacific Gulls	97.06%
Ravens	94.12%
Magpies	91.18%
Birds of prey	91.18%
Foxes	88.24%
Dogs off lead	88.24%
Dogs on lead	85.29%
Vehicles	85.29%
Horses	50.00%
Stock	17.65%
Cats	8.82%

Threats were then examined in more detail by exploring the proportion of visits a threat was recorded. The threats recorded at most visits across the seven seasons (for all sites combined) were people, recorded on 74% to 97% of visits each season and dogs (including prints and sightings), recorded on 48% to 92% of visits (Table 6). Within each of the seven seasons, dogs off lead were observed more frequently than dogs on lead. For example, off lead dogs were observed on as many as 60% of visits in 2009/2010, whereas dogs on lead were only observed on 41% of visits in that season. Silver Gulls were the most frequently recorded non-human related threat, recorded at between 32% and 69% of visits each season, followed by foxes (prints) which ranged from 4% to 37% of visits per season.

Table 6: Proportion of visits where each threat was recorded (frequency of occurrence data), where the number of threat assessments each season appears in brackets.

Threat type	2009/10 (n=147)	2010/11 (n=323)	2011/12 (n=311)	2012/13 (n=266)	2013/14 (n=384)	2014/15 (n=791)	2015/16 (n=1572)
People (prints and sightings)	97% (143)	96% (311)	93% (290)	88% (234)	74% (285)	84% (664)	91% (1426)
Dogs (prints and sightings)	92% (135)	89% (287)	82% (255)	48% (128)	55% (213)	61% (480)	77% (1215)
Silver gulls	32% (47)	34% (111)	57% (176)	54% (143)	47% (182)	72% (567)	69% (1088)
Dogs sighted	69% (102)	51% (164)	48% (149)	48% (128)	36% (138)	43% (341)	59% (934)
Dogs off lead	60% (88)	39% (127)	43% (134)	42% (112)	29% (111)	31% (245)	45% (700)
Dogs on lead	41% (61)	29% (94)	27% (83)	21% (56)	18% (71)	28% (219)	37% (579)
Foxes (prints)	4% (6)	13% (42)	8% (26)	29% (78)	37% (143)	29% (230)	13% (208)
Pacific/Kelp Gulls	6% (9)	9% (30)	5% (15)	20% (53)	17% (67)	25% (194)	26% (408)
Ravens	5% (8)	16% (51)	10% (32)	9% (23)	16% (61)	18% (139)	9% (144)
Magpies	0% (0)	3% (9)	3% (10)	10% (26)	10% (40)	15% (116)	12% (195)
Vehicles (tracks and sightings)	10% (14)	20% (63)	21% (66)	16% (43)	15% (56)	8% (67)	17% (268)
Permitted vehicles sighted	0% (0)	8% (26)	10% (30)	4% (11)	3% (10)	2% (15)	8% (129)
Birds of prey	0% (0)	0% (0)	0% (0)	11% (28)	9% (34)	5% (43)	5% (86)
Horses (prints and sightings)	3% (5)	5% (15)	5% (16)	7% (19)	4% (14)	0% (0)	7% (108)
Non-permitted vehicles sighted	0% (0)	0% (0)	0% (0)	3% (9)	2% (9)	0% (1)	1% (13)
Cats (prints)*	-	-	-	-	1% (5)	0.5% (4)	0.1% (1)
Stock (prints and sightings)*	-	-	-	7% (20)	3% (12)	8% (62)	1% (13)

* Cat prints and stock prints/sightings were only added to the data sheets/portal from 2013/14 season onwards, however observed stock numbers were entered in the general notes section in 2012/13 and thus included in this table.

The proportion of visits where a given threat was recorded at each site is presented in Table 7. The most commonly observed threat was people, being recorded at some sites such as Maslin's Beach, on every visit. At the more remote sites, like those on Tunkalilla beach, the most commonly occurring threat was foxes. The only site where people or foxes were not the most common threats were Parsons Beach, where Silver Gulls were the prevalent threat. Table 7 also highlights the range of common threats which occurred at each site, for example, Coolawang has only four threat types

that occurred in more than 10% of visits, while Aldinga has eight threat types which occurred in more than 10% of visits.

Table 7: The proportion of visits when each threat was recorded (occurrence) at sites across seven breeding seasons. Excludes sites with <35 total threat assessments. Cells are highlighted where the occurrence of the threat was for more than 10% of visits.

SITE NAME (n = number of threat assessments carried out)	THREAT	OCCURRENCE
Aldinga (n = 86)	People	100% (86)
	Dog prints	94.19% (81)
	Vehicles	89.53% (77)
	Dogs off lead	76.74% (66)
	Silver Gulls	72.09% (62)
	Dogs on lead	70.93% (61)
	Horses	34.88% (30)
	Pacific Gulls	19.77% (17)
	Magpies	9.30% (8)
	Ravens	8.14% (7)
	Birds of prey	4.65% (4)
Ballaparudda (n = 38)	Foxes	97.37% (37)
	Stock	47.37% (18)
	Silver Gulls	44.74% (17)
	Birds of prey	28.95% (11)
	People	10.53% (4)
	Magpies	7.89% (3)
	Dog prints	5.26% (2)
	Raven	2.63% (1)
Bashams Beach (n = 228)	People	78.51% (179)
	Silver Gulls	72.37% (165)
	Dog prints	51.75% (118)
	Dogs on lead	30.7% (70)
	Pacific Gulls	29.82% (68)
	Dogs off lead	25% (57)
	Magpies	11.84% (27)
	Ravens	7.46% (17)
	Birds of prey	3.51% (8)
	Foxes	1.32% (3)
	Vehicles	0.88% (2)
	Horses	0.44% (1)

SITE NAME (n = number of threat assessments carried out)	THREAT	OCCURRENCE
Carrickalinga Estuary & South (n = 54)	People	90.74% (49)
	Dog prints	77.78% (42)
	Silver Gulls	61.11% (33)
	Dogs off lead	53.7% (29)
	Foxes	37.04% (20)
	Dogs on lead	33.33% (18)
	Ravens	22.22% (12)
	Vehicles	9.26% (5)
	Pacific Gulls	5.56% (3)
	Magpies	1.85% (1)
	Birds of prey	1.85% (1)
Carrickalinga North (n = 62)	People	98.39% (61)
	Dog prints	82.26% (51)
	Silver Gulls	40.32% (25)
	Dogs off lead	35.48% (22)
	Ravens	35.48% (22)
	Dogs on lead	19.35% (12)
	Magpies	12.90% (8)
	Foxes	9.68% (6)
	Pacific Gulls	6.45% (4)
	Vehicles	1.61% (1)
Carrickalinga Rotunda (n = 115)	People	96.52% (111)
	Dog prints	73.91% (85)
	Silver Gulls	35.65% (41)
	Dogs off lead	31.3% (36)
	Ravens	21.74% (25)
	Dogs on lead	20% (23)
	Foxes	5.22% (6)
	Vehicles	5.22% (6)
	Magpies	4.35% (5)
	Pacific Gulls	4.35% (5)
	Birds of prey	1.74% (2)
Coolawang (n = 38)	Foxes	81.58% (31)
	People	60.53% (23)
	Silver Gulls	34.21% (13)
	Magpies	23.68% (9)
	Ravens	7.89% (3)
	Vehicles	7.89% (3)
	Pacific Gulls	5.26% (2)
	Birds of prey	5.26% (2)
	Dog prints	2.63% (1)
	Stock	2.63% (1)

SITE NAME (n = number of threat assessments carried out)	THREAT	OCCURRENCE
Hindmarsh River Mouth (n = 203)	People	97.04% (197)
	Dog prints	83.74% (170)
	Silver Gulls	78.82% (160)
	Dogs off lead	68.47% (139)
	Dogs on lead	56.65% (115)
	Pacific Gulls	12.32% (25)
	Ravens	9.85% (20)
	Foxes	8.37% (17)
	Magpies	7.39% (15)
	Vehicles	2.46% (5)
	Birds of prey	1.97% (4)
Inman River Outlet (n = 210)	People	99.05% (208)
	Dog prints	79.52% (167)
	Silver Gulls	66.19% (139)
	Dogs off lead	45.24% (95)
	Dogs on lead	28.57% (60)
	Pacific Gulls	13.33% (28)
	Ravens	5.24% (11)
	Magpies	3.81% (8)
	Vehicles	3.81% (8)
	Birds of prey	2.38% (5)
	Horses	0.95% (2)
	Foxes	0.48% (1)
Lands End (n = 66)	People	45.45% (30)
	Silver Gulls	40.91% (27)
	Foxes	40.91% (27)
	Dog prints	28.79% (19)
	Ravens	22.73% (15)
	Pacific Gulls	12.12% (8)
	Magpies	9.09% (6)
	Dogs off lead	6.06% (4)
	Dogs on lead	6.06% (4)
	Birds of prey	3.03% (2)
	Cat	3.03% (2)
Maslin Beach (n = 190)	People	100% (190)
	Dog prints	82.63% (157)
	Dogs off lead	56.84% (108)
	Dogs on lead	33.68% (64)
	Silver Gulls	32.63% (62)
	Vehicles	8.95% (17)
	Foxes	8.42% (16)
	Pacific Gulls	5.26% (10)
	Horses	5.26% (10)
	Birds of prey	3.16% (6)
	Magpies	2.63% (5)
	Ravens	1.05% (2)
	Cat	0.53% (1)

SITE NAME (n = number of threat assessments carried out)	THREAT	OCCURRENCE
Middleton Beach (n = 50)	People	96% (48)
	Human prints	94% (47)
	Silver Gulls	94% (47)
	Dog prints	82% (41)
	Dogs on lead	68% (34)
	Dogs off lead	64% (32)
	Pacific Gulls	30% (15)
	Magpies	20% (10)
	Vehicles	8% (4)
	Ravens	8% (4)
	Foxes	2% (1)
	Moana Beach (n = 69)	People
Dog prints		88.41% (61)
Silver Gulls		75.36% (52)
Dogs off lead		71.01% (49)
Dogs on lead		44.93% (31)
Vehicles		40.58% (28)
Pacific Gulls		20.29% (14)
Birds of prey		11.59% (8)
Horses		5.80% (4)
Magpies		4.35% (3)
Morgans Beach (n = 57)	People	98.25% (56)
	Vehicles	96.49% (55)
	Dog prints	59.65% (34)
	Silver Gulls	42.11% (24)
	Dogs off lead	33.33% (19)
	Pacific Gulls	12.28% (7)
	Dogs on lead	7.02% (4)
	Horses	7.02% (4)
	Magpies	7.02% (4)
	Foxes	5.26% (3)
	Birds of prey	3.51% (2)
	Ravens	3.51% (2)
	Myponga Beach (n = 70)	People
Dog prints		61.43% (43)
Silver Gulls		55.71% (39)
Dogs off lead		32.86% (23)
Vehicles		32.86% (23)
Dogs on lead		14.29% (10)
Pacific Gulls		12.86% (9)
Birds of prey		4.29% (3)
Cat		2.86% (2)
Horses		1.43% (1)
Foxes		1.43% (1)

SITE NAME (n = number of threat assessments carried out)	THREAT	OCCURRENCE	
Normanville North (n = 59)	People	91.53% (54)	
	Dog prints	62.71% (37)	
	Dogs off lead	59.32% (35)	
	Silver Gulls	40.68% (24)	
	Dogs on lead	38.98% (23)	
	Ravens	25.42% (15)	
	Foxes	15.25% (9)	
	Vehicles	13.56% (8)	
	Pacific Gulls	3.39% (2)	
	Birds of prey	1.69% (1)	
	Horses	1.69% (1)	
	Magpies	1.69% (1)	
	Normanville South (n = 88)	People	95.45% (84)
Dogs off lead		45.45% (40)	
Dogs on lead		45.45% (40)	
Vehicles		44.32% (39)	
Dog prints		36.36% (32)	
Silver Gulls		27.27% (24)	
Horses		13.64% (12)	
Ravens		10.23% (9)	
Pacific Gulls		3.41%(3)	
Foxes		2.27% (2)	
Birds of prey		1.14% (1)	
Ochre Cove, Maslins (n = 166)	People	96.39% (160)	
	Dog prints	87.35% (145)	
	Silver Gulls	81.33% (135)	
	Magpies	22.89% (38)	
	Dogs off lead	19.28% (32)	
	Pacific Gulls	17.47% (29)	
	Dogs on lead	10.84% (18)	
	Birds of prey	3.01% (5)	
	Vehicles	1.81% (3)	
	Ravens	0.60% (1)	
	Foxes	0.60% (1)	
	Olivers Reef (n = 147)	People	100.00% (147)
		Dog prints	97.96% (144)
Silver Gulls		88.44% (130)	
Dogs off lead		80.27% (118)	
Dogs on lead		46.26% (68)	
Foxes		19.73% (29)	
Pacific Gulls		15.65% (23)	
Birds of prey		8.84% (13)	
Vehicles		4.76% (7)	
Ravens		4.76% (7)	
Magpies		1.36% (2)	
Horses		1.36% (2)	

SITE NAME (n = number of threat assessments carried out)	THREAT	OCCURRENCE
Parsons Beach (n = 115)	Silver Gulls	86.09% (99)
	People	80.87% (93)
	Foxes	59.13% (68)
	Pacific Gulls	34.78% (40)
	Ravens	33.04% (38)
	Dog prints	11.30% (13)
	Birds of prey	8.70% (10)
	Magpies	7.83% (9)
	Dogs off lead	0.87% (1)
Port Willunga (n = 188)	People	100% (188)
	Dogs off lead	77.13% (145)
	Dog prints	76.6% (144)
	Dogs on lead	39.89% (75)
	Silver Gulls	27.66% (52)
	Pacific Gulls	6.38% (12)
	Birds of prey	4.79% (9)
	Magpies	1.60% (3)
	Ravens	1.06% (2)
	Vehicles	1.06% (2)
	Horses	1.06% (2)
	Foxes	0.53% (1)
	Sheepies Beach (n = 71)	Foxes
Silver Gulls		47.89% (34)
People		38.03% (27)
Magpies		29.58% (21)
Stock		12.68% (9)
Pacific Gulls		7.04% (5)
Dog prints		4.23% (3)
Ravens		4.23% (3)
Vehicles		4.23% (3)
Birds of prey		1.41% (1)
Shelley Beach (lady bay; n = 96)	People	95.83% (92)
	Dog prints	81.25% (78)
	Silver Gulls	43.75% (42)
	Ravens	40.63% (39)
	Vehicles	37.5% (36)
	Foxes	26.04% (25)
	Dogs off lead	26.04% (25)
	Pacific Gulls	20.83% (20)
	Magpies	14.58% (14)
	Birds of prey	12.50% (12)
	Dogs on lead	11.46% (11)
	Horses	0.01% (1)

SITE NAME (n = number of threat assessments carried out)	THREAT	OCCURRENCE
Silver Sands (n = 136)	People	100% (136)
	Dog prints	96.32% (131)
	Vehicles	82.35% (112)
	Dogs off lead	75.74% (103)
	Dogs on lead	61.76% (84)
	Horses	58.09% (79)
	Silver Gulls	57.35% (78)
	Ravens	8.09% (11)
	Pacific Gulls	8.09% (11)
	Magpies	2.94% (4)
	Birds of prey	2.21% (3)
Snapper Point (n = 135)	People	96.30% (130)
	Dog prints	88.15% (119)
	Silver Gulls	77.04% (104)
	Pacific Gulls	57.78% (78)
	Dogs off lead	51.11% (69)
	Dogs on lead	42.96% (58)
	Magpies	17.78% (24)
	Birds of prey	11.11% (15)
	Vehicles	3.70% (5)
	Ravens	1.48% (2)
	Southport (n = 89)	People
Dog prints		84.27% (75)
Silver Gulls		73.03% (65)
Dogs off lead		61.8% (55)
Dogs on lead		53.93% (48)
Vehicles		50.56% (45)
Pacific Gulls		14.61% (13)
Birds of prey		5.62% (5)
Ravens		2.25% (2)
Foxes		2.25% (2)
Tunkalilla Heysen (n = 52)		Foxes
	People	61.54% (32)
	Silver Gulls	40.38% (21)
	Magpies	36.54% (19)
	Stock	36.54% (19)
	Pacific Gulls	23.08% (12)
	Birds of prey	17.31% (9)
	Vehicles	11.54% (6)
	Dogs off lead	5.77% (3)
	Dog prints	3.85% (2)
	Horses	3.85% (2)
	Dogs on lead	1.92% (1)
	Ravens	1.92% (1)

SITE NAME (n = number of threat assessments carried out)	THREAT	OCCURRENCE
Tunkalilla mid west estuary (n = 43)	Foxes	100% (43)
	People	69.77% (30)
	Stock	46.51% (20)
	Silver Gulls	34.88% (15)
	Pacific Gulls	20.93% (9)
	Magpies	16.28% (7)
	Horses	9.30% (4)
	Ravens	9.30% (4)
	Dog prints	6.98% (3)
	Dogs off lead	4.65% (2)
	Vehicles	2.33% (1)
	Dogs on lead	2.33% (1)
Tunkalilla west estuary (n = 43)	Foxes	93.02% (40)
	People	79.07% (34)
	Stock	44.19% (19)
	Silver Gulls	41.86% (18)
	Pacific Gulls	37.21% (16)
	Magpies	27.91% (12)
	Vehicles	13.95% (6)
	Ravens	11.63% (5)
	Birds of prey	11.63% (5)
	Horses	9.30% (4)
	Dog prints	9.30% (4)
	Dogs off lead	4.65% (2)
Dogs on lead	2.33% (1)	
Waitpinga Beach (east; n = 104)	People	85.58% (89)
	Silver Gulls	68.27% (71)
	Foxes	62.5% (65)
	Ravens	50% (52)
	Pacific Gulls	43.27% (45)
	Magpies	18.27% (19)
	Birds of prey	7.69% (8)
	Dog prints	4.81% (5)
	Dogs off lead	1.92% (2)
	Dogs on lead	0.96% (1)
Waitpinga Beach (west; n = 59)	People	91.53% (54)
	Silver Gulls	72.88% (43)
	Foxes	40.68% (24)
	Pacific Gulls	37.29% (22)
	Ravens	28.81% (17)
	Birds of prey	6.78% (4)
	Dog prints	1.69% (1)

SITE NAME (n = number of threat assessments carried out)	THREAT	OCCURRENCE
Watsons Gap (n = 158)	People	93.67% (148)
	Dog prints	70.89% (112)
	Silver Gulls	70.89% (112)
	Dogs off lead	26.58% (42)
	Pacific Gulls	25.32% (40)
	Dogs on lead	23.42% (37)
	Foxes	12.03% (19)
	Birds of prey	8.23% (13)
	Magpies	8.23% (13)
	Vehicles	6.33% (10)
	Ravens	2.53% (4)
Yankalilla river mouth (n = 37)	People	97.30% (36)
	Ravens	89.19% (33)
	Dog prints	86.49% (32)
	Silver Gulls	83.78% (31)
	Foxes	67.57% (25)
	Vehicles	67.57% (25)
	Pacific Gulls	43.24% (16)
	Dogs off lead	18.92% (7)
	Dogs on lead	10.81% (4)
	Magpies	10.81% (4)
	Birds of prey	8.11% (3)
	Horses	2.70% (1)
Yilki (n = 290)	People	88.28% (256)
	Silver Gulls	85.17% (247)
	Dog prints	73.1% (212)
	Dogs on lead	55.86% (162)
	Pacific Gulls	48.97% (142)
	Dogs off lead	38.97% (113)
	Magpies	23.79% (69)
	Ravens	6.55% (19)
	Birds of prey	2.07% (6)
	Foxes	1.38% (4)
Vehicles	1.03% (3)	

Human activity types

When a threat assessment was carried out at a site, monitors also recorded the type of recreational activity people were observed participating in. This is useful information as different activities can have varying impacts on the Hooded Plovers, additionally understanding the key user groups can assist in tailoring education materials and messaging for given sites, which may then improve the effectiveness of this outreach.

Over the seven breeding seasons, the main beach user groups recorded across sites on the Fleurieu Peninsula were walkers and joggers, and dog walkers. These are typically the most common activities occurring on similar beaches throughout south eastern Australia (Maguire *et al*, 2011; Maguire *et al*, 2018). The least frequently observed recreational activities were driving, fishing and playing games (Table 8). These activities typically vary either spatially (e.g. driving regulations vary from beach to beach) or temporally (e.g. playing games usually involved kids/families and is influenced by their availability, such as out of school hours).

Table 8: Categories of human recreational beach use recorded on the Fleurieu Peninsula beaches, the average number of people observed in these categories (\pm standard error) and the total number of individuals recorded participating in each recreational activity pooled across seven seasons.

Recreational activity	Average (\pm se)	Total # individuals
Walking/jogging	3.07 \pm 0.14	11,647
Dog walking	1.87 \pm 0.05	7,088
Sitting/sunbaking	1.19 \pm 0.18	4,520
Surfing/swimming	1.10 \pm 0.15	4,160
Driving	0.7 \pm 0.20	2,657
Fishing	0.30 \pm 0.02	1,150
Playing games	0.28 \pm 0.04	1,045

The number of visits to sites varied from year to year, so in order to investigate the prevalence of recreational activities occurring at each of the Hooded Plover sites, we limited the data set to sites where at least 35 threat assessments were recorded over the 7 seasons (Table 9). Walking and jogging was the most common activity and made up the highest proportion of recreational activity undertaken at 21 of the 34 sites. Surfing/swimming, dog walking and sitting/sunbaking were also common activities (and the most frequently observed activity at 3 sites, 4 sites and 3 sites, respectively). Some sites stood out as unique in their beach user profiles. For example, the most frequently observed activity at Aldinga beach was driving, where over 31% of people recorded were in a vehicle. At the two Waitpinga beach sites, fishing was the most frequently observed activity, representing 62% and 49% of beach use observed here.

To examine two of the most commonly recorded threats in more detail, the average number of people and dogs, both on and off lead, were calculated for each site for each of the seven seasons (Tables 10, 11 and 12). Southport and Aldinga recorded the highest average number of people in a given season, with 59.95 and 65.1 people observed at respective sites (Table 10). Typically, when high average values were recorded, there were also high levels of variation in the number of people recorded at each visit, shown by the standard error presented in the table. This suggests that there are likely peak use periods or events that draw extra people to these beaches. Only a handful of the

quite remote beaches, or those like Port Stanvac (note this had < 35 threat assessments) where no public access is permitted, experienced zero people recorded for a given season (Table 10). Overall, trends in the average number of dogs recorded showed that at most sites, in a given year, the numbers of off lead dogs were greater than the number of on lead dogs (Tables 11 and 12). The highest number of on lead dogs were recorded at Silvers Sands (3.22) and Aldinga (3.07), however both of these sites were also amongst the highest in the average number of off lead dogs, with 6.44 at Silvers Sands and 4.22 at Aldinga. Port Willunga and Hindmarsh river mouth also had high average number of off lead dogs, 5.93 and 4.86, respectively. Three sites, Sheepies, Port Stanvac (note this had < 35 threat assessments) and Waitpinga Beach (west), had no dogs either on or off lead recorded during any of the visits over these seven seasons (Tables 11 and 12); each of these sites has difficult or restricted access.

Table 9: The main recreational activities of beach users at sites monitored on the Fleurieu Peninsula. The percentage is the proportion of the total number of people recorded at that site, participating in a given activity. This table excludes sites with < 35 threat assessments carried out. Cells highlighted represent when a recreational activity type was recorded during more than 5% of visits.

Site (n = number of threat assessments carried out)	Recreational activity	Occurrence
Aldinga (n = 86)	Driving	31.61% (1,628)
	Walkers/Joggers	27.61% (1,422)
	Sitting/sunbaking	16% (824)
	Dog walkers	10.85% (559)
	Surfing/swimming	7.9% (407)
	Playing games	5.36% (276)
	Fishing	0.66% (34)
Ballaparudda (n = 38)	Walkers/Joggers	100% (1)
Bashams Beach (n = 228)	Dog walkers	41.48% (258)
	Walkers/Joggers	22.19% (138)
	Fishing	17.52% (109)
	Surfing/swimming	7.4% (46)
	Sitting/sunbaking	7.07% (44)
	Playing games	4.34% (27)
Carrickalinga Estuary & South (n = 54)	Walkers/Joggers	43.76% (193)
	Sitting/sunbaking	24.26% (107)
	Dog walkers	21.32% (94)
	Surfing/swimming	9.3% (41)
	Playing games	0.68% (3)
	Fishing	0.68% (3)
Carrickalinga North (n = 62)	Walkers/Joggers	43% (178)
	Sitting/sunbaking	22.71% (94)
	Dog walkers	16.18% (67)
	Surfing/swimming	10.87% (45)
	Fishing	5.56% (23)
	Playing games	1.69% (7)

Site (n = number of threat assessments carried out)	Recreational activity	Occurrence
Carrickalinga Rotunda (n = 115)	Sitting/sunbaking	41.47% (513)
	Walkers/Joggers	29.43% (364)
	Surfing/swimming	14.31% (177)
	Dog walkers	10.27% (127)
	Playing games	2.75% (34)
	Fishing	1.54% (19)
	Driving	0.24% (3)
Coolawang (n = 38)	Walkers/Joggers	78.26% (18)
	Playing games	21.74% (5)
Hindmarsh River Mouth (n = 203)	Walkers/Joggers	48.97% (1,001)
	Dog walkers	38.16% (780)
	Surfing/swimming	5.43% (111)
	Sitting/sunbaking	5.04% (103)
	Playing games	1.61% (33)
	Fishing	0.68% (14)
	Driving	0.1% (2)
Inman River Outlet (n = 210)	Walkers/Joggers	47.95% (445)
	Dog walkers	31.9% (296)
	Surfing/swimming	7.33% (68)
	Sitting/sunbaking	7% (65)
	Playing games	4.42% (41)
	Fishing	1.4% (13)
Lands End (n = 66)	Walkers/Joggers	75% (45)
	Dog walkers	20% (12)
	Surfing/swimming	5% (3)
Maslin Beach (n = 190)	Walkers/Joggers	55.65% (719)
	Dog walkers	27.24% (352)
	Fishing	8.51% (110)
	Sitting/sunbaking	5.5% (71)
	Surfing/swimming	2.86% (37)
	Driving	0.15% (2)
	Playing games	0.08% (1)
Middleton Beach (n = 50)	Surfing/swimming	30.92% (299)
	Walkers/Joggers	28.96% (280)
	Sitting/sunbaking	17.48% (169)
	Dog walkers	17.27% (167)
	Playing games	4.24% (41)
	Fishing	1.14% (11)
Moana Beach (n = 69)	Sitting/sunbaking	44.5% (745)
	Driving	18.28% (306)
	Walkers/Joggers	12.31% (206)
	Dog walkers	11.05% (185)
	Surfing/swimming	8.96% (150)
	Playing games	3.05% (51)
	Fishing	1.85% (31)

Site (n = number of threat assessments carried out)	Recreational activity	Occurrence
Morgans Beach (n = 57)	Sitting/sunbaking	37.96% (205)
	Driving	20.37% (110)
	Walkers/Joggers	14.63% (79)
	Surfing/swimming	12.59% (68)
	Fishing	8.15% (44)
	Dog walkers	3.52% (19)
	Playing games	2.78% (15)
Myponga Beach (n = 70)	Walkers/Joggers	31.04% (122)
	Sitting/sunbaking	21.63% (85)
	Playing games	15.27% (60)
	Dog walkers	13.23% (52)
	Surfing/swimming	8.65% (34)
	Fishing	6.36% (25)
	Driving	3.82% (15)
Normanville North (n = 59)	Walkers/Joggers	45.52% (320)
	Dog walkers	25.46% (179)
	Surfing/swimming	14.37% (101)
	Sitting/sunbaking	12.52% (88)
	Playing games	1.14% (8)
	Fishing	0.71% (5)
	Driving	0.28% (2)
Normanville South (n = 88)	Walkers/Joggers	29.84% (302)
	Sitting/sunbaking	17.29% (175)
	Playing games	15.51% (157)
	Driving	12.65% (128)
	Dog walkers	12.15% (123)
	Surfing/swimming	9.98% (101)
	Fishing	2.57% (26)
Ochre Cove, Maslins (n = 166)	Walkers/Joggers	44.81% (69)
	Dog walkers	31.17% (48)
	Fishing	11.04% (17)
	Sitting/sunbaking	9.09% (14)
	Playing games	3.9% (6)
Olivers Reef (n = 147)	Dog walkers	42.42% (560)
	Walkers/Joggers	40.3% (532)
	Sitting/sunbaking	6.97% (92)
	Surfing/swimming	6.29% (83)
	Playing games	3.03% (40)
	Fishing	0.76% (10)
	Driving	0.23% (3)
Parsons Beach (n = 115)	Surfing/swimming	38.87% (124)
	Walkers/Joggers	35.42% (113)
	Fishing	22.57% (72)
	Sitting/sunbaking	2.51% (8)
	Dog walkers	0.63% (2)

Site (n = number of threat assessments carried out)	Recreational activity	Occurrence
Port Willunga (n = 188)	Dog walkers	50.66% (915)
	Walkers/Joggers	44.74% (808)
	Sitting/sunbaking	1.83% (33)
	Surfing/swimming	1.77% (32)
	Fishing	1% (18)
Sheepies Beach (n = 71)	Walkers/Joggers	55.56% (5)
	Surfing/swimming	33.33% (3)
	Driving	11.11% (1)
Shelley Beach (lady bay; n = 96)	Walkers/Joggers	30.56% (55)
	Dog walkers	23.89% (43)
	Surfing/swimming	15% (27)
	Fishing	12.78% (23)
	Sitting/sunbaking	12.22% (22)
	Playing games	3.33% (6)
	Driving	2.22% (4)
Silver Sands (n = 136)	Walkers/Joggers	37.33% (909)
	Dog walkers	22.79% (555)
	Driving	14.37% (350)
	Sitting/sunbaking	11.13% (271)
	Surfing/swimming	9.36% (228)
	Playing games	3.33% (81)
	Fishing	1.68% (41)
Snapper Point (n = 135)	Dog walkers	47.31% (220)
	Walkers/Joggers	45.38% (211)
	Sitting/sunbaking	4.52% (21)
	Surfing/swimming	1.29% (6)
	Playing games	1.08% (5)
	Driving	0.43% (2)
Southport (n = 89)	Surfing/swimming	45.87% (1,473)
	Walkers/Joggers	22.42% (720)
	Sitting/sunbaking	14.48% (465)
	Dog walkers	9.31% (299)
	Fishing	3.43% (110)
	Driving	2.3% (74)
	Playing games	2.18% (70)
Tunkalilla Heysen (n = 52)	Walkers/Joggers	68.6% (59)
	Dog walkers	3.49% (3)
Tunkalilla mid west estuary (n = 43)	Walkers/Joggers	31.62% (43)
	Surfing/swimming	22.79% (31)
	Sitting/sunbaking	11.76% (16)
	Dog walkers	3.68% (5)
	Fishing	0.74% (1)

Site (n = number of threat assessments carried out)	Recreational activity	Occurrence
Tunkalilla West Estuary (n = 43)	Walkers/Joggers	53.33% (40)
	Surfing/swimming	18.67% (14)
	Dog walkers	5.33% (4)
	Sitting/sunbaking	5.33% (4)
	Driving	5.33% (4)
	Fishing	1.33% (1)
Waitpinga Beach (east; n = 104)	Fishing	61.62% (236)
	Surfing/swimming	17.23% (66)
	Walkers/Joggers	15.14% (58)
	Sitting/sunbaking	5.74% (22)
	Dog walkers	0.26% (1)
Waitpinga Beach (west; n = 59)	Fishing	49.13% (85)
	Walkers/Joggers	32.37% (56)
	Surfing/swimming	15.03% (26)
	Sitting/sunbaking	2.31% (4)
	Playing games	1.16% (2)
Watsons Gap (n = 158)	Walkers/Joggers	47.19% (327)
	Dog walkers	23.23% (161)
	Surfing/swimming	16.45% (114)
	Sitting/sunbaking	6.93% (48)
	Fishing	4.76% (33)
	Playing games	1.15% (8)
	Driving	0.29% (2)
Yankalilla river mouth (n = 37)	Walkers/Joggers	38.64% (17)
	Dog walkers	27.27% (12)
	Sitting/sunbaking	13.64% (6)
	Driving	6.82% (3)
	Playing games	6.82% (3)
	Fishing	6.82% (3)
Yilki (n = 290)	Walkers/Joggers	54.11% (1,165)
	Dog walkers	34.14% (735)
	Surfing/swimming	5.34% (115)
	Sitting/sunbaking	3.25% (70)
	Playing games	2.83% (61)
	Fishing	0.28% (6)
	Driving	0.05% (1)

Table 10: Mean (\pm standard error) number of people observed at each site over seven breeding seasons. Sites with <8 threat assessments are highlighted in grey and should be interpreted with caution. A blank cell represents no threat data available, while zero represents no detection of people at a site.

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Aldinga		3	50 \pm 12.81	28.67 \pm 27.67	69.25 \pm 36.97	19.25 \pm 10.32	65.1 \pm 24.1
Ballaparudda				0 \pm 0	0 \pm 0	0.08 \pm 0.08	0 \pm 0
Bashams Beach	4.58 \pm 1.25	3.36 \pm 0.97	1.7 \pm 0.83	3.73 \pm 1.07	1	2.77 \pm 0.37	2.15 \pm 0.29
Callawonga				0	0.33 \pm 0.24	0 \pm 0	0 \pm 0
Carrickalinga Estuary & South	12.67 \pm 3.71	6.5 \pm 4.5	0 \pm 0			6.64 \pm 2.34	9 \pm 2.93
Carrickalinga North	4 \pm 4	6.71 \pm 2.03	2.75 \pm 0.64	25	0.5 \pm 0.5	13.7 \pm 7.06	6.18 \pm 1.6
Carrickalinga Rotunda	46	18.55 \pm 5.66	4.44 \pm 2.15	2.8 \pm 1.36	8.14 \pm 3.1	9.18 \pm 2.37	8.09 \pm 2.22
Christies Beach			14.5 \pm 7.82	78.25 \pm 44.03			8 \pm 4.93
Coolawang	0	2.5 \pm 2.5	10		0	0.13 \pm 0.13	0.07 \pm 0.07
Goolwa beach		6 \pm 1					17.5 \pm 9.5
Hindmarsh River Mouth	15.21 \pm 2.54	6.81 \pm 1.27	9.5 \pm 6.5	3.5 \pm 1.22	0	11.23 \pm 0.99	9.65 \pm 1.67
Inman River Outlet	6.69 \pm 1.6	1.86 \pm 0.36	4.91 \pm 1.96	3.16 \pm 0.79	4.14 \pm 0.7	6.2 \pm 1.3	5.33 \pm 1.16
Lands End		3.38 \pm 3.23	2.2 \pm 1.5	0.6 \pm 0.6	0.11 \pm 0.11	0.55 \pm 0.37	0.43 \pm 0.31
Maslin Beach	7.22 \pm 0.93	4.47 \pm 0.53	6.79 \pm 1.13	6.78 \pm 1.29	7.09 \pm 0.79	11.06 \pm 3.06	6.18 \pm 2.59
Middleton Beach		49	14.75 \pm 3.64	8 \pm 5	20		20.11 \pm 3.93
Moana Beach		5.82 \pm 0.85	7.62 \pm 2.63	4.6 \pm 1.03	4.5 \pm 1.5	30.27 \pm 15.45	42.44 \pm 26.75
Morgans Beach	17.8 \pm 7.64	7.5 \pm 2.66	5.5 \pm 2.09	11.4 \pm 4.73	5.75 \pm 3.48	6.75 \pm 6.42	19 \pm 9.24
Myponga Beach		0.15 \pm 0.15	4.33 \pm 2.19	4.75 \pm 1.31	8.71 \pm 2.29	4.95 \pm 1.37	9.14 \pm 3.45
Normanville North	140 \pm 0	3.63 \pm 0.99	1.5 \pm 1.5	4.5 \pm 0.5	6.5 \pm 2.96	7 \pm 2.55	5.87 \pm 1.44
Normanville South		5.67 \pm 1.76	8.8 \pm 4.8	20 \pm 16	11	7	11.82 \pm 2.03
Ochre Cove, Maslins						1.02 \pm 0.22	0.88 \pm 0.13
Olivers Reef						10.42 \pm 1.93	8.7 \pm 0.75
O'Sullivan's Beach			17.86 \pm 9.56	19.25 \pm 15.59			8.67 \pm 5.93
Parsons Beach	3.63 \pm 1.31	1.6 \pm 1.19	5.2 \pm 2	1.78 \pm 1.42	6.75 \pm 5.45	1.74 \pm 0.65	1.42 \pm 0.74
Port Stanvac				0 \pm 0	0 \pm 0	0.1 \pm 0.1	0

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Port Willunga	10.3 ± 3.88	11.31 ± 1.96	8.72 ± 1.19	9.61 ± 1.45	9.77 ± 1.89	10.1 ± 1.75	9.6 ± 0.99
Port Willunga South	20.4 ± 5.24						
Sheepies Beach			0.38 ± 0.26	0.25 ± 0.25	0 ± 0	0.09 ± 0.06	0.13 ± 0.13
Shelley Beach (lady bay)		3.5 ± 0.85	0.93 ± 0.37	2.67 ± 1.76	1.88 ± 0.75	0.61 ± 0.22	2.33 ± 1
Silver Sands		18.93 ± 3.78	65 ± 24.4			3.5 ± 1.5	14.85 ± 1.49
Snapper Point					8.4 ± 3.08	1.8 ± 0.37	3.31 ± 0.33
Southport		13.23 ± 3.7	31.92 ± 7.41	22.22 ± 5.07	39.95 ± 15.35	22.6 ± 4.12	59.95 ± 24.65
Tunkalilla 1st house east		0	0	9 ± 2.9	2.78 ± 1.05		0.75 ± 0.75
Tunkalilla 3rd house east		0 ± 0	1 ± 1	2 ± 0.63			
Tunkalilla far west		0.67 ± 0.67	0 ± 0	6.5 ± 3.48	1.45 ± 0.86		0 ± 0
Tunkalilla Heysen			0 ± 0	4.36 ± 2.6	1.14 ± 0.55	1.4 ± 1.11	0 ± 0
Tunkalilla mid west estuary		4		8.75 ± 2.61	1.36 ± 0.72	1.68 ± 0.82	1.25 ± 1.25
Tunkalilla shed caravan		0		0 ± 0	2.22 ± 1.54		0 ± 0
Tunkalilla West Estuary				9.09 ± 2.54	2.82 ± 1.24	0.5 ± 0.23	1.67 ± 1.67
Waitpinga Beach (east)		3.78 ± 1.96	9 ± 3.18	6 ± 1.83	3.6 ± 1.36	4.32 ± 0.8	1.31 ± 0.41
Waitpinga Beach (west)						3.41 ± 0.95	2.37 ± 1.13
Watsons Gap	2 ± 0.45	7.67 ± 6.7	0.4 ± 0.4	4.83 ± 3.08	3.25 ± 1.31	3.33 ± 2.4	4.58 ± 0.58
Yankalilla river mouth					2.2 ± 0.85	0.74 ± 0.27	1 ± 0.63
Yilki						6.76 ± 1.29	7.73 ± 1

Table 11: Mean (\pm standard error) number of dogs on lead observed at sites over the last seven breeding seasons. Sites with <8 threat assessments are highlighted in grey.

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Aldinga		0	2.43 \pm 0.61	1.33 \pm 1.33	4.5 \pm 1.76	1.25 \pm 0.95	3.07 \pm 0.78
Ballaparudda				0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
Bashams Beach	0.58 \pm 0.23	0.71 \pm 0.25	0 \pm 0	0.91 \pm 0.39	0	0.51 \pm 0.09	0.45 \pm 0.11
Callawonga				0	0 \pm 0	0 \pm 0	0 \pm 0
Carrickalinga Estuary & South	0.33 \pm 0.33	0.5 \pm 0.5	0 \pm 0			0.5 \pm 0.23	0.42 \pm 0.12
Carrickalinga North	0 \pm 0	0.79 \pm 0.3	0 \pm 0	0	0 \pm 0	0.2 \pm 0.2	0.47 \pm 0.19
Carrickalinga Rotunda	7	0.38 \pm 0.32	0.22 \pm 0.22	0.4 \pm 0.24	0.57 \pm 0.5	0.41 \pm 0.17	0.51 \pm 0.19
Christies Beach			0.75 \pm 0.75	2 \pm 1			0 \pm 0
Coolawang	0	0 \pm 0	0		0	0 \pm 0	0 \pm 0
Goolwa beach		1 \pm 1					0.5 \pm 0.5
Hindmarsh River Mouth	2 \pm 0.46	1.41 \pm 0.45	1 \pm 1	0 \pm 0	0	2.15 \pm 0.21	0.76 \pm 0.18
Inman River Outlet	0.58 \pm 0.15	0.21 \pm 0.09	0.35 \pm 0.11	0.48 \pm 0.18	0.64 \pm 0.19	0.73 \pm 0.3	1.5 \pm 0.73
Lands End		0.25 \pm 0.16	0.6 \pm 0.4	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
Maslin Beach	0.69 \pm 0.18	0.64 \pm 0.17	0.5 \pm 0.15	0.5 \pm 0.23	0.7 \pm 0.18	0.65 \pm 0.19	0.18 \pm 0.18
Middleton Beach		3	1.13 \pm 0.3	0.5 \pm 0.5	4		1.37 \pm 0.22
Moana Beach		1.45 \pm 0.64	1 \pm 0.38	0.6 \pm 0.24	0.5 \pm 0.5	0.82 \pm 0.46	2.11 \pm 1.47
Morgans Beach	0.6 \pm 0.4	0.5 \pm 0.5	0 \pm 0	0 \pm 0	0 \pm 0	1.25 \pm 1.25	0 \pm 0
Myponga Beach		0 \pm 0	0.67 \pm 0.67	0.5 \pm 0.5	0.14 \pm 0.1	0.09 \pm 0.06	0.43 \pm 0.23
Normanville North	20 \pm 0	0.37 \pm 0.16	0 \pm 0	0.5 \pm 0.5	1.17 \pm 0.98	0.75 \pm 0.75	1.13 \pm 0.3
Normanville South		0.67 \pm 0.33	0.6 \pm 0.24	2.5 \pm 1.5	0	1	0.93 \pm 0.19
Ochre Cove, Maslins						0.26 \pm 0.09	0.14 \pm 0.05
Olivers Reef						1.29 \pm 0.41	0.83 \pm 0.1
O'Sullivan's Beach			0.43 \pm 0.43	0.5 \pm 0.5			0.33 \pm 0.33
Parsons Beach	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
Port Stanvac				0 \pm 0	0 \pm 0	0 \pm 0	0

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Port Willunga	1.5 ± 1.39	0.23 ± 0.17	1.16 ± 0.25	0.78 ± 0.24	1.12 ± 0.27	1.4 ± 0.69	0.96 ± 0.26
Port Willunga South	1.85 ± 0.41						
Sheepies Beach			0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Shelley Beach (lady bay)		0.65 ± 0.21	0 ± 0	0 ± 0	0 ± 0	0.09 ± 0.06	0.11 ± 0.11
Silver Sands		1.64 ± 0.46	3.22 ± 1.26			1 ± 1	1.38 ± 0.15
Snapper Point					1.4 ± 0.75	0 ± 0	0.62 ± 0.07
Southport		0.77 ± 0.34	1.54 ± 0.81	1.67 ± 0.65	0.86 ± 0.21	0.6 ± 0.22	1.23 ± 0.25
Tunkalilla 1st house east		0	0	0 ± 0	0 ± 0		0 ± 0
Tunkalilla 3rd house east		0 ± 0	0.5 ± 0.5	0 ± 0			
Tunkalilla far west		1 ± 1	0 ± 0	0 ± 0	0 ± 0		0 ± 0
Tunkalilla Heysen			0 ± 0	0 ± 0	0.07 ± 0.07	0 ± 0	0 ± 0
Tunkalilla mid west estuary		0		0 ± 0	0 ± 0	0.05 ± 0.05	0 ± 0
Tunkalilla shed caravan		0		0 ± 0	0 ± 0		0 ± 0
Tunkalilla West Estuary				0 ± 0	0 ± 0	0.11 ± 0.11	0 ± 0
Waitpinga Beach (east)		0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.03 ± 0.03	0 ± 0
Waitpinga Beach (west)						0 ± 0	0 ± 0
Watsons Gap	0 ± 0	0 ± 0	0 ± 0	0.33 ± 0.21	0.13 ± 0.13	0 ± 0	0.49 ± 0.09
Yankalilla river mouth					0.3 ± 0.15	0.05 ± 0.05	0 ± 0
Yilki						1.33 ± 0.21	1.9 ± 0.21

Table 12: Mean (\pm standard error) number of dogs off lead observed at sites over the last seven breeding seasons. Sites with <8 threat assessments are highlighted in grey.

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Aldinga		4	7.43 \pm 1.78	4.33 \pm 4.33	5.25 \pm 0.63	3.75 \pm 1.03	4.22 \pm 0.64
Ballaparudda				0 \pm 0	0 \pm 0	0 \pm 0	0 \pm 0
Bashams Beach	2.5 \pm 0.92	0.29 \pm 0.12	1 \pm 0.54	2.27 \pm 0.82	1	0.39 \pm 0.12	0.59 \pm 0.17
Callawonga				0	0 \pm 0	0 \pm 0	0 \pm 0
Carrickalinga Estuary & South	1.67 \pm 1.67	0.5 \pm 0.5	0 \pm 0			1.43 \pm 0.44	1.94 \pm 0.51
Carrickalinga North	0 \pm 0	1.21 \pm 0.46	0.38 \pm 0.18	1	0 \pm 0	1.4 \pm 0.72	1.06 \pm 0.38
Carrickalinga Rotunda	0	0.1 \pm 0.06	0 \pm 0	0.6 \pm 0.6	0.57 \pm 0.31	1.09 \pm 0.26	1.23 \pm 0.29
Christies Beach			1.5 \pm 0.87	2.5 \pm 1.85			2.33 \pm 1.45
Coolawang	0	0 \pm 0	0		0	0 \pm 0	0 \pm 0
Goolwa beach		3.5 \pm 1.5					1.5 \pm 1.5
Hindmarsh River Mouth	4.86 \pm 1.1	2 \pm 0.45	5 \pm 0	1.6 \pm 0.69	0	3.29 \pm 0.32	2.96 \pm 0.45
Inman River Outlet	1.23 \pm 0.25	0.36 \pm 0.13	0.59 \pm 0.13	0.94 \pm 0.28	0.95 \pm 0.23	1.67 \pm 0.37	2.17 \pm 0.84
Lands End		0.13 \pm 0.13	0 \pm 0	0 \pm 0	0 \pm 0	0.09 \pm 0.09	0.07 \pm 0.05
Maslin Beach	1 \pm 0.22	1.14 \pm 0.29	1.32 \pm 0.39	1.67 \pm 0.47	1.23 \pm 0.21	3.59 \pm 0.6	1.36 \pm 0.31
Middleton Beach		14	3.13 \pm 1.19	0.5 \pm 0.5	2		1.74 \pm 0.37
Moana Beach		2.27 \pm 0.78	2.54 \pm 0.69	2 \pm 0.55	1 \pm 0	2.73 \pm 0.84	1.7 \pm 0.48
Morgans Beach	4.2 \pm 1.62	0.25 \pm 0.25	0.56 \pm 0.26	1.47 \pm 0.74	0.13 \pm 0.13	0 \pm 0	1.2 \pm 0.58
Myponga Beach		0 \pm 0	0.67 \pm 0.67	0.75 \pm 0.25	0.64 \pm 0.31	1.05 \pm 0.33	0.57 \pm 0.27
Normanville North	20 \pm 0	1.11 \pm 0.3	0 \pm 0	0.5 \pm 0.5	1.83 \pm 1.08	1.5 \pm 0.5	1.48 \pm 0.35
Normanville South		0.33 \pm 0.33	1 \pm 0.45	0.5 \pm 0.5	3	3	1.04 \pm 0.19
Ochre Cove, Maslins						0.46 \pm 0.11	0.21 \pm 0.05
Olivers Reef						3.75 \pm 0.55	3.1 \pm 0.3
O'Sullivan's Beach			7.71 \pm 3.39	12.5 \pm 5.25			5 \pm 2.89
Parsons Beach	0 \pm 0	0 \pm 0	0 \pm 0	0.56 \pm 0.56	0 \pm 0	0 \pm 0	0 \pm 0
Port Stanvac				0 \pm 0	0 \pm 0	0 \pm 0	0

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Port Willunga	3 ± 1.01	4.62 ± 1.12	3.05 ± 0.51	3.73 ± 0.66	4.04 ± 0.96	3.7 ± 0.84	5.93 ± 0.75
Port Willunga South	3.25 ± 0.79						
Sheepies Beach			0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Shelley Beach (lady bay)		0.6 ± 0.26	0.47 ± 0.19	0.67 ± 0.67	0.18 ± 0.13	0.22 ± 0.11	0.72 ± 0.25
Silver Sands		2.5 ± 0.34	6.44 ± 1.7			1 ± 1	2.56 ± 0.28
Snapper Point					1.6 ± 0.68	1.2 ± 0.37	1.1 ± 0.14
Southport		2.46 ± 0.68	2.54 ± 0.82	1.33 ± 0.58	1.36 ± 0.35	1.3 ± 0.58	1.73 ± 0.44
Tunkalilla 1st house east		0	0	0.8 ± 0.49	0.11 ± 0.11		0 ± 0
Tunkalilla 3rd house east		0 ± 0	0 ± 0	0.6 ± 0.4			
Tunkalilla far west		0 ± 0	0 ± 0	0.1 ± 0.1	0 ± 0		0 ± 0
Tunkalilla Heysen			0 ± 0	0.18 ± 0.12	0 ± 0	0.1 ± 0.1	0 ± 0
Tunkalilla mid west estuary		0		0.38 ± 0.26	0 ± 0	0 ± 0	0 ± 0
Tunkalilla shed caravan		0		0.5 ± 0.5	0.22 ± 0.22		0 ± 0
Tunkalilla West Estuary				0.09 ± 0.09	0 ± 0	0.22 ± 0.22	0 ± 0
Waitpinga Beach (east)		0.22 ± 0.15	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Waitpinga Beach (west)						0 ± 0	0 ± 0
Watsons Gap	0.33 ± 0.21	1.17 ± 0.83	0 ± 0	2.67 ± 2.28	0.38 ± 0.38	0 ± 0	0.72 ± 0.15
Yankalilla river mouth					0.5 ± 0.31	0.16 ± 0.12	0.38 ± 0.26
Yilki						1.11 ± 0.34	1.32 ± 0.17

In order to compare the exposure of Hooded Plovers to threats at sites across the Fleurieu Peninsula, two methods of formulating threat 'indices' were used. The first index was simply the sum of ranks assigned to each threat type (representing its frequency of occurrence at a site) as per Table 13. The second is a *weighted* threat index where the rank assigned to each threat is multiplied by the impact rating of that threat (taken from Table 3). The standardised weighted threat index is then calculated by subtracting the minimum weighted index from each site value, then dividing each value by maximum of result. Table 13 presents sites in order of the highest weighted threat index to the lowest, while Figure 31 maps the sites according to their index rating.

The two indices do not differ greatly in results. Three sites on the Fleurieu Peninsula had 'very high' threat ratings: Aldinga and Silver Sands appear to be very popular beaches for recreational beach use, and associated threats including dogs, vehicles and horses. The third 'very high' threat beach was Tunkalilla West Estuary which is a remote beach however high numbers of foxes, stock and magpies led to its categorisation as of 'very high' threat to breeding Hooded Plovers. Beaches in remote areas as well as those in highly urbanised parts of the Fleurieu Peninsula were not always predictable in threat ratings, revealing that isolation from people does not always mean the Hooded Plovers will necessarily be experiencing low threats to their breeding at these sites. Sites are highly variable in the range of threats present and the intensity of these threats, and these unique threat profiles should be used to shape the management recommendations at sites.

Table 13: The rank value assigned to each threat type sites across the Fleurieu Peninsula. The first threat index is the sum of the ranks assigned to each of the eight threat types in the table below. The second is a weighted threat index where the rank assigned to each threat (representing its frequency of occurrence at a site; in the table below) is multiplied by the impact rating of that threat (listed in Table 3). The weighted threat index is then standardised. This table only includes sites with >35 threat assessments.

Site	People	Dog on	Dog off	Fox	Horse	Vehicle	Magpie	Raven	Stock	Cat	1. Sum threat ranks	2. Weighted threat index	Weighted threat index (stand.)
Aldinga	4	4	4	0	3	4	2	2	2	0	25	96	1.00
Silver Sands	3	4	4	0	4	4	1	2	0	0	22	85.5	0.84
Tunkalilla West Estuary	2	1	1	4	2	2	3	2	4	0	21	81	0.77
Yankalilla river mouth	1	1	2	4	1	4	2	4	0	0	19	76.5	0.70
Tunkalilla mid west estuary	2	1	1	4	2	1	2	2	4	0	19	73	0.65
Tunkalilla Heysen	1	1	1	4	1	2	3	1	4	0	18	69.5	0.60
Normanville North	2	4	3	2	1	2	1	3	0	0	18	68	0.57
Morgans Beach	2	2	3	1	2	4	2	1	0	0	17	67	0.56
Shelley Beach (lady bay)	1	2	2	3	1	3	2	3	0	0	17	66.5	0.55
Normanville South	2	3	3	1	2	3	0	2	0	0	16	63	0.50
Southport	4	3	3	1	0	4	0	1	0	0	16	63	0.50
Carrickalinga Estuary & South	2	2	3	3	0	2	1	3	0	0	16	62	0.48
Hindmarsh River Mouth	2	4	4	2	0	1	2	2	0	0	17	62	0.48
Maslin Beach	2	3	3	2	1	2	1	1	0	1	16	61	0.47
Middleton Beach	3	3	3	1	0	2	2	2	0	0	16	59.5	0.44
Moana Beach	3	3	3	0	2	3	1	0	0	0	15	57.5	0.41
Yilki	2	4	3	1	0	1	3	2	0	0	16	57	0.40
Olivers Reef	2	3	4	2	1	1	1	1	0	0	15	56	0.39
Carrickalinga North	2	2	2	2	0	1	2	3	0	0	14	52	0.33
Myponga Beach	2	2	2	1	1	3	0	0	0	2	13	52	0.33
Port Willunga	2	3	4	1	1	1	1	1	0	0	14	52	0.33
Coolawang	1	0	0	4	0	2	3	2	1	0	13	50.5	0.31
Watsons Gap	2	2	2	2	0	2	2	1	0	0	13	49	0.28

Site	People	Dog on	Dog off	Fox	Horse	Vehicle	Magpie	Raven	Stock	Cat	1. Sum threat ranks	2. Weighted threat index	Weighted threat index (stand.)
Lands End	1	1	1	3	0	0	2	3	0	2	13	48.5	0.27
Carrickalinga Rotunda	2	2	2	1	0	1	1	3	0	0	12	45	0.22
Snapper Point	2	3	3	0	0	1	2	1	0	0	12	43	0.19
Ballaparudda	0	0	0	4	0	0	2	1	4	0	11	42	0.18
Sheepies Beach	0	0	0	3	0	1	3	1	3	0	11	42	0.18
Parsons Beach	1	0	1	4	0	0	2	3	0	0	11	41.5	0.17
Inman River Outlet	2	2	3	0	1	1	1	1	0	0	11	41	0.16
Waitpinga Beach (east)	2	0	0	4	0	0	2	3	0	0	11	41	0.16
Bashams Beach	1	2	2	1	0	1	2	2	0	0	11	40.5	0.15
Ochre Cove, Maslins	1	2	2	1	0	1	3	1	0	0	11	39.5	0.14
Waitpinga Beach (west)	1	0	0	3	0	0	1	3	0	0	8	30.5	0.00



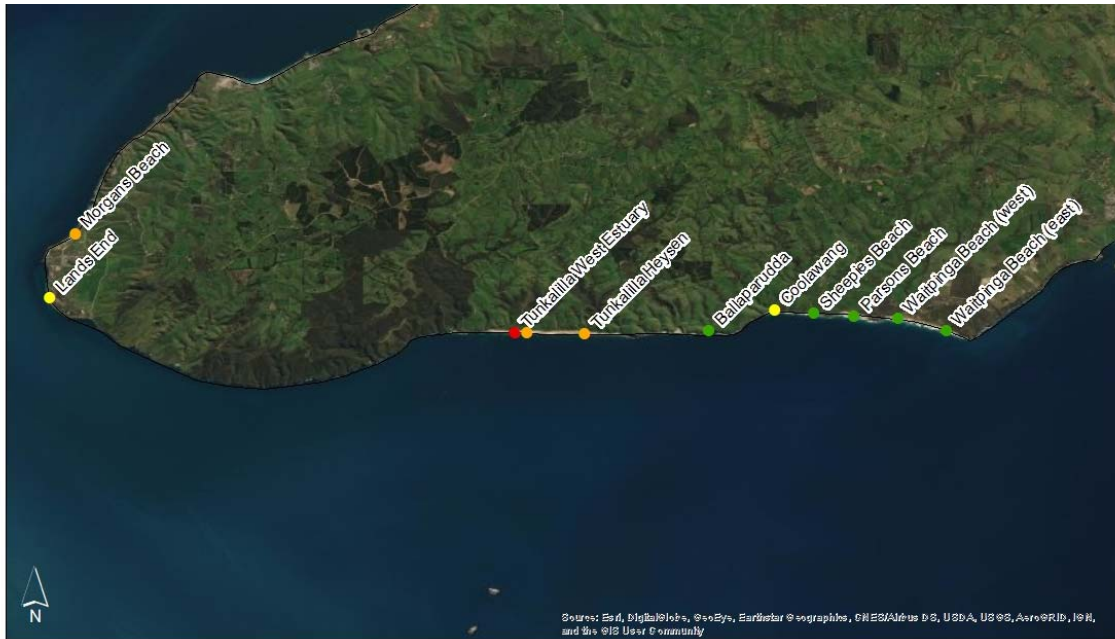
**Hooded Plover threat index
North coast**



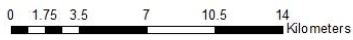
Threat Index

- Low
- Medium
- High
- Very high



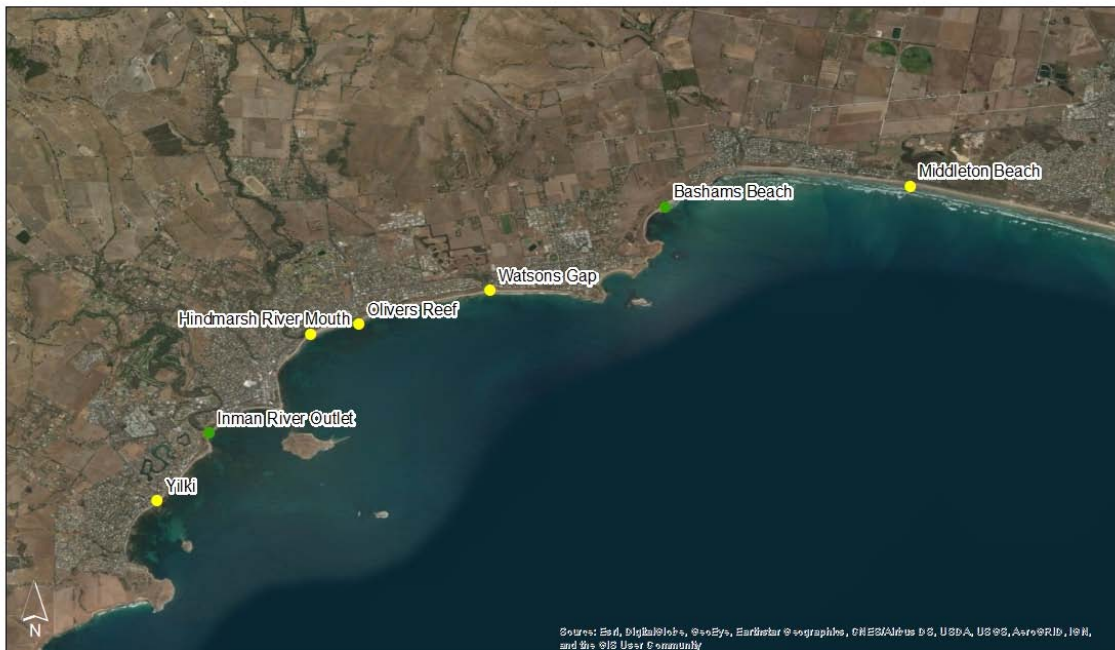


**Hooded Plover threat index
South west coast**

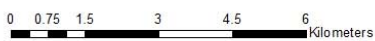


Threat Index

- Low
- Medium
- High
- Very high



**Hooded Plover threat index
South east coast**



Threat Index

- Low
- Medium
- High
- Very high






















Figure 31: The weighted threat index for each site across the Fleurieu Peninsula (using the standardised weighted threat index [Table 13], coded as low = 0 – 0.25, medium = 0.26 – 0.50, high = 0.51 – 0.75, very high = 0.76 – 1.00).

Site Descriptions and Management Recommendations




The following pages provide descriptions of each of the sites in this report including the geomorphology of the site, history of the pair that have occupied the site (the program to band Hooded Plovers on the Fleurieu Peninsula began in the summer breeding season of 2011/12 meaning that, prior to the 2012/13 season, birds were unbanded and thus unidentifiable), key breeding summary statistics, key beach user groups (as per Table 9, showing only those user groups making up $\geq 5\%$ of visitors to the sites), key threats (as per Table 7, showing only those threats present in $\geq 10\%$ of threat assessments) and recommendations for threat mitigation at the site.




Symbols used for threats are as follows:

	People walking		Foxes (prints)
	People sitting/ sunbaking		Dogs off lead
	Surfers/swimmers		Dogs on lead
	Dog walker		Ravens
	People Fishing		Magpies
	Games		Silver Gulls
	ORVs		Pacific Gulls
	People overall		Birds of Prey
	Horses		Cats (prints)
	Stock (sheep and/or cattle)		







Aldinga

Managed by The City of Onkaparinga.








 Beach Morphology	Wide beach, backed with dune system. There is a shingle/pebble ridge at the back of the beach.
 Ease of Detection	Long stretch of beach. Birds can be quite easy to find, but vehicles are allowed to be on the beach, and can make it difficult to search for nesting birds.
 Pair Identity	2013/14 no nesting 2014/15 DP Orange (banded Aug 2014 at Pt Willunga, female) and HV Orange (banded Jan 2013 at Snapper Point, male) 2015/16 DP Orange /HV Orange

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2010/11	2	2	6	3	0	-


Key user groups:







					
32%	28%	16%	11%	8%	5%

Key threats:

						
100%	90%	77%	72%	71%	35%	20%

Threat mitigation actions:

	Prevent crushing; Minimise disturbance; Protect habitat from damage	Improved signage for vehicles Aim to review and implement solutions to mitigate ORV impacts to breeding success (including potential temporary exclusion periods when chicks are present, e.g. the option of a series of opportunities throughout the day to enable chicks to feed at water's edge)
---	---	--

		Temporary banners at access points for vehicle users Actions to ensure vehicles do not park in front of the nest/chick site including no parking signs
	Prevent crushing	Temporary fencing around nest including additional buffer with no parking signs Temporary signage flanking nest/chick site Education and events
	Minimise disturbance	Temporary signage flanking nest/chick site including no parking signs Temporary fencing around nest/chick site (large buffer zone) Extend fence/signs at times of low tide in peak use periods Chick shelters Temporary banners Education and events Media Site guardians during peak beach use periods in chick phase
	Prevent crushing; Minimise disturbance; Prevent predation	Improve dog regulations. As a minimum, regulations should not allow for off leash access during breeding season (or the very least when birds are actively breeding at the site) at any time of day Enforcement patrols Compliance data collected Site guardians at peak beach use times during chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted Review of compliance each year with aim to improve dog regulations and/or enforcement efforts
	Prevent crushing; Minimise disturbance; Protect habitat from damage	Liaise with horse riders about use of this site Investigate possibility of horse permit system or alternative to ensure all horse riders are provided with conditions of use to mitigate potential impacts (i.e. avoid access at times of high tide) Actions to ensure horses do not turn around in front of the nest/chick site, or dismount in front of this area
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.



Aldinga Beach, winter 2008 (Photo Bill Doyle, AMLR NRM Board)






View of Aldinga Bay SLSC and the vehicle-free zone north of Norman Road (Aerial image, DEW)






Vehicles parked directly in front of protected nesting zone of the Hooded Plover on Aldinga beach, despite signage to request that the zone is kept clear due to this being within the disturbance buffer of the birds. The chicks could not access their foraging zone at the water's edge. In 7 years, this site has never produced a fledgling. (photo Sue and Ash Read)


Ballaparudda

Managed by the District Council of Yankalilla






 Beach Morphology	Private access to this beach. Large estuary site, with rocky outcrops.
 Ease of Detection	Sometimes not on territory, the birds may be at Callawonga.
 Pair Identity	2013/14 unbanded/unbanded 2014/15 unbanded/unbanded 2015/16 unbanded/unbanded

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2012/13	4	7	18	4	2	2015/16


Key user groups (*caution low sample size, n=38*):







100%

Key threats (*caution low sample size, n=38*):

				
97%	47%	45%	29%	11%

Threat mitigation actions:

	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) – note foxes have been implicated in multiple nest failures at this site (2012/13, 2014/15) Den searches Fox control (bait, trap, shoot, den fumigation)
---	--------------------	--

	<p>Prevent crushing; minimise disturbance</p>	<p>Encourage landholder to be an ambassador for the site, assisting with protection of habitat Actions to ensure stock cannot access the beach or dune system, e.g. fencing installed/maintained (note: fencing was installed in 2014 at this site led by local volunteer)</p>
	<p>Prevent crushing</p>	<p>Private access at this site provides added protection for the birds Encourage landholder to be an ambassador for the site, providing landholder with information about the birds and strategies for avoiding impacts, so that they can enact and pass on to visitors</p>
	<p>Minimise disturbance</p>	<p>Private access at this site provides added protection for the birds Encourage landholder to be an ambassador for the site. Provide landholder with information about the birds and strategies for avoiding impacts, so that they can pass on to visitors – this may mean a few small (non-flapping) markers (spaced at least 15m from the nest in each direction) may be required to denote nest area to avoid</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds If applicable, liaise with landholder to discuss impacts of potential uncovered waste or wildlife feeding</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate.</p>






Ballaparudda nesting habitat. Photo David Thorn.






Ballaparudda creek mouth. Photo David Thorn.






Bashams Beach

Managed by Alexandrina Council







 Beach Morphology	At the western end, where the beach is slightly wider, there is an eroding dune ledge. Not much nesting habitat is available here. At the eastern end, near the whale watching area, there is a flat foredune with ample nesting space among Coastal Spinifex
 Ease of Detection	Easy to find Hooded Plovers.
 Pair Identity	2013/14 no nesting 2014/15 SA Orange (banded Nov 2013 at Bashams Beach, male) /UE Orange (banded Feb 2014 at Waitpinga Beach west, female) 2015/16 SA Orange /UE Orange

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2009/10	5	11	30	4	2	2010/11


Key user groups:






				
42%	22%	18%	7%	7%

Key threats:

					
79%	72%	31%	30%	25%	12%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
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	<p>Minimise disturbance</p>	<p>Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Chick shelters Education and events Targeted signage for people fishing Media Trial chick update signs at nearest access points Potential to trial using site guardians during peak beach use periods in chick phase Look for opportunities to add awareness information to whale watching communication channels, and ensure whale watchers do not linger near fenced areas particularly at the eastern end of the beach at the whale lookout.</p>
	<p>Prevent crushing; Minimise disturbance; Prevent predation</p>	<p>Improve dog regulations. As a minimum, regulations should not allow for off leash access during breeding season (or the very least when birds are actively breeding at the site) at any time of day Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
 *	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Carry out targeted fox control when foxes are identified as a problem predator (council undertake control in the reserve behind, ensure joint approach)</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using native Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>

* While foxes weren't in the top 10% of threats detected at this site, they have been implicated in nest failures here (2009/10, 2010/11, 2011/12).



Eastern end access point



Beach at western end is heavily eroded and largely unsuitable.



Beach to west.



Western end access.



Eastern end of beach with wide foredune suitable for nesting.






Fenced dune along eastern end.






Eastern end edged by rocky outcrop.

Callawonga





Managed by the District Council of Yankalilla



 Beach Morphology	Private access to this beach. Large estuary site, with rocky outcrops.
 Ease of Detection	Sometimes not on territory, the birds may be at Ballaparudda.
 Pair Identity	2013/14 unbanded/unbanded 2014/15 no nesting 2015/16 unbanded/unbanded

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2012/13	2	3	9	3	1	2013/14

There is not enough threat data to collate a summary for this site.

Actions may include the below, subject to better understanding of the threats at the site. These actions are based on similarities to Ballaparudda and local site knowledge:

	Prevent crushing; minimise disturbance	Encourage landholder to be an ambassador for the site, assisting with protection of habitat Actions to ensure stock cannot access the beach or dune system, e.g. fencing installed
 *	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Carry out targeted fox control when foxes are identified as a problem predator
	Prevent crushing	Private access at this site provides added protection for the birds Encourage landholder to be an ambassador for the site, providing landholder with information about the birds and strategies for avoiding impacts, so that they can enact and pass on to visitors
	Minimise disturbance	Private access at this site provides added protection for the birds Encourage landholder to be an ambassador for the site. Provide landholder with information about the birds and strategies for avoiding impacts, so that they can pass on to visitors – this may mean a few small (non-flapping) markers

		(spaced at least 15m from the nest in each direction) may be required to denote nest area to avoid
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds If applicable, liaise with landholder to discuss impacts of potential uncovered litter or wildlife feeding
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate.

* Foxes were implicated in nest failures here (2013/14).



View of Callawonga beach and estuary. Photo David Thorn






Callawonga beach. Photo David Thorn.






Callawonga nesting habitat. Photo David Thorn.





Carrickalinga Estuary and South

Managed by the District Council of Yankalilla







 Beach Morphology	Characterised by moderate to heavy seaweed cover and a relatively narrow dune system which is backed by a road and then houses. Area includes an estuary.
 Ease of Detection	Check in the estuary. The birds can often be seen on the beach to the south of the estuary. This may involve a long walk
 Pair Identity	2013/14 no birds 2014/15 CK Orange (banded Jan 2013 at Carrickalinga estuary, male) /SS Orange (banded Sept 2013 at Carrickalinga Pitmans access) 2015/16 CK Orange /SS Orange

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2009/10	3	4	10	2	0	-


Key user groups (*caution low sample size, n=54*):






			
44%	24%	21%	9%

Key threats (*caution low sample size, n=54*):

					
91%	61%	54%	37%	33%	22%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site or where the birds use the estuary or a more defined fence that blocks off the entire estuary as a refuge zone Education and events
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	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Trial chick update signs at nearest access points Chick shelters Education and events Media Potential to trial using site guardians during peak beach use periods in chick phase
	Prevent crushing; Minimise disturbance; Prevent predation	Maintain current dog regulations as minimum protection with the exception of South of the Carrickalinga estuary which is a permanent dogs off leash area to 200m north of Normanville jetty. Here, protection from off leash dogs during breeding season is critical and requires change to the current bylaw Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Potential to trial using site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) - note foxes have been implicated in nest failures at this site (2015/16) Den searches Fox control (bait, trap, shoot, den fumigation)
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, follow current methodology to ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.



View extending from Carrickalinga North, past rocky point, to Carrickalinga Rotunda and ending at Carrickalinga estuary. Aerial image DENR 2012






Fenced nesting site location, Feb 2011 (Emma Stephens)






Estuary at Carrickalinga Sands






Carrickalinga North

Managed by the District Council of Yankalilla








 Beach Morphology	Wide sandy beach, housing directly behind dune system with many informal access points.
 Ease of Detection	Easy to find, short beach, typically nest midway along
 Pair Identity	2012/13 AR Orange (banded Jan 2013 at Carrickalinga North, male) /NA Orange (banded Jan 2013 at Carrickalinga North, unknown sex) 2013/14 no birds 2014/15 unbanded/unbanded 2015/16 LP Orange (banded Jan 2013 at Carrickalinga estuary, unknown sex) /unbanded also using Carrickalinga Rotunda

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2009/10	4	5	11	0	0	-


Key user groups:






				
43%	23%	16%	11%	6%

Key threats:

						
98%	40%	35%	35%	19%	13%	10%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
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	<p>Minimise disturbance</p>	<p>Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage at access points Chick shelters Education and events, in particular liaise with Council, NRM and BirdLife regarding weddings on the beach. Media Site guardians during peak beach use periods in chick phase</p>
	<p>Prevent crushing; Minimise disturbance; Prevent predation</p>	<p>Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Carry out targeted fox control when foxes are identified as a problem predator</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, follow current methodology to ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>



Carrickalinga North beach (Aerial image, DENR 2012)



View of Carrickalinga North beach. Photo Grainne Maguire






Carrickalinga North from the northern end. Photo Grainne Maguire.






View of Carrickalinga North from the southern end. Photo Grainne Maguire.





Carrickalinga Rotunda

Managed by the District Council of Yankalilla






 Beach Morphology	Just south of Carrickalinga North, Rotunda is a narrow beach, with a rocky outcrop. Characterised by moderate to heavy seaweed cover and a relatively narrow dune system which is backed by a road and then housing.
 Ease of Detection	The birds use both north and south of the rocky outcrop. Check the rocks for hooded plovers feeding
 Pair Identity	2013/14 unbanded/unbanded 2014/15 LP Orange (banded Jan 2013 at Carrickalinga estuary, unknown sex) /unbanded 2015/16 LP Orange /unbanded also using Carrickalinga North

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	 <i>Total Eggs</i>	 <i>Total chicks</i>	 <i>Total Fledglings</i>	<i>Years successful</i>
2009/10	6	12	30	5	3	2010/11 2015/16


Key user groups:






			
42%	29%	14%	10%

Key threats:

				
97%	36%	31%	22%	20%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone)

		<p>Temporary nest update signage at access points Chick shelters Education and events Media Site guardians during peak beach use periods in chick phase</p>
	<p>Prevent crushing; Minimise disturbance; Prevent predation</p>	<p>Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) - note foxes have been implicated in multiple nest failures at this site (2014/15, 2015/16) Carry out targeted fox control when foxes are identified as a problem predator</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, follow current methodology to ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>



Example of Sand drift fencing with gap



Example of Sand drift fencing with gap



Example of nesting location, Oct 2010 (Emma Stephens)






View facing north. Photo Grainne Maguire.






View facing south. Photo Grainne Maguire.

Coolawang

Managed by the District Council of Yankalilla

 Beach Morphology	A small, remote beach (second bay west of Parsons Beach), approximately 250m long and surrounded by private property. Estuary at the site which is used by the Hooded Plovers. There are rocks at the base of the foredune where the high tide can reach. Upper beach is sandy in parts and has large pebbles elsewhere. Sea Spurge and Sea Rocket are present on foredune, but sparsely vegetated overall. The Heysen Trail passes through the dunes.
 Ease of Detection	A small beach to search, birds may be in pebbles on back of beach which makes it difficult to find them. As it's a remote site, searching for nests may be difficult as the birds are likely to flush off their nest early. Birds will easily fly between Sheepies beach (to the east) and Coolawang.
 Pair Identity	2013/14 no birds 2014/15 unbanded/unbanded 2015/16 no nesting





<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2009/10	-	-	-	-	-	-

* Birds recorded on territory for 3 years







Key user groups (*caution low sample size, n=38*):

	
78%	22%

Key threats (*caution low sample size, n=38*):

			
82%	61%	34%	24%

Threat mitigation actions:

	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches Fox control (bait, trap, shoot, den fumigation)</p>
	<p>Prevent crushing</p>	<p>Ensure permanent signage about presence of Hooded Plovers is maintained at the two nearest access points Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced Encourage walkers to keep to the track in the dunes during the breeding season months, as the trail was realigned from its original position on the beach Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
	<p>Minimise disturbance</p>	<p>Ensure permanent signage about presence of Hooded Plovers is maintained at the two nearest access points Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
	<p>Prevent crushing; minimise disturbance</p>	<p>Encourage landholder to be an ambassador for the site, assisting with protection of habitat Actions to ensure stock cannot access the beach or dune system, e.g. fencing installed</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate.</p>






Coolawang beach. Photos Emma Stephens






Coolawang beach. Photos Emma Stephens.





Hindmarsh River Mouth

Managed by the City of Victor Harbor






 Beach Morphology	North of Victor Harbor township. Abundant nesting habitat exists either side of the estuary, with sparse vegetation and a wider beach here
 Ease of Detection	Very open, easy to find the birds, need to check estuary. Sometimes birds will move further towards Olivers Reef or towards the township of Victor.
 Pair Identity	2013/14 no nesting 2014/15 AU Orange (banded Jan 2013 at Watsons Gap, female) /BX Orange (banded Jan 2013 at Watsons Gap, male) 2015/16 scrape unknown birds

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2009/10	5	16	41	7	0	-


Key user groups:







			
49%	38%	5%	5%

Key threats:

				
97%	79%	68%	57%	12%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
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	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage at access points Chick shelters Education and events, including schoolies. Look at opportunities to engage with school camp groups that use the beach Media Site guardians during peak beach use periods (including schoolies) in chick phase
	Prevent crushing; Minimise disturbance; Prevent predation	Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted Engage with local group who run the dog park
 	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
 *	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Carry out targeted fox control (e.g. den fumigation or cage trapping) when foxes are identified as a problem predator
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.

* While foxes weren't in the top 10% of threats detected at this site, they have been implicated in nest/chick failures here (2010/11, 2011/12, 2016/17).



Edge of estuary



Wide beach near estuary



Wide beach by estuary



Nesting area east of river mouth 21/11/10, Photo Richard Edwards






Beach west of estuary






Beach west of estuary





Inman River Outlet

Managed by the City of Victor Harbor






 Beach Morphology	South of Victor Harbor township, the beach has heavy seaweed cover and a low dune system, sparsely vegetated and variable in width. There is little room for the dune to retreat over time, as the beach is backed by a grassy nature strip and roadside, walking path and then a residential area. The beach itself either side of Kent Point is quite narrow.
 Ease of Detection	Often they are easy to find but sometimes seaweed on the beach makes sighting the birds difficult.
 Pair Identity	2013/14 KV Orange (banded Nov 2013 at Inman River outlet, unknown sex) /unbanded 2014/15 no nesting 2015/16 no nesting

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	 <i>Eggs</i>	 <i>chicks</i>	 <i>Total Fledglings</i>	<i>Years successful</i>
2009/10	5	13	31	11	3	2009/10 2010/11


Key user groups:







			
48%	32%	7%	7%

Key threats:

				
99%	66%	45%	29%	13%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
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	<p>Minimise disturbance</p>	<p>Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage at access points Chick shelters Education and events Media Site guardians during peak beach use periods (including schoolies) in chick phase Where needed, engage with kite surfers who surf near this area</p>
	<p>Prevent crushing; Minimise disturbance; Prevent predation</p>	<p>Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted</p>
 	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
 *	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) If foxes are identified as a problem predator, carry out targeted fox control (e.g. den fumigation or cage trapping)</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>

* Foxes have been detected at this site and thus warrant management attention.



Inman River Outlet beach. Photo Grainne Maguire.






Example of habitat. Photo Grainne Maguire.






Hooded Plover family Feb 2011, photo Richard Edwards




Lands End

Managed by the District Council of Yankalilla






 Beach Morphology	A remote, rocky beach with pebbles, shell grit, patches of sand, and large rocky outcrops.
 Ease of Detection	Remote site, difficult to find the birds, as there are so many rocks and embayments for them to hide. Lots of pebbles at the back of the beach and rocky outcrops also make it difficult to locate them. Big storms in spring 2016 eroded the sand off the beach and there has been no breeding observed since. The Heysen trail goes directly behind the beach.
 Pair Identity	2013/14 no birds 2014/15 unbanded/unbanded 2015/16 JW Orange (banded Nov 2015 at Lands end, unknown sex) /unbanded

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	 <i>Eggs</i>	 <i>chicks</i>	 <i>Total Fledglings</i>	<i>Years successful</i>
2010/11	2	3	9	7	5	2014/15 2015/16


Key user groups:









		
75%	20%	5%

Key threats:

				
45%	41%	41%	23%	12%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site, particularly as it is on the Heysen Trail Temporary fencing around nest/chick site where needed, but at this site it is unlikely
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	<p>Minimise disturbance</p>	<p>Ensure permanent signage is present along the nearest access track Temporary signage flanking nest/chick site Temporary fencing around nest/chick site where needed, but at this site it is unlikely due to difficult terrain Media Encourage Heysen trail walkers to stay on the track behind the beach during the breeding season months Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
  *	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches Fox control (bait, trap, shoot, den fumigation) Community education around responsible cat ownership Cat control when cats detected at this site</p>
	<p>Prevent crushing; Minimise disturbance; Prevent predation</p>	<p>Maintain current dog regulations (dogs prohibited at this site) Due to remoteness of site, encourage community to report any sightings of dogs to the Council's inspector for follow up Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted</p>
  	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate.</p>




* Cats have been detected at this site and thus warrant management attention.






Lands End. Photos Grainne Maguire.





Maslin Beach

Managed by The City of Onkaparinga





 Beach Morphology	The Northern end of the Hooded Plover site has a sparsely vegetated dune and is adjacent to a small estuary (highly favoured by the Hooded Plovers). The Southern end is edged by a dramatic, eroding cliff line.
 Ease of Detection	Challenging, because they can be up in the dune systems near the estuary, and can be quite hidden.
 Pair Identity	2012/13 MX Orange (banded May 2012 at Maslin Beach, female) /unbanded 2013/14 NA Orange (banded Jan 2013 at Carrickalinga North, unknown sex) /unbanded 2014/15 unbanded/unbanded no nesting 2015/16 no nesting

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	 <i>Eggs</i>	 <i>chicks</i>	 <i>Total Fledglings</i>	<i>Years successful</i>
2009/10	5	17	46	16	4	2009/10 2011/12








Key user groups:

			
56%	27%	9%	6%

Key threats:

			
100%	57%	34%	33%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site and if this occurs at the estuary, fencing off most of the estuary (large buffer zone) Temporary nest update signage at access point nearest the estuary car park Chick shelters Education and events, in particular the nude games. Media Site guardians during peak beach use periods in chick phase
	Prevent crushing; Minimise disturbance; Prevent predation	Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted
  *	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Carry out targeted fox control when foxes are identified as a problem predator Community education around responsible cat ownership Cat control when cats detected at this site
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.

* Cats have been detected at this site and thus warrant management attention. While foxes weren't in the top 10% of threats detected at this site, they have been implicated in multiple nest failures here, including detection by remote camera (2011/12, 2012/13, 2013/14).



View of the beach (Photo Emma Stephens)



Nest site August 2010 (Photo Emma Stephens)



Dune nesting site 19/10/10 (Photo Emma Stephens)









Nesting site signage 3/12/09 (Photos Emma Stephens)







Middleton Beach

Managed by Alexandrina Council







 Beach Morphology	Long continuous beach with a dune system backing it.
 Ease of Detection	Moderate difficulty finding birds. Extensive dune system may add to difficulty in detecting birds if they choose to nest here.
 Pair Identity	2013/14 no birds 2014/15 no birds 2015/16 SA Orange (banded Nov 2013 at Bashams Beach, male) /UE Orange (banded Feb 2014 at Waitpinga Beach west, female)

Surveyed Since (to 2015/16)	Years present and breeding	Total nests	Total Eggs	Total chicks	Total Fledglings	Years successful
2010/11	1	1				-


Key user groups (caution low sample size, n=50):






			
31%	29%	17%	17%

Key threats (caution low sample size, n=50):

					
96%	94%	68%	64%	30%	20%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events, particularly surf related events, lessons and Surf Life Saving Club activities.
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	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Chick shelters Education and events Media Potential to trial using site guardians during peak beach use periods in chick phase
	Prevent crushing; Minimise disturbance; Prevent predation	Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Carry out targeted fox control when foxes are identified as a problem predator. Council has suggested a 'dob in a den' media campaign to locate dens.
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.




* Foxes have been detected at this site and thus warrant management attention.






Middleton beach and access. Photos Grainne Maguire.






Moana Beach

Managed by The City of Onkaparinga








 Beach Morphology	A narrow beach with a cobble ridge extending back to a sandy foredune and dune. The beach is zoned into two sections, the northern section, with vehicle access, and the southern section, vehicle-free.
 Ease of Detection	Birds and nests can be hard to see on the pebble substrate.
 Pair Identity	2013/14 no birds 2014/15 no birds 2015/16 no birds

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2010/11	1	1	1	0	0	-


Key user groups:







				
45%	18%	12%	11%	9%

Key threats:

						
100%	75%	71%	45%	41%	20%	12%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
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	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Chick shelters Education and events, opportunities to engage through the Surf Life Saving Club Media Site guardians during peak beach use periods in chick phase
	Prevent crushing; Minimise disturbance; Prevent predation	Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted
	Prevent crushing; Minimise disturbance; Protect habitat from damage	Improved signage for vehicles Aim to review and implement solutions to mitigate ORV impacts to breeding success (including potential temporary exclusion periods when chicks are present) Temporary banners at access points for vehicle users Actions to ensure vehicles do not park in front of the nest/chick site including no parking signs
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
 *	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Carry out targeted fox control when foxes are identified as a problem predator
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Hairy Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.

* Foxes have been detected at this site and thus warrant management attention.



Moana beach Northern view within vehicle free zone. Photo Grainne Maguire.






Moana beach Southern view within vehicle free zone. Photo Grainne Maguire.






Example of vehicles parked at Moana beach, vehicle permitted section (Dec 2019), Photo Ash Read.






Morgans Beach

Managed by the District Council of Yankalilla






 Beach Morphology	A small beach north-east of Cape Jervis, where high tides reach to the base of the dune. The dune is steep with shifting sands and there is limited space available for nesting. Steep dune with foredune humps below access, and rocky shale on beach at northern end.
 Ease of Detection	One nest recorded, nests can be hard to find due to massive dune blowout.
 Pair Identity	2013/14 no nesting 2014/15 no birds 2015/16 no nesting

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2009/10	1	1	3	1	0	-


Key user groups (*caution low sample size, n=57*):







				
38%	20%	15%	13%	8%

Key threats (*caution low sample size, n=57*):

				
98%	96%	42%	33%	12%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site Education and events
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	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Chick shelters Education and events Media
	Prevent crushing; Minimise disturbance; Protect habitat from damage	Large banners so that vehicle users can read these with ease Compliance visits to ensure vehicles are not parked within fenced/signed area Aim to review and implement solutions to mitigate ORV impacts to breeding success (including potential temporary exclusion periods when chicks are present)
	Prevent crushing; Minimise disturbance; Prevent predation	Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
 *	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Carry out targeted fox control when foxes are identified as a problem predator
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate.




* Foxes have been detected at this site and thus warrant management attention.






View looking down on to Morgan's beach. Photo Grainne Maguire.







Myponga Beach

Managed by the District Council of Yankalilla







 Beach Morphology	The beach is backed by private land and housing. A large estuary leads onto the beach and pebbles at the western end of the beach.
 Ease of Detection	Birds can either be at the estuary, or up at the pebbles at the northern end, so the whole beach needs to be searched.
 Pair Identity	2012/13 EY Orange (banded May 2012 at Myponga beach, unknown sex) /unbanded 2013/14 EY Orange /unbanded 2014/15 EY Orange /unbanded 2015/16 EY Orange /US Orange (banded Aug 2015 at Myponga Beach, unknown sex)

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	 <i>Eggs</i>	 <i>chicks</i>	 <i>Total Fledglings</i>	<i>Years successful</i>
2009/10	7	12	32	11	5	2010/11 2011/12 2015/16








Key user groups:

					
31%	22%	15%	13%	9%	6%

Key threats:

					
90%	56%	33%	33%	14%	13%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage at access points Chick shelters Education and events, in particular weddings on the beach Media Site guardians during peak beach use periods in chick phase
	Prevent crushing; Minimise disturbance; Prevent predation	Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted
	Prevent crushing; Minimise disturbance	Ensure boat ramp access signage 'vehicles prohibited beyond this point' are maintained Enforcement patrols If compliance is low, consider bollards to prevent vehicles travelling beyond boat access
 *	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Carry out targeted fox control when foxes are identified as a problem predator Community education around responsible cat ownership Cat control when cats detected at this site
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.

* Cats and foxes have been detected at this site and thus warrant management attention.



Southern end of Myponga Beach (Photo Grainne Maguire)



Pebble banks at Southern end of beach (Photo Grainne Maguire)



Northern end of Myponga October 2010 (Photo Grainne Maguire)



Fenced nesting area by estuary September 2010 (Photo Emma Stephens).






Southern end of Myponga Beach (Photo Grainne Maguire)






Sand-drift fencing in front of houses on Myponga Beach (Photos Grainne Maguire)





Normanville North

Managed by the District Council of Yankalilla








 Beach Morphology	A wide beach (north of jetty) with a healthy dune system. Lots of suitable dune habitat, with Coastal Spinifex and bare sand. Territory roughly ends around the boardwalk at 'South Shores'.
 Ease of Detection	Often at the estuary, so needs a thorough search. Head north from the estuary to search for the Hooded Plovers.
 Pair Identity	2013/14 CK Orange (banded Jan 2013 at Carrickalinga estuary, unknown sex)/unbanded 2104/15 no nesting 2015/16 PD Orange (banded Feb 2014 at Waitpinga Beach east, unknown sex)/unbanded

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2009/10	3	5	14	0	0	-


Key user groups (*caution low sample size, n=59*):







			
46%	25%	14%	13%

Key threats (*caution low sample size, n=59*):

						
92%	59%	41%	39%	25%	15%	14%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
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	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage at access points Chick shelters Education and events Media Site guardians during peak beach use periods in chick phase
	Prevent crushing; Minimise disturbance; Prevent predation	Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted
	Prevent crushing; Minimise disturbance; Protect habitat from damage	Improved signage for vehicles Aim to review and implement solutions to mitigate ORV impacts to breeding success (including potential temporary exclusion periods when chicks are present) Temporary banners at access points for vehicle users Actions to ensure vehicles do not park in front of the nest/chick site
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches Fox control (bait, trap, shoot, den fumigation)
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.






Example of habitat along this stretch



Aerial image towards Normanville jetty DENR 2012





Normanville South

Managed by the District Council of Yankalilla








 Beach Morphology	An estuary with a wide beach to the south) and a healthy dune system. Lots of suitable dune habitat, with Coastal Spinifex and bare sand.
 Ease of Detection	Often at the estuary, so needs a thorough search. Can be at least 1km south from the estuary.
 Pair Identity	2013/14 no birds 2014/15 no birds 2015/16 unbanded/unbanded

Surveyed Since (to 2015/16)	Years present and breeding	Total nests	Total Eggs	Total chicks	Total Fledglings	Years successful
2010/11	4	5	15	6	3	2015/16



Key user groups:







					
30%	17%	16%	13%	12%	10%

Key threats:

						
95%	45%	45%	44%	27%	14%	10%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone)

		<p>Temporary nest update signage at access points</p> <p>Chick shelters</p> <p>Education and events</p> <p>Media</p> <p>Site guardians during peak beach use periods in chick phase</p>
	<p>Prevent crushing;</p> <p>Minimise disturbance;</p> <p>Prevent predation</p>	<p>Maintain current dog regulations as minimum protection</p> <p>Compliance data collected</p> <p>Review effectiveness of regulations every two years</p> <p>Dog regulations clearly displayed</p> <p>Enforcement patrols</p> <p>Site guardians during peak beach use periods in chick phase</p> <p>Education and events</p> <p>Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted</p>
	<p>Prevent crushing;</p> <p>Minimise disturbance;</p> <p>Protect habitat from damage</p>	<p>Improved signage for vehicles</p> <p>Aim to review and implement solutions to mitigate ORV impacts to breeding success (including potential temporary exclusion periods when chicks are present)</p> <p>Temporary banners at access points for vehicle users</p> <p>Actions to ensure vehicles do not park in front of the nest/chick site</p>
	<p>Prevent crushing;</p> <p>Minimise disturbance;</p> <p>Protect habitat from damage</p>	<p>Liaise with horse riders about use of this site</p> <p>Investigate possibility of horse permit system or alternative to ensure all horse riders are provided with conditions for use to mitigate potential impacts (i.e. avoid access at times of high tide)</p> <p>Actions to ensure horses do not turn around in front of the nest/chick site, or dismount in front of this area</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply)</p> <p>Investigate methods of reducing predation by native birds</p> <p>Reduce litter</p> <p>Discourage feeding wildlife</p>
 *	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply)</p> <p>Den searches</p> <p>Fox control (bait, trap, shoot, den fumigation)</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate.</p> <p>Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>

* While foxes weren't in the top 10% of threats detected at this site, they have been implicated in nest/chick failures here (2010/11).



Estuary Normanville South, July 2011



Café by Normanville SLSC



Carpark and facilities






View towards jetty






View overlooking estuary from carpark





Ochre Cove, Maslins

Managed by The City of Onkaparinga







 Beach Morphology	Small beach on the northern side of Maslin Beach, beyond a rocky headland. Wide exposed rocky platforms during low tide. Large cliffs in some sections and in others, there's a gentle sloping sandy dune.
 Ease of Detection	It is a relatively long walk to get to the site. Generally easy, but ensure to check the rocks for the hooded plovers.
 Pair Identity	2013/14 no birds 2014/15 NA Orange (banded Jan 2013 at Carrickalinga North, unknown sex) /TJ Orange (banded Oct 2014 at Ochre Cove Maslins, male) 2015/16 NA Orange /unbanded

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	 <i>Total Eggs</i>	 <i>Total chicks</i>	 <i>Total Fledglings</i>	<i>Years successful</i>
2014/15	2	5	15	15	2	2014/15 2015/16


Key user groups:






			
45%	31%	11%	9%

Key threats:

					
96%	81%	23%	19%	17%	11%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
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	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage could be placed on path coming from Maslin beach just before entering this cove Education and events Media
	Prevent crushing; Minimise disturbance; Prevent predation	Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Potential to trial using site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
 *	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches Fox control (bait, trap, shoot, den fumigation)
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate.

* Foxes have been detected at this site and thus warrant management attention.






Ochre Cove, May 2015. Photo Sue and Ash Read.






Path leaving Ochre Cove towards Maslin beach. Photo Grainne Maguire.





Olivers Reef

Managed by the City of Victor Harbor







 Beach Morphology	North of Victor Harbor township. Abundant nesting habitat exists, with sparse vegetation.
 Ease of Detection	Very open, easy to find the birds.
 Pair Identity	2013/14 no birds 2014/15 no nesting 2015/16 AU Orange (banded Jan 2013 at Watsons Gap, female) /BX Orange (banded Jan 2013 at Watsons Gap, male) and unbanded/unbanded

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2014/15	1	3	8	3	0	-


Key user groups:







			
42%	40%	7%	6%

Key threats:

					
100%	88%	80%	46%	20%	16%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
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	<p>Minimise disturbance</p>	<p>Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage at access points Chick shelters Education and events, including schoolies. Look at opportunities to engage with school camp groups that use the beach Media Potential to trial using site guardians during peak beach use (including schoolies) periods in chick phase</p>
	<p>Prevent crushing; Minimise disturbance; Prevent predation</p>	<p>Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Potential to trial using site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) – note foxes were implicated in nest failure at this site in 2015/16 Den searches Fox control (e.g. den fumigation or cage trapping)</p>
 	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>






Olivers Reef access. Photo Richard Edwards.






Olivers Reef. Photo Richard Edwards.




Parsons Beach

Within the Newland Head Conservation Park, Managed by Department for Environment and Water, National Parks and Wildlife.






 Beach Morphology	The site is protected within Newland Head Conservation Park. The far western end is heavily eroded, while the eastern end and beach near the estuary widen and have a dune system more suitable for nesting. The Heysen trail goes along the length of the beach.
 Ease of Detection	Careful check in the large dune system to confirm nests. This requires relying on footprints, or watching the birds from a great distance. Relatively easy to find the birds on the beach. However, birds may move between this beach and the nearby Sheepies.
 Pair Identity	2012/13 EV Orange (banded Jan 2013 at Parsons Beach, unknown sex) /CL Orange (banded Jan 2013 at Parsons Beach, female) 2013/14 EV Orange /unbanded 2014/15 no birds 2015/16 EV Orange /unbanded

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2009/10	3	6	16	0	0	-






Key user groups:

		
39%	35%	23%

Key threats:

				
86%	81%	59%	35%	33%

Threat mitigation actions:

	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches Fox control (bait, trap, shoot, den fumigation)</p>
	<p>Prevent crushing</p>	<p>Maintain permanent signage Temporary signage flanking nest/chick site or at the beach access Include information about the birds, impacts and how to do no harm on website and in other promotional material for Newland Head Conservation Park Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
	<p>Minimise disturbance</p>	<p>Maintain permanent signage Temporary signage flanking nest/chick site or at the beach access Include information about the birds, impacts and how to do no harm on website and in other promotional material for Newland Head Conservation Park Media Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>



View looking down on to Parsons beach. Photo Grainne Maguire.






Eroding dune face at Parsons beach. Photo Grainne Maguire.






Parsons Beach. Photo Grainne Maguire.


Port Stanvac



Managed by Exxon Mobil, pending decommissioning.

 Beach Morphology	Very small beach broken in two by a rock groyne that was the start of a substantial wharf. The northern beach is wide and sandy with low sparsely vegetated dunes at the rear. The birds have nested on this beach, but also on the groyne and attempts have been seen on the edge of the old boat ramp on the northern side of the beach. Chicks regularly use the shelter of the rocks of the groyne for shade and protection. Note: these birds are not using typical nesting habitat.
 Ease of Detection	Private access only. These birds are monitored by BirdLife Australia staff and trained Exxon Mobil staff.
 Pair Identity	2013/14 AR (banded Jan 2013 at Carrickalinga North, male) /unbanded 2014/15 AR Orange /unbanded 2015/16 no nesting

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2012/13	2	4	8	2	0	-

There is not enough threat data to collate a summary for this site. Recommendations are based on local knowledge of site.

	Prevent crushing; Minimise disturbance	<p>Restricted access site at the time of this report so that access by the public is not an issue.</p> <p>Direct and regular liaison with Mobil Exxon staff is essential to ensure staff are aware that the birds may nest near the work zone and that nest/chick site may need to be protected from crushing/disturbance via fencing.</p> <p>Ensure monitoring continues at Port Stanvac when future wharf demolition is complete (monitoring was required as part of the development approval)</p> <p>The Port Stanvac Mobil site will be decommissioned and will be opened up to the public in future. Future use of land and sea areas is being considered by the SA Government. Marine Park amendments are proposed to create a new nearshore sanctuary zone. It is essential that it is deemed a Conservation Area to protect the birds using this very small beach site with zero capacity for buffer from disturbance.</p> <p>Part of this future management should ensure that dogs are prohibited from this site. Also, the conservation values of the site need to be well communicated to the public</p>
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	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) – note foxes were implicated in nest failure at this site in 2014/15 Carry out targeted fox control when foxes are identified as a problem predator
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter



Satellite photo of Port Stanvac beach from Google Earth.



Main northern bay. Photos Emma Stephens.



Edge of groin where birds have previously nested. Photo Emma Stephens.



Southern bay. Photo Emma Stephens.






View from old southern boat ramp looking North. Photo Emma Stephens.






Main northern bay beach. Photo Emma Stephens.

Port Willunga South

Managed by The City of Onkaparinga

 Beach Morphology	A wide beach with estuary and dune system with Coastal Spinifex.
 Ease of Detection	Scan the dunes with binoculars, as the birds can often nest on the foredune and near the estuary. If not found at this site, the birds may be found north of the estuary.
 Pair Identity	One unbanded pair nested once in 2009/10 season, just south of the estuary

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2009/10	1	1	3	1	0	-

There is not enough threat data to collate a summary for this site.



Fenced nesting site in November 2009. Photo Emma Stephens.



Port Willunga South, July 2013. Photo Sue and Ash Read.






Arrows denote northern and southern nesting areas at Port Willunga. Photo Grainne Maguire.






Formalised access path with Hooded Plover signage. Photo Grainne Maguire.



Port Willunga

Managed by The City of Onkaparinga





 Beach Morphology	Cliff backed with a low foredune dominated by Sea Wheat Grass.
 Ease of Detection	Large beach to search, if the hooded plovers are not here, search Port Willunga south. High tide can cut off access to the north (bay past the headland), however access is also available via the northern end of the beach.
 Pair Identity	2012/13 HV Orange (banded Jan 2013 at Snapper Point, male) 2013/14 HV Orange / unbanded 2014/15 no nesting 2015/16 HV Orange /DP Orange (banded Aug 2014 at Port Willunga North, female)

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2009/10	6	11	29	17	5	2010/11 2011/12 2015/16


Key user groups:






	
51%	45%

Key threats:

			
100%	77%	40%	28%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
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	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage at access points Chick shelters Education and events Liaison with the local Friends of Port Willunga group Media Trial effectiveness of site guardians during peak beach use periods in chick phase
	Prevent crushing; Minimise disturbance; Prevent predation	Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events, including Dogs Breakfast events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
 *	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches Fox control (bait, trap, shoot, den fumigation)
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.




* Foxes have been detected at this site and warrant management attention.






Port Willunga Jan 2013. Photos Grainne Maguire.




Sheepies Beach

Managed by the City of Victor Harbor






 Beach Morphology	Small beach surrounded by private property with an estuary and pebble bank on the upper beach. Rocky habitat at west of site. The Heysen Trail passes behind the beach.
 Ease of Detection	Moderate. Can be hard to find the birds in the rocks. Access to the beach is along the Heysen Trail from Parsons beach.
 Pair Identity	2013/14 unbanded/unbanded 2014/15 unbanded/unbanded 2015/16 unbanded/unbanded

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2010/11	3	5	14	3	0	-


Key user groups:






		
56%	33%	11%

Key threats:

				
49%	48%	38%	30%	13%

Threat mitigation actions:

	Prevent crushing	Ensure permanent signage is maintained Temporary signage at key points of entry Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail
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	Minimise disturbance	Ensure permanent signage is maintained Temporary signage at key points of entry Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail
	Prevent crushing; minimise disturbance	Encourage landholder to be an ambassador for the site, assisting with protection of habitat Actions to ensure stock cannot access the beach or dune system, e.g. fencing installed
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) – note foxes were implicated in nest failure at this site in 2014/15 Den searches Fox control (bait, trap, shoot, den fumigation)
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate.






Sheepies beach. Photo David Thorn.






Hoodies at Sheepies beach. Photo David Thorn.






Shelley Beach (Lady Bay)

Managed by the District Council of Yankalilla











 Beach Morphology	A small isolated beach with two shacks at the northern end and one halfway along the beach. Backed by cliffs, the beach substrate varies and consists of pebbles, seaweed, shale and sand. A small creek runs immediately south of the access gate and first shack.
 Ease of Detection	Moderate, sometimes difficult to spot the birds if feeding in amongst rocks at southern end. Search the pebble banks for Hooded Plovers. Sometimes are not on territory, could potentially be on the rocky platforms to the north of the site.
 Pair Identity	2013/14 LD Orange (Banded Sept 2013 at Shelley Beach, unknown sex)/ SB Orange (Banded Sept 2013 at Shelley Beach, unknown sex) 2014/15 SB Orange /unbanded 2015/16 SB Orange /unbanded

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2010/11	6	10	20	6	1	2014/15







Key user groups:

				
31%	24%	15%	13%	12%

Key threats:

						
96%	44%	41%	38%	26%	26%	21%
						
15%	13%	11%				

Threat mitigation actions:

	<p>Prevent crushing</p>	<p>Maintain permanent Hooded Plover signage, and vehicle prohibited signage Temporary signage flanking nest/chick site, and on access point/gate Temporary fencing around nest/chick site where needed</p>
	<p>Minimise disturbance</p>	<p>Temporary signage flanking nest/chick site, and on access point/gate Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage at access points Media</p>
	<p>Prevent crushing; Minimise disturbance; Prevent predation</p>	<p>Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches Fox control (bait, trap, shoot, den fumigation)</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>



Aerial view DENR 2012






Shelley beach shacks. Photos Grainne Maguire.






Shelley beach including gated access. Photos Grainne Maguire.






Silver Sands

Managed by The City of Onkaparinga







 Beach Morphology	Wide beach, backed with flat dune system, and steep cliff/dune behind generally heavily vegetated. There is a shingle/pebble ridge at the back of the beach.
 Ease of Detection	Long beach to survey, vehicles on the beach can make it difficult to locate nesting Hooded Plovers.
 Pair Identity	2013/14 no birds 2014/15 no nesting 2015/16 SR Orange (banded Oct 2014 at Ochre Cove, Maslins, male) /unbanded

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2010/11	2	2	4	2	0	-



Key user groups:






				
37%	23%	14%	11%	9%

Key threats:

					
100%	82%	76%	62%	58%	57%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage at access points




		<p>Chick shelters</p> <p>Education and events</p> <p>Media</p> <p>Site guardians during peak beach use periods in chick phase</p>
	<p>Prevent crushing;</p> <p>Minimise disturbance;</p> <p>Protect habitat from damage</p>	<p>Improved signage for vehicles</p> <p>Aim to review and implement solutions to mitigate ORV impacts to breeding success (including potential temporary exclusion periods when chicks are present, e.g. the option of a series of opportunities throughout the day to enable chicks to feed at water's edge)</p> <p>Temporary banners at access points for vehicle users</p> <p>Actions to ensure vehicles do not park in front of the nest/chick site including no parking signage</p>
	<p>Prevent crushing;</p> <p>Minimise disturbance;</p> <p>Prevent predation</p>	<p>Maintain current dog regulations as minimum protection</p> <p>Compliance data collected</p> <p>Review effectiveness of regulations every two years</p> <p>Dog regulations clearly displayed</p> <p>Enforcement patrols</p> <p>Site guardians during peak beach use periods in chick phase</p> <p>Education and events</p> <p>Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply)</p> <p>Investigate methods of reducing predation by native birds</p> <p>Reduce litter</p> <p>Discourage feeding wildlife</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply)</p> <p>Den searches</p> <p>Fox control (bait, trap, shoot, den fumigation)</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate.</p> <p>Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>






Silver Sands Beach, winter 2008. (Photos Bill Doyle, AMLR NRM Board)




Snapper Point

Managed by The City of Onkaparinga








 Beach Morphology	Narrow beach, with extensive rock platforms and rocky substrate, and at times dense cover of seagrass wrack.
 Ease of Detection	Easy, but check the rocks for the birds
 Pair Identity	2013/14 no birds 2014/15 no nesting 2015/16 unbanded/unbanded

Surveyed Since (to 2015/16)	Years present and breeding	Total nests	Total Eggs 	Total chicks 	Total Fledglings 	Years successful
2013/14	1	2	5	4	1	2015/16



Key user groups:





		
47%	45%	5%

Key threats:

						
96%	77%	58%	51%	43%	18%	11%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Education and events Media

	<p>Prevent crushing; Minimise disturbance; Prevent predation</p>	<p>Seek to improve current dog regulations at this site (also significant site for migratory shorebirds). Snapper Point (Butterworth Road to Ocean Street) is a dogs off leash exercise area at all times. North of Butterworth is dogs on leash during specific hours during daylight savings. Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
 *	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches Fox control (bait, trap, shoot, den fumigation)</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>

* Foxes have been detected at this site and warrant management attention.



Access to beach Jan 2013. Photo Grainne Maguire.






View of Snapper Point beach 2013. Photo Grainne Maguire.






Exposed rocks at Snapper Point at low tide. Photo Sue and Ash Read.





Southport

Managed by The City of Onkaparinga







 Beach Morphology	Popular southern metropolitan beach where the Onkaparinga River flows into the sea. Extensive sand dune system with remnant vegetation behind the beach and a large spit.
 Ease of Detection	Easy. Flat sand, short walk from access point. May involve a search in the estuary as well as the beach as the birds may be up in the estuary
 Pair Identity	2013/14 no nesting 2014/15 no birds 2015/16 no nesting

Surveyed Since (to 2015/16)	Years present and breeding	Total nests	Total Eggs	Total chicks	Total Fledglings	Years successful
2010/11	2	2				-



Key user groups:






			
46%	22%	14%	9%

Key threats:

					
99%	73%	62%	54%	51%	15%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site where needed Education and events, and liaise with Surf Life Saving Club and Aquatics Club that provide lessons for school children
	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage at access points Chick shelters

		Education and events Media
	Prevent crushing; Minimise disturbance Protect habitat from damage	Liaise with Surf Life Saving Club and Aquatics Club about vehicle use of beach Establish best practice for the clubs accessing the beach during breeding months Ensure clubs are provided with information on any active breeding attempts
	Prevent crushing; Minimise disturbance; Prevent predation	Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
 *	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches Fox control (bait, trap, shoot, den fumigation)
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.

* Foxes have been detected at this site and warrant management attention.






Access stairs to Onkaparinga estuary, looking North toward Southport beach and dune system. Photo Bill Doyle, AMLR NRM Board.






Southport dune system with sparse Marram Grass and native species such as Coast Daisy. Photo Bill Doyle, AMLR NRM Board.

Tunkalilla Far West

Managed by the District Council of Yankalilla

 Beach Morphology	Remote site with a long, steep walk along a dirt track from the top of the hill car park to access the beach. The entire “Tunkalilla Beach” is 5.5km long and a wide high-energy beach, but can get narrow with very high tides, and the beach often has deep soft sand. The Far West site is comprised of highly vegetated (Coastal Spinifex) dune systems, with cliffing in some sections. The Heysen Trail goes along the length of the beach, and a small goat track exists in some places along the top of the cliffs.
 Ease of Detection	Birds can be difficult to detect nesting, as they are at a remote site, and will flush off the nest when you’re up to 200m away from them.
 Pair Identity	2013/14 LA Orange /unbanded 2014/15 LA Orange /UB Orange 2015/16 LA Orange /UB Orange

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2010/11	3	4	12	11	9	2010/11 2012/13 2013/14




There is not enough threat data to collate a summary for this site. However, threat assessment and threat mitigation actions can be based on similarities to Tunkalilla Heysen, Tunkalilla mid west Estuary and Tunkalilla West Estuary.






Photo Grainne Maguire.

Tunkalilla First House East

Managed by the District Council of Yankalilla




 Beach Morphology	Remote site with a long, steep walk along a dirt track from the top of the hill car park to access the beach. The entire “Tunkalilla Beach” is 5.5km long and a wide high-energy beach, but can get narrow with very high tides, and the beach often has deep soft sand. The First House East site is at the first house (with high vegetation) seen when walking east. Upper beach and dunes comprised of highly vegetated (Coastal Spinifex) dune systems. Cliffing in some sections. The Heysen Trail goes along the length of the beach, and a small goat track exists in some places along the top of the cliffs.
 Ease of Detection	Birds can be difficult to detect nesting, as they are at a remote site, and will flush off the nest when you’re up to 200m away from them.
 Pair Identity	2013/14 no nesting 2014/15 MT/ Orange ME Orange also Tunkalilla mid west estuary 2015/16 no nesting




<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2010/11	3	3	7	2	1	2015/16

There is not enough threat data to collate a summary for this site. However, threat assessment and threat mitigation actions can be based on similarities to Tunkalilla Heysen, Tunkalilla mid west Estuary and Tunkalilla West Estuary.


Tunkalilla Heysen

Managed by the District Council of Yankalilla








 Beach Morphology	Remote site with a long, steep walk along a dirt track from the top of the hill car park to access the beach. The entire “Tunkalilla Beach” is 5.5km long and a wide high-energy beach, but can get narrow with very high tides, and the beach often has deep soft sand. The Heysen site is at the eastern most end of the beach, where the access point from the Heysen Trail comes to the beach. Upper beach and dunes comprised of Coastal Spinifex dunes, and other highly vegetated dune systems. Cliffling in some sections. Has pebble banks on the upper beach and dune. The Heysen Trail goes along the length of the beach.
 Ease of Detection	Birds can be difficult to detect nesting, as they are at a remote site, and will flush off the nest when you’re up to 200m away from them.
 Pair Identity	2013/14 ST Orange (banded Nov 2013 at Tunkalilla Creek/3rd house east, unknown sex) /unbanded also using Tunkalilla Third house east 2014/15 DK Orange (banded Jan 2013 at Tunkalilla Creek/3rd house east, male) /unbanded also using Tunkalilla Third house east 2015/16 DK Orange /unbanded also using Tunkalilla Third house east

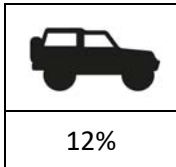
<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2011/12	5	9	24	9	6	2013/14 2014/15 2015/16

Key user groups (*caution low sample size, n=52*):






69%





Key threats (*caution low sample size, n=52*):

						
100%	62%	40%	37%	37%	23%	17%



Threat mitigation actions:

	<p>Prevent crushing</p>	<p>Install and maintain permanent signage at either end of the beach and where people access the beach from the track and in the car park Temporary signage flanking nest/chick site Encourage nearby residents to be ambassadors for this beach, providing them with information about the birds and strategies for avoiding impacts, so that they can enact and pass on to visitors Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
	<p>Minimise disturbance</p>	<p>Install and maintain permanent signage at either end of the beach and where people access the beach from the track and in the car park Temporary signage flanking nest/chick site Temporary nest update signage at access points Chick shelters Encourage nearby residents to be ambassadors for this beach, providing them with information about the birds and strategies for avoiding impacts, so that they can enact and pass on to visitors Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
 *	<p>Prevent crushing; Minimise disturbance; Protect habitat from damage</p>	<p>Install and maintain permanent signage at either end of the beach and where people access the beach from the track and in the car park Dogs are not permitted on Tunkalilla beach between 1st December and of February and the Easter weekend. Outside of these times dogs must be exercised on leash at all times. Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols if non-compliance is detected as an issue at this remote site Educate residents about responsible pet ownership and ensure they (plus their visitors) follow dog regulations and keep cats inside</p>
	<p>Prevent crushing; Minimise disturbance; Protect habitat from damage</p>	<p>Vehicles are not permitted on this beach Educate landholders about regulations and why vehicles are not permitted on this beach Encourage community to report vehicles observed on the beach direct to council for follow up</p>

	Prevent crushing; minimise disturbance	Encourage landholders to be ambassadors for the site, assisting with protection of habitat Actions to ensure stock cannot access the beach or dune system, e.g. fencing installed
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) – note foxes were implicated in nest failure at this site in 2013/14 Den searches Fox control (bait, trap, shoot, den fumigation)
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.

* Dogs have been infrequently sighted on this beach but given visits have been infrequent, they are potentially an issue of concern.






Eastern end of Tunkalilla, Jan 2013. Photos Grainne Maguire






Tunkalilla East. Photos David Thorn




Tunkalilla mid west Estuary

Managed by the District Council of Yankalilla







 Beach Morphology	Remote site with a long, steep walk along a dirt track from the top of the hill car park to access the beach. The entire “Tunkalilla Beach” is 5.5km long and a wide high-energy beach, but can get narrow with very high tides, and the beach often has deep soft sand. The Mid West Estuary site is at the second estuary (First Creek) from the west. Upper beach and dunes comprised of Coastal Spinifex dunes, and other highly vegetated dune systems. Cliffling in some sections. The Heysen Trail goes along the length of the beach.
 Ease of Detection	Birds can be difficult to detect nesting, as they are at a remote site, and will flush off the nest when you’re up to 200m away from them.
 Pair Identity	2013/14 MT Orange (banded Nov 2013 at Tunkalilla mid west estuary, unknown sex)/unbanded 2014/15 MT Orange /ME Orange (banded Oct 2014 at Tunkalilla mid west estuary, female) – also Tunkalilla first house east 2015/16 MT Orange /ME Orange

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2010/11	4	6	16	5	4	2012/13 2013/14 2014/15






Key user groups (*caution low sample size, n=43*):



		
32%	23%	12%

Key threats (*caution low sample size, n=43*):

					
100%	70%	47%	35%	21%	16%

Threat mitigation actions:

	<p>Prevent crushing</p>	<p>Install and maintain permanent signage at either end of the beach and where people access the beach from the track and in the car park</p> <p>Temporary signage flanking nest/chick site</p> <p>Encourage nearby residents to be ambassadors for this beach, providing them with information about the birds and strategies for avoiding impacts, so that they can enact and pass on to visitors</p> <p>Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
	<p>Minimise disturbance</p>	<p>Install and maintain permanent signage at either end of the beach and where people access the beach from the track and in the car park</p> <p>Temporary signage flanking nest/chick site</p> <p>Temporary nest update signage at access points</p> <p>Chick shelters</p> <p>Encourage nearby residents to be ambassadors for this beach, providing them with information about the birds and strategies for avoiding impacts, so that they can enact and pass on to visitors</p> <p>Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
 *	<p>Prevent crushing; Minimise disturbance; Protect habitat from damage</p>	<p>Install and maintain permanent signage at either end of the beach and where people access the beach from the track and in the car park</p> <p>Dogs are not permitted on Tunkalilla beach between 1st December and of February and the Easter weekend. Outside of these times dogs must be exercised on leash at all times.</p> <p>Maintain current dog regulations as minimum protection</p> <p>Compliance data collected</p> <p>Review effectiveness of regulations every two years</p> <p>Dog regulations clearly displayed</p> <p>Enforcement patrols if non-compliance is detected as an issue at this remote site</p> <p>Educate residents about responsible pet ownership and ensure they (plus their visitors) follow dog regulations and keep cats inside</p>
	<p>Prevent crushing; minimise disturbance</p>	<p>Encourage landholders to be ambassadors for the site, assisting with protection of habitat</p> <p>Actions to ensure stock cannot access the beach or dune system, e.g. fencing installed</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply)</p> <p>Investigate methods of reducing predation by native birds</p> <p>Reduce litter</p> <p>Discourage feeding wildlife</p>

	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches Fox control (bait, trap, shoot, den fumigation)
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.

* Dogs have been infrequently sighted on this beach but given visits have been infrequent, they are potentially an issue of concern.






Mid-west Estuary Territory. Scrape with hoodie prints plus roo prints. Photo Emma Stephens.






View from mid-west towards the west of Tunkalilla. Photo Rob Brinsley.

Tunkalilla Third House East

Managed by the District Council of Yankalilla

 <p>Beach Morphology</p>	<p>Remote site with a long steep walk along a dirt track from the top of the hill to access the beach. The entire “Tunkalilla Beach” is 5.5km long and a wide high-energy beach, but can get narrow with very high tides, and the beach often has deep soft sand. The Third House East site is at the third house seen when walking east. It is near the third estuary on the beach. Upper beach and dunes comprised of Coastal Spinifex dunes, and other highly vegetated dune systems. Cliffling in some sections. The Heysen Trail goes along the length of the beach.</p>
 <p>Ease of Detection</p>	<p>Birds can be difficult to detect nesting, as they are at a remote site, and will flush off the nest when you’re up to 200m away from them.</p>
 <p>Pair Identity</p>	<p>2013/14 ST Orange (banded Nov 2013 at Tunkalilla Creek/3rd house east, unknown sex) /unbanded also using Tunkalilla Heysen 2014/15 DK Orange (banded Jan 2013 at Tunkalilla Creek/3rd house east, male) /unbanded also using Tunkalilla Heysen 2015/16 DK Orange /unbanded also using Tunkalilla Heysen</p>

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2010/11	2	3	7	2	2	2012/13

In January 2011, a remote motion-triggered camera was installed on a nest at this site that captured images of the nest failing due to extreme heat. It was abandoned and then a fox took the eggs a few days later.




There is not enough threat data to collate a summary for this site. However, threat assessment and threat mitigation actions can be based on similarities to Tunkalilla Heysen, Tunkalilla mid west Estuary and Tunkalilla West Estuary.






Nest in foreground on Tunkalilla beach. Photo Grainne Maguire.






Tunkalilla West Estuary

Managed by the District Council of Yankalilla










 Beach Morphology	Remote site with a long steep walk along a dirt track from the top of the hill to access the beach. The entire “Tunkalilla Beach” is 5.5km long and a wide high-energy beach, but can get narrow with very high tides, and the beach can often have deep soft sand. The site includes the West Estuary. Upper beach and dunes comprised of Coastal Spinifex dunes, and other highly vegetated dune systems. Cliffling in some sections. The Heysen Trail goes along the length of the beach.
 Ease of Detection	Birds can be difficult to detect nesting, as they are at a remote site and will flush off the nest when you’re up to 200m away from them.
 Pair Identity	2013/14 KW Orange (banded Nov 2013 at Tunkalilla west estuary, unknown sex) /unbanded 2014/15 KW Orange /unbanded, WE Orange (banded Oct 2014 at Tunkalilla west estuary, female) /unbanded, and LA Orange (banded Nov 2013 at Tunkalilla west, female) /UB Orange (banded April 2014 at Tunkalilla west, male) 2015/16 LA Orange /UB Orange

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2012/13	3	7	18	11	1	2013/14





Key user groups (*caution low sample size, n=43*):




				
53%	19%	5%	5%	5%

Key threats (caution low sample size, n=43):

						
93%	79%	44%	42%	37%	28%	14%
						
12%	12%					

Threat mitigation actions:

	Prevent crushing	<p>Install and maintain permanent signage at either end of the beach and where people access the beach from the track and in the car park</p> <p>Temporary signage flanking nest/chick site</p> <p>Encourage nearby residents to be ambassadors for this beach, providing them with information about the birds and strategies for avoiding impacts, so that they can enact and pass on to visitors</p> <p>Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
	Minimise disturbance	<p>Install and maintain permanent signage at either end of the beach and where people access the beach from the track and in the car park</p> <p>Temporary signage flanking nest/chick site</p> <p>Temporary nest update signage at access points</p> <p>Chick shelters</p> <p>Encourage nearby residents to be ambassadors for this beach, providing them with information about the birds and strategies for avoiding impacts, so that they can enact and pass on to visitors</p> <p>Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
	Prevent crushing; Minimise disturbance; Protect habitat from damage	<p>Vehicles are not permitted on this beach</p> <p>Educate landholders about regulations and why vehicles are not permitted on this beach</p> <p>Encourage community to report vehicles observed on the beach direct to council for follow up</p>
 *	Prevent crushing; Minimise disturbance; Protect habitat from damage	<p>Install and maintain permanent signage at either end of the beach and where people access the beach from the track and in the car park</p> <p>Dogs are not permitted on Tunkalilla beach between 1st December and of February and the Easter weekend. Outside of these times dogs must be exercised on leash at all times.</p> <p>Maintain current dog regulations as minimum protection</p> <p>Compliance data collected</p>

		<p>Review effectiveness of regulations every two years</p> <p>Dog regulations clearly displayed</p> <p>Enforcement patrols if non-compliance is detected as an issue at this remote site</p> <p>Educate residents about responsible pet ownership and ensure they (plus their visitors) follow dog regulations and keep cats inside</p>
	Minimise predation	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply)</p> <p>Investigate methods of reducing predation by native birds</p> <p>Reduce litter</p> <p>Discourage feeding wildlife</p>
	Minimise predation	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply)</p> <p>Den searches</p> <p>Fox control (bait, trap, shoot, den fumigation)</p>
	Habitat preservation	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate.</p> <p>Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>




* Dogs have been infrequently sighted on this beach but given visits have been infrequent, they are potentially an issue of concern.






Jan 2013. Photo Grainne Maguire





Waitpinga Beach East

Managed by the Department for Environment and Water, National Parks and Wildlife.







 Beach Morphology	East of the Dennis Road carpark, this site has a natural dune system vegetated with Coastal Spinifex and protected within Newland Head Conservation Park. Limited nesting habitat is available, with a dynamic sand shelf and strong onshore wave action. The beach at the far eastern end is very narrow. There are two access points (from two car parks) and the beach becomes cut off when the river flows out to the sea. The Heysen Trail extends along the beach from the far western end of Waitpinga and exits off the beach at the Dennis Road access point.
 Ease of Detection	Birds are easy to find, it's just a large site to search.
 Pair Identity	2013/14 KJ Orange (banded Jan 2013 at Waitpinga Beach east, female) /unbanded 2014/15 unbanded/unbanded 2015/16 KP Orange (banded Feb 2014 at Callawonga Beach, unknown sex) /unbanded

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2010/11	5	8	16	5	4	2013/14






Key user groups:

			
62%	17%	15%	6%

Key threats:

					
86%	68%	63%	50%	43%	18%

Threat mitigation actions:




	<p>Prevent crushing</p>	<p>Maintain permanent signage Temporary signage flanking nest/chick site or at the beach access Include information about the birds, impacts and how to do no harm on website and in other promotional material for Newland Head Conservation Park Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
	<p>Minimise disturbance</p>	<p>Maintain permanent signage Temporary signage flanking nest/chick site or at the beach access Include information about the birds, impacts and how to do no harm on website and in other promotional material for Newland Head Conservation Park Media Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches Fox control (bait, trap, shoot, den fumigation)</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>



Waitpinga East. Photo David Thorn.

Waitpinga Beach West

Managed by the Department for Environment and Water, National Parks and Wildlife.






 Beach Morphology	West of the Dennis Road carpark and the estuary, this site has a natural dune system vegetated with Coastal Spinifex and protected within the Newland Head Conservation Park. Limited nesting habitat is available, with a dynamic sand shelf and strong onshore wave action. The beach at the estuary and to the west is wide. There are two access points and the beach becomes cut off when the river flows out to the sea. The Heysen Trail goes along the length of this beach/site.
 Ease of Detection	Birds are easy to find, it's just a large site to search.
 Pair Identity	2013/14 no birds 2014/15 EV Orange (banded Jan 2013 at Parsons Beach, unknown sex) /KP Orange (banded Feb 2014 at Callawonga Beach, unknown sex) 2015/16 no nesting.

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i>	<i>Total chicks</i>	<i>Total Fledglings</i>	<i>Years successful</i>
2013/14	1	2	7	0	0	-






Key user groups (*caution low sample size, n=59*):

		
49%	32%	15%

Key threats (*caution low sample size, n=59*):

				
92%	73%	41%	37%	29%

Threat mitigation actions:




	<p>Prevent crushing</p>	<p>Maintain permanent signage Temporary signage flanking nest/chick site or at the beach access Include information about the birds, impacts and how to do no harm on website and in other promotional material for Newland Head Conservation Park Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
	<p>Minimise disturbance</p>	<p>Maintain permanent signage Temporary signage flanking nest/chick site or at the beach access Include information about the birds, impacts and how to do no harm on website and in other promotional material for Newland Head Conservation Park Media Ensure information about the birds, impacts and ways to do no harm are part of all Heysen Trail materials/resources produced, including liaison with Friends of the Heysen Trail</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches Fox control (bait, trap, shoot, den fumigation)</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>






Waitpinga West. Photos Grainne Maguire.





Watsons Gap

Managed by Alexandrina Council







 Beach Morphology	An estuary and a wide, flat beach which slopes steeply to the water's edge and has a suitable foredune and gentle dune humps. There is a railway line behind the beach and an eco-village with a walkway behind the estuary.
 Ease of Detection	Very easy to find birds.
 Pair Identity	2012/13 AU Orange (banded Jan 2013 at Watsons Gap, female) /BX Orange (banded Jan 2013 at Watsons Gap, male) 2013/14 AU Orange /unbanded 2014/15 no nesting 2015/16 AU Orange /BX Orange

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	<i>Total Eggs</i> 	<i>Total chicks</i> 	<i>Total Fledglings</i> 	<i>Years successful</i>
2010/11	6	12	31	19	4	2009/10 2011/12 2012/13


Key user groups:






			
47%	23%	16%	7%

Key threats:

					
94%	71%	27%	25%	23%	12%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events, including liaison with Chiton Rocks Surf Life Saving Club
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	<p>Minimise disturbance</p>	<p>Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage at access points Chick shelters Education and events, including liaison with Chiton Rocks Surf Life Saving Club Media Site guardians during peak beach use periods in chick phase</p>
	<p>Prevent crushing; Minimise disturbance; Prevent predation</p>	<p>Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) – note foxes have been implicated in nest failures in 2009/10 Den searches Fox control (den fumigation, cage trapping)</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>






Access to beach and Hooded Plover signage. Photos Grainne Maguire






Watsons Gap territory. Photos Grainne Maguire.







Yankalilla River Mouth

Managed by the District Council of Yankalilla










 Beach Morphology	Flat, beach often backed by houses. Volcanic rocks on the seaward side with an estuary.
 Ease of Detection	Hard to find the birds as black volcanic rock at the water's edge which makes it difficult to see them.
 Pair Identity	2013/14 no nesting 2014/15 unbanded/unbanded 2015/16 unbanded/unbanded

Surveyed Since (to 2015/16)	Years present and breeding	Total nests	Total Eggs	Total chicks	Total Fledglings	Years successful
2013/14	1	3				-








Key user groups (caution low sample size, n=37):

					
39%	27%	14%	7%	7%	7%

Key threats (caution low sample size, n=37):

						
97%	89%	84%	68%	68%	43%	19%
						
11%	11%					

Threat mitigation actions:




	<p>Prevent crushing</p>	<p>Temporary signage flanking nest/chick site Temporary fencing around nest/chick site where needed Education and events</p>
	<p>Minimise disturbance</p>	<p>Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Chick shelters Education and events Media</p>
	<p>Prevent crushing; Minimise disturbance; Prevent predation</p>	<p>Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted</p>
	<p>Prevent crushing; Minimise disturbance; Protect habitat from damage</p>	<p>Improved signage for vehicles Ensure vehicles launching boats do not drive beyond boat launching locations. If birds nest near boat launching location, ensure vehicles do not park in front of or too close to fenced refuge area. Extend fence area to provide further buffer and install no parking signs.</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife</p>
	<p>Minimise predation</p>	<p>Investigate identity and impacts of predators via remote camera installation (strict protocols apply) – note foxes have been implicated in nest failures in 2014/15 Den searches Fox control (bait, trap, shoot, den fumigation)</p>
	<p>Habitat preservation</p>	<p>Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.</p>






Yankalilla River mouth. Photo David Thorn.




Yilki

Managed by the City of Victor Harbor







 Beach Morphology	Flat beach, backed by low vegetated dunes, a footpath, main road and then houses. Can be very narrow in sections with little vegetation on the upper beach.
 Ease of Detection	Moderate difficulty, as there is a lot of seaweed on the beach in which the birds can hide.
 Pair Identity	2013/14 no data 2014/15 KV Orange (banded Nov 2013 at Inman River outlet, unknown sex) /unbanded 2015/16 KV Orange /VH Orange (banded Feb 2016 at Yilki, unknown sex)

<i>Surveyed Since (to 2015/16)</i>	<i>Years present and breeding</i>	<i>Total nests</i>	 <i>Total Eggs</i>	 <i>Total chicks</i>	 <i>Total Fledglings</i>	<i>Years successful</i>
2014/14	2	6	16	14	2	2015/16



Key user groups:





		
54%	34%	5%

Key threats:

					
88%	73%	56%	49%	39%	24%

Threat mitigation actions:

	Prevent crushing	Temporary signage flanking nest/chick site Temporary fencing around nest where needed Temporary fence ends to symbolise chick site Education and events
	Minimise disturbance	Temporary signage flanking nest/chick site Temporary fencing around nest/chick site (large buffer zone) Temporary nest update signage at access points

		Chick shelters Education and events Media Site guardians during peak beach use periods in chick phase
	Prevent crushing; Minimise disturbance; Prevent predation	Maintain current dog regulations as minimum protection Compliance data collected Review effectiveness of regulations every two years Dog regulations clearly displayed Enforcement patrols Site guardians during peak beach use periods in chick phase Education and events Media to encourage choosing appropriate beaches for dog walking and the need to leash dogs where permitted
	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Investigate methods of reducing predation by native birds Reduce litter Discourage feeding wildlife
 *	Minimise predation	Investigate identity and impacts of predators via remote camera installation (strict protocols apply) Den searches, including on the Bluff where foxes are frequently seen Fox control (bait, trap, shoot, den fumigation)
	Habitat preservation	Control weeds such as Sea-wheat Grass, Marram Grass, Pyp Grass and Sea Spurge. Revegetate with native Coastal Spinifex where appropriate. Where dune stabilisation is required, opt for creating stabilisation using Coastal Spinifex. Avoid brush and jute matting. If urgently required, use sparsely and away from optimal nesting habitat. If sand drift fencing is urgently needed for dune stabilisation, ensure sections do not have the mesh fabric installed to enable nesting and chick access behind fencing.

* While foxes weren't in the top 10% of threats detected at this site, they have been implicated in nest/chick failures here (2014/15).



Fenced nesting area at Yilki. Photo David Thorn.



View of Yilki territory. Photo David Thorn.

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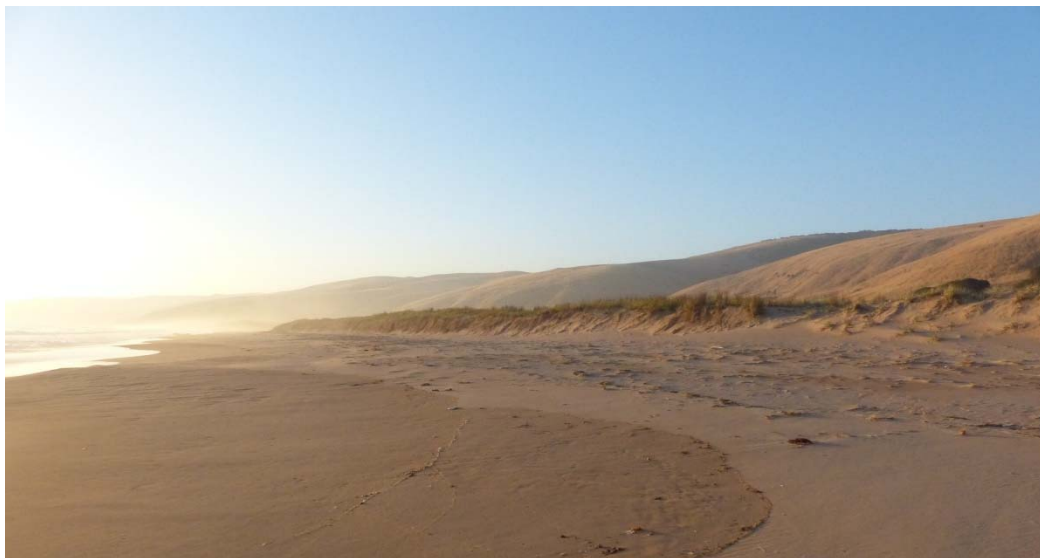
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Tunkalilla beach, Elizabeth Steele-Collins