# Draft Belfast Coastal Reserve Management Plan

**Submission by BirdLife Australia, Suite 2-05, 60 Leicester St, Carlton VIC 3053**

BirdLife Australia is Australia's largest, not-for-profit bird conservation organisation, committed to the conservation of over 200 threatened native bird species through multi-species, landscape-scale adaptive management programs.

Formed through the merger of Birds Australia and Bird Observation and Conservation Australia (BOCA) in 2012, BirdLife Australia offers the combined skills and experience of the two longest-running bird conservation organisations in Australia. BirdLife Australia consists of 31 local branches nationwide which engage with the local communities, special interest groups, reserves and observatories to make positive contributions to the wellbeing of Australian birdlife. From this reach we now have over 12,200 members across the nation, as well as a further 120,000 supporters who provide BirdLife Australia with the capacity to undertake its conservation and research.

BirdLife Australia has an extensive program of research and conservation including:

- Migratory Shorebirds Program guided by a national, multi-stakeholder Conservation Action Plan 2017 (formerly known as the Shorebirds 2020 program). This operationalises the Australian Government's Wildlife Conservation Plan for Migratory Shorebirds 2015 and includes addressing priority threats to sites within Australia (primarily from recreation and development), developing management plans for sites of national and international significance, resolving key knowledge gaps, and working with partners to reduce threats in the East Asian-Australasian Flyway. A major component of this project is monitoring changes in migratory shorebird populations within key sites in Australia (Hansen *et al.* 2018).

- National Beach-nesting Birds (BNB) Program, developed to address the severe impacts of recreational activities on beaches and coastal habitat changes on the breeding of Australia's resident beach-nesting shorebirds. BirdLife has led recovery efforts for the Hooded Plover (*Thinornis rubricollis*) across Victoria and South Australia including establishment of best practice monitoring (Hansen *et al.* 2018) and nest/chick site protection protocols (Maguire 2008), extensive training and recruitment of volunteers, research in to new recovery techniques, formation of 12 Friends of Hooded Plover groups, targeted education and community behaviour change guided by research, support and coordination toward strategic, national goals, leading recovery team meetings, and review of threat and bird data to adapt management and investment over time. We also have a multi-state leg flagging program where we are seeking to overcome knowledge gaps and collecting genetic samples to better understand gene flow and identify sensible units of management. For four decades, we have coordinated a population census across the entire eastern mainland population (Vic, SA and NSW), enabling us to track trajectory changes and trends in threats. We host a national conference bringing together all participants in recovery across the country and hold an annual recovery meeting to review progress toward recovery goals and prioritise actions.

This multi-faceted project uses an evidence-based, adaptive management approach to engage community volunteers and coastal land managers in monitoring and on-ground threat mitigation to directly improve the trajectory of the population. Census data have revealed an increase in the population that correlates directly with implementation of BirdLife Australia's recovery project. Leg flagging has enabled us to identify the reoccupation of beaches where the species had been absent for a decade or more, and subsequent successful breeding. Analysis of breeding data has revealed a tenfold increase in the probability of successfully fledging young at sites where there is active investment in mitigating human-based threats. These sites contribute between 50-80% of the fledglings produced in Victoria each season, which has accounted for the detected increase in the

population trajectory. The BNB Program has been active within the Belfast Coastal Reserve (BCR) from its inception in 2006 and established a local community group 'Friends of the Hooded Plover Far West Victoria' in 2010.

- BirdLife has been involved in the Orange-bellied Parrot (OBP) Recovery Program since its inception in 1983 and led the coordination of winter counts across the mainland range since 1984. The OBP mainland monitoring database, maintained by BirdLife Australia, includes band resightings, habitat and species data collected by over 1,300 registered observers and has formed the crucial baseline for our research mapping large-scale optimal habitat models, small scale habitat requirements and the efficacy of management interventions. BirdLife has worked with a large cross-section of community including government, private sector, local land holders and citizen scientists in training and engagement to improve our capacity to detect OBPs and optimise habitat condition. More recently funding allocations from the Threatened Species Commissioner enabled BirdLife to review national survey techniques for OBP and trial new methods for remote detection. The Commissioner's office has also tasked BirdLife with completing an exhaustive review of the Recovery Program to date, which will aid in prioritising urgent recovery actions and funding.

- Belfast Coastal Reserve is of global significance for the conservation of biodiversity as part of the Port Fairy to Warrnambool Key Biodiversity Area (KBA). The status of KBA is assigned to an area if it continuously meets the rigorous scientific standard set by the IUCN for KBAs https://portals.iucn.org/library/node/46259. KBAs will be part of the UN Convention on Biological Diversity in its post 2020 Framework where they will identify areas most worthy of protection and management for biodiversity values. As a signatory to the Convention the Commonwealth is obliged to support its implementation. The Hooded Plover population of Belfast Coastal Reserve and the Port Fairy to Warrnambool KBA is of global significance. Due to the threats through recreational activities and horse training in this location the entire KBA is currently one of only 19 KBAs in Australia listed as 'In Danger'. This listing puts it on par with Christmas Island, South East Tasmania, Murray Sunset, Hattah and Annuello KBAs where extensive destruction through mining, logging or wildfires have made this 'In Danger' status inevitable.

## BirdLife Australia's work within Belfast Coastal Reserve

The Belfast Coastal Reserve contains critical habitat for several threatened bird species: the Critically Endangered Orange-bellied Parrot, Endangered Australasian Bittern, Vulnerable Hooded Plover, and significant populations of EPBC-listed migratory shorebirds including Sanderling (internationally significant site), Sharp-tailed Sandpiper (internationally significant site), Double-banded Plover (nationally significant site) and Ruddy Turnstone (nationally significant site). An additional ten nationally threatened bird species use the Reserve, and an additional 32 bird species listed on the Victorian Advisory List of Threatened Fauna, use the Reserve.

Since 2006, our staff and volunteers have been monitoring the threats present within the Reserve and have used the Hooded Plover as an indicator for the health of the Reserve for other resident and migratory shorebirds. Threats are intensifying in frequency and impact over time, and breeding success rates are regularly falling short of targets required to maintain the population trajectory over time (44% of pairs monitored over 5 breeding seasons did not produce young, Maguire *et al.* 2014). The Reserve holds the largest density of breeding Hooded Plovers in their entire eastern range (~12% of the Victorian population; 2.5% of the entire Eastern subspecies; BirdLife Australia 2014-2018 data), and while elsewhere in the species range, efforts have been made to strengthen regulations and mitigate threats, in the Belfast Coastal Reserve, high impact threats of racehorse training, trail bikes, off leash dogs, unregulated recreational horse riding and major coastal weeds, have been left unaddressed.

BirdLife Australia has been bringing together key land managers from across the different agencies within local (Warrnambool City Council, Moyne Shire) and state government (Parks Victoria, DELWP), and active community volunteers since 2006, through regular biannual workshops and annual recovery meetings. We hosted our 2014 National Beach-nesting Birds Conference in Warrnambool and Port Fairy and over 120 people attended from across Australia. We have advertised widely and held community talks and workshops in Warrnambool, Koroit and Port Fairy, school incursions, guided beach walks, dogs breakfast events, stalls at the Port Fairy Folk Festival, Moyneyana Festival and Warrnambool Summer Night Markets. The students of Port Fairy Consolidated Primary School and Gilson College have made chick shelters for use in the area, and have helped make awareness raising posters for display in the Port Fairy township. We have also done incursions with Koroit, Warrnambool East and St Patricks primary schools, involving these schools in our Postcard Partners program where we linked them with other schools around Australia to share knowledge about their local coast and its significance. The broader community have been very interested in learning more about the birds, and our most successful events have been in Port Fairy and Warrnambool. Events held in Killarney, such as dogs' breakfasts and guided beach walks, unfortunately have been poorly attended despite widely advertising among the local community.

Since 2008, after reviewing the first three years of data for the project, BirdLife Australia has been actively involved in advocating for the significance of the Belfast Coastal Reserve to be recognised and protected either through increased tenure and/or a strong regulatory framework that a Management Plan can provide. During this time, we have written to the Minister of Environment on several occasions flagging the increasing issues with horses in the Reserve, as well as logged this in the Actions for Biodiversity Conservation database. During the last decade, the intensity of horse and dog use has escalated, and Parks Victoria have had no enforcement capacity/authority to try to mitigate these impacts on threatened species in the Reserve due to the lack of regulations in place. Education approaches via community volunteers, signage and seasonal ranger patrols (in the last five breeding seasons, funded via Victorian Government funding streams and Parks Victoria) have been limited in the success that can be achieved due to the lack of enforcement capacity. Dogs off leash running through signed and fenced breeding zones of the Hooded Plover are a daily occurrence within the Belfast Coastal Reserve, and horses ridden above the high tide mark and accompanied by off leash dogs are also a common occurrence. Appendix 1 provides a snapshot of examples of this behaviour.

Our high-level of experience in leading community education and recovery actions for the Hooded Plover around Australia for over a decade has indicated that 'bottom-up' recovery actions for Hooded Plovers need to be met by 'top-down' support for long-term sustainability of on-ground mitigation strategies (protection of critical habitat and policy to mitigate threats) and in order to address the proportion of beach users who are unresponsive to an educational approach.

**We believe it is critical to implement appropriate zoning and restrictions of recreational activities to achieve a balance within the Belfast Coastal Reserve, and to invest in mitigation of predator and weed impacts, monitoring and research, and community education. These are fundamental to the future preservation and resilience of the significant avifauna within this Reserve.**

## Background research on the Hooded Plover relevant to the Draft Management Plan

The Hooded Plover (*Thinornis rubricollis*) is the most threatened beach-nesting bird in south eastern Australia because it has the most restricted habitat range, being an ocean beach habitat specialist (Ehmke *et al.* 2016) and this habitat type is under severe pressure from a range of threats.

**Threats and life cycle**

The breeding season extends from August to March, but in western Victoria typically extends into late April (Weston 2000; Baird and Dann 2003; BirdLife Australia data). Hooded Plovers generally lay 1-3 eggs in a simple nest scrape on the beach above the high tide mark, foredune or dune, preferring open areas with sparse to no vegetation for nest placement to have a broad view of potential threats around them in order to minimise predator ambush. They appear to prefer to place nests by dead objects such as driftwood, seaweed or beach-cast debris in order to minimise depredation risk (Cribbin 2012). Incubation is for 28 days and they use passive nest defence and heavy camouflage of the eggs to reduce the chances of predation. 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. If the adult remains away for too long or if disturbances are too frequent, the eggs can be exposed to harsh temperatures that lead to the death of the embryo inside (Welty 1982; Schulz and Bamford 1987; Bergstrom 1991; Schulz 1992) or can be exposed to other approaching predators (Flemming *et al.* 1988; Hanisch 1998). People using beaches for recreation pose a high disturbance threat to incubating birds, and some threats have been identified as having higher disturbance impacts, for example dogs off leash and static recreational activities (Weston and Elgar 2005a, 2007; Weston *et al.* 2011).

After hatching it takes 35 days until the chicks can fly. During this period, they are active on the beach needing to find their own food, being warned into hiding by calls from their parents. The chicks will run to cover and crouch until the perceived threat is gone and the parents call them out from hiding. The chicks require brooding in their first two weeks as they are unable to thermoregulate. They feed mostly at the water's edge and along the wrack line amongst beach cast seaweed. They commonly run from danger toward the dune and they crouch by or under shelter such as rocks, vegetation or beach debris.

Ground-nesting shorebirds are particularly vulnerable to having their cryptic chicks inadvertently crushed by humans. Furthermore, disturbance to brood-rearing parents can lead to the temporary abandonment of young, and as a consequence, an increase in depredation rates and thermal stress of chicks (e.g. Burger 1981, Flemming *et al.* 1988, Bergstrom 1991, Visser and Ricklefs 1993a,b, Weston and Elgar 2005). Chicks may also suffer from energetic stress, with high levels of disturbance, particularly from humans and dogs, often decreasing foraging time and increasing energy-expensive evasion/escape responses (e.g. Flemming *et al.* 1988, Beintema and Visser 1989, Burger 1991, Loegering and Fraser 1995, Lord *et al.* 1997, Weston and Elgar 2005). Low chick survival is a major contributor to the impoverished conservation status of many shorebird populations worldwide (e.g. Piping Plover *Charadrius melodus* US Fish and Wildlife Service 1996; Hooded Plover, Weston and Elgar 2005; New Zealand Dotterel, C. obscurus, Dowding and Davis 2007; Western Snowy Plover, *C. alexandrinus*, US Fish and Wildlife Service 2007).

Ameliorating threats to beach-nesting birds, while simultaneously maintaining human recreational access to beaches, is a challenge faced by conservation managers. While methods for improving hatching success, such as fencing, have been largely effective (Jimenez *et al.* 2001, Stoyle 2001, 2002, Ikuta and Blumstein 2003, Wills *et al.* 2003, Murphy *et al.* 2003, Lafferty *et al.* 2006; Maguire *et al.* 2014), the precocial chicks of beach-nesting birds are more difficult to protect because although they are flightless, they are free-roaming and forage in areas most commonly used by

recreationists, specifically, close to the water's edge and wrack line (Mueller 1982, Schulz and Bamford 1987, Murphy *et al.* 2003, Weston 2005). Current approaches to chick management commonly involve the use of signage and regulations to reduce human disturbance. However, these have proved less successful than for egg protection, because management efforts tend to occur over larger sections of beaches, and so are less intensive. Thus, disturbance remains prevalent for chicks.

Appendix 2 provides a full list of threats to the species and ranks these in impact, including specifying which stage of the life cycle they impact (from a comprehensive threat review in Maguire 2008, Maguire *et al.* 2014).

**Habitat requirements and ecology**

Sandy beaches are characterised by a lack of primary productivity, and the infauna which form a major food source for shorebirds depend on energetic contributions ('subsidies') from marine systems such as stranded macrophytes (Kirkman & Kendrick, 1997; Schlacher *et al.*, 2008). Within the Reserve, the beach wrack is therefore a critical component of the food web. Investigation in to the habitat requirements of the Hooded Plover has revealed that the species is highly selective of beaches with high invertebrate abundance and assemblages dominated by isopods (Cuttriss *et al.* 2015) and wrack deposits have been linked with higher invertebrate abundance/food availability for the species (Schlachler *et al.* 2017). The entire beach zone from the exposed reefs to the base of the dune forms the foraging zone for this species, with the area available for foraging changing with the tide cycle (i.e. reefs and lower beach are only accessible at times of low tide).

Hooded Plovers are highly selective of beach habitats that support their survival and reproductive needs, with marine and terrestrial parameters both playing a role in habitat suitability (Ehmke *et al.* 2016; Cuttriss *et al.* 2015). In particular, the amount of unvegetated dune and foredune, and the amount of intertidal and sub-tidal reef are positively associated with the presence of breeding territories (Ehmke *et al.* 2016). This essentially means that not any beach will do, but instead there are particular beaches along the coast which offer critical habitat for this species. Furthermore, Hooded Plovers occupy distinct territories when breeding (August-April), are highly defensive of these territories and show strong site fidelity (Weston *et al.* 2009). Breeding territories are on average 1km of beach (36.7 ± 5.7 ha), however these territories vary in size, with some parts of the coast having higher food availability and thus affording higher densities of territories (e.g. BCR, Maguire *et al.* 2014). Breeding territories overlap from year to year in all cases and the birds spend little time off their territories during the breeding season, lending strength to the contention that the territories are the core spatial unit of most ecological relevance for breeding Hooded Plovers (Weston *et al.* 2009). The high fidelity and constancy of territories confirm that ongoing management investment in these sites is warranted (Weston *et al.* 2009). Wintering, non-breeding sites are also selected non-randomly and used consistently over time (Weston *et al.* 2009). These sites do not necessarily overlap with breeding areas, and can include wetlands and near shore lakes (Weston *et al.* 2009). These are also critical habitat locations fundamental to the life cycle of the birds.

Leg flagging of birds within south west Victoria has revealed dispersive movements to the west, as far as the Port MacDonnell area in South Australia, and as far east as Torquay. These movements have been rare, and most dispersal events have occurred more locally within the coast between Discovery Bay and Warrnambool. We suspect local breeding success is therefore critical to sustaining the south west Victoria population. We have been able to discover that young that have fledged from the Reserve have established breeding sites in Port Fairy (e.g. RB a fledgling from Towilla Way Killarney in Feb 2014 is now a breeder at Port Fairy Griffiths Island confirmed in Jan 2018) and

Tyrendarra (JC a fledgling from Towilla Way Killarney in Feb 2014 is now a breeder at the Fitzroy River mouth, Tyrendarra confirmed in Jan 2016).

'Moving the birds' to low threat areas is not a recovery option for this species (high selectivity of habitat features, territorial and high site fidelity) as the birds would move back to their previous territories or new birds will move in to the sites due to their suitability. Furthermore, there are very few suitable beaches that are classified as low threat/remote in Victoria. Captive breeding is also not a feasible option as it does not tackle the threats facing the species, so that return to the wild would be purposeless, with the species then becoming reliant on captive rearing for continued persistence.

The beaches, dunes and estuarine system of the Belfast Coastal Reserve are Critical Habitat for the Hooded Plover (the *habitat* is used to meet *essential* life cycle requirements) as defined by the Environment Protection and Biodiversity Conservation (EPBC) Act 1999. The most effective (ecological and economic) recovery approach is to manage the species in situ, to mitigate the highest impact threats to return a balance to the birds' breeding sites so that they can successfully breed, and to ensure long-term resilience through appropriate habitat management and protections/policy. It has been demonstrated that conservation in situ can be highly effective for minimal economic investment and has already resulted in tenfold increases in breeding success where implemented (Maguire *et al.* 2014).

**Recovery and indicators of population health**

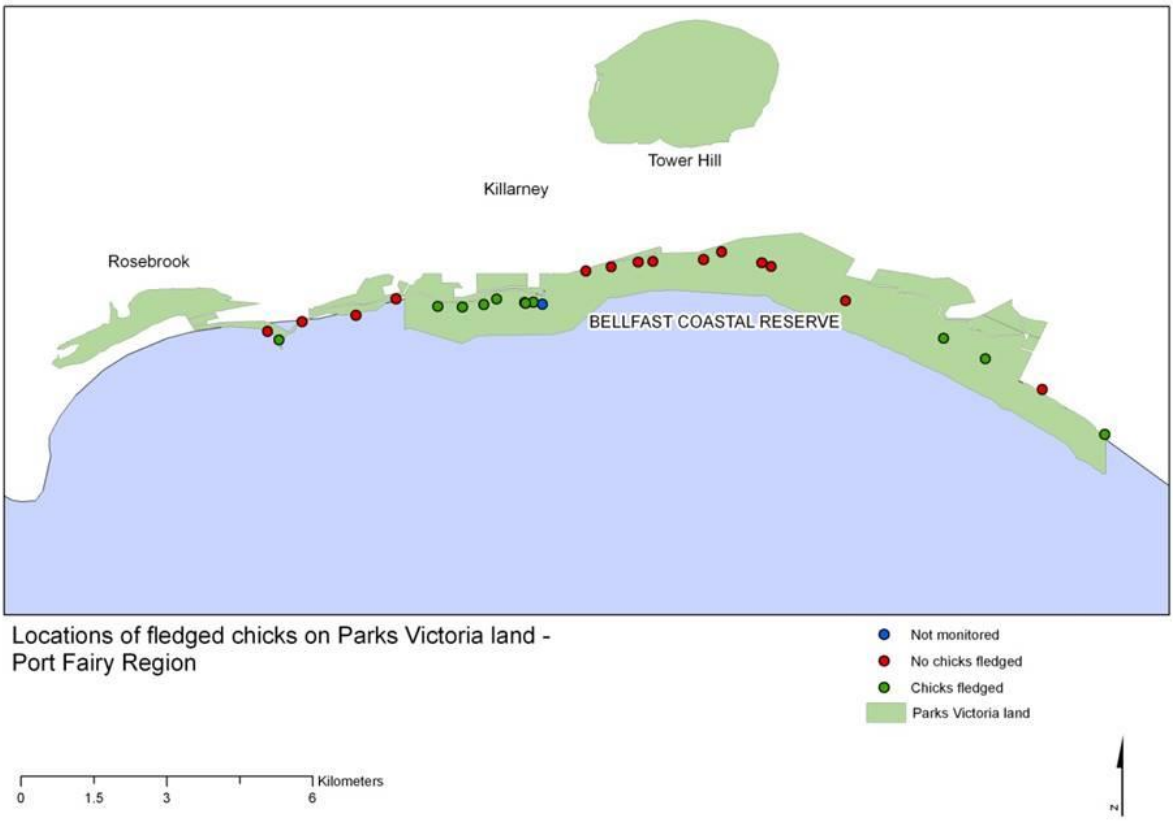
There are approximately 3000 birds in the Eastern subspecies of the Hooded Plover (Garnett *et al.* 2011). Biennial counts of Hooded Plovers have been undertaken since 1980, however became highly coordinated from 2006 onwards, enabling a population census of the entire eastern mainland range (Victoria, South Australia, NSW).

The population in Victoria has increased since the plummeting decline that was detected from the 1980s to early 2000s. This is a direct result of intensive effort in protection of breeding sites and working with land managers and policy makers to change regulations and improve coastal zoning, as well as education of beach users and increased patrols that has occurred since 2006 (Garnett *et al.* 2011; Szabo *et al.* 2012). The species was predicted to have an Endangered status in the absence of threat mitigation efforts (Szabo *et al.* 2012). While the trajectory of the population has altered from a decline to beginning to increase again, its numbers have not returned to pre-decline levels.

The BCR population has experienced a slight increase in the number of breeding adults over time (however note that there has been a loss of several breeding pairs in 2016-18). Adult numbers are not the sole indicator that we use to assess health of this species. On the Mornington Peninsula (MP) the population also increased from the late 1990s onwards. However, our analysis of thousands of breeding observation visits collected between 2006-2011 revealed that the MP and BCR populations are essentially acting as sinks (Maguire *et al.* 2014). The habitat has all the right physical features that attract the species in high numbers, so that as we improve breeding success rates within Victoria, we add more birds to the coast and the areas with the most suitable habitat increase in population numbers. If threats to their breeding success however, aren't reduced in these areas, then the birds attempt to reproduce again and again, for a lifetime even, with no success. This is termed an 'evolutionary or ecological trap' (Schaepfer *et al.* 2002). Their presence in the population therefore does not contribute to sustaining the population and these sites are classified as 'sinks'. On the MP for example, the population kept increasing and monthly counts were used to conclude

that the species must be doing brilliantly in this area. Once we started our monitoring of breeding success in 2006, we revealed that the fledgling rates were lowest of anywhere in the state and we directly correlated 'sink' territories (50% of sites) with the number of off leash dogs at these sites; it was the most compelling relationship of any threat type, including predators and beach users in general. Similarly, in BCR, 44% of sites were identified as sinks (Maguire *et al.* 2014, see Figure 1 below). This triggers alarm as the area has one of the highest density breeding populations and thus has potential to contribute greatly to the viability of not only the Victorian population but also to the entire eastern subspecies.

Figure 1: the distribution of successful (fledging chicks in at least one season) and unsuccessful sites (no fledglings over five seasons), across the Belfast Coastal Reserve. Note the clustering of red and green locations, suggesting that threatening processes are spatially clustered along this coastline.




Due to the lower human population base, and low numbers of beach users using the Reserve, BCR is predicted to have higher breeding success rates than our other key monitoring regions which are heavily impacted by high rates of beach use. However, it is not doing better, and even though numbers of breeding birds are slowly increasing, we are not seeing an increase in the number of fledglings being produced over time. In the 2016-17 season, there were only 13 fledglings and in the 2017-18 breeding season, we have had an all time low of only 6 fledglings to date in the BCR (note there are a few pairs still currently breeding in the Reserve, however flocking has started signalling most pairs have finished breeding for the season). Note this season is one of the worst on record, with no nests surviving from Basin East to Levy's beach, and no success from the permitted race horse stretch from Mills reef west to East beach Port Fairy.

The dominance of off leash dogs in the Reserve (due to lack of regulations and disregard of signed nesting zones; see comparative Table 1 for some key parks where we have had the most monitoring) and the presence of horses at around 66% of breeding sites (this would have changed since the 2014

report, and be greater now), are two major identified threats. Alleviation of these threats through restrictions and enforced regulations is required to improve breeding outcomes.

Table 1. Mean (± standard error) number of people and dogs on and off leash observed at Hooded Plover sites monitored within four parks across five seasons. Only parks with more than three Hooded Plover pairs monitored were included.

| PARK (DATA PERIOD 2006-2011) | PEOPLE | DOGS ON LEASH | DOGS OFF LEASH | DOGS OFF/DOGS ON |
|---|---|---|---|---|
| Belfast Coastal Reserve (21 pairs, n=667) | 3.15 ± 0.45 | 0.16 ± 0.02 | 0.67 ± 0.05 | 4.19 |
| Mornington Peninsula National Park (26 pairs, n=1422) | 6.70 ± 0.48 | 0.10 ± 0.02 | 0.31 ± 0.03 | 3.10 |
| Kilcunda – Harmers Haven Coastal Reserve (10 pairs, n=330) | 2.18 ± 0.27 | 0.13 ± 0.02 | 0.46 ± 0.06 | 3.54 |
| Cape Liptrap Coastal Park (3 pairs, n=172) | 8.19 ± 3.10 | 0.14 ± 0.04 | 0.27 ± 0.06 | 1.93 |

Within the Mornington Peninsula National Park, dogs have been banned for two breeding seasons (from November 2016), and this has proven highly successful. Fledging success rates were steeply declining in the park (average of 6 fledglings produced from 2006/07-2015/16). However, since the ban has been in place, fledging production has doubled (average of 12.5 fledglings 2016/17-2017/18)) and if compared to the three prior seasons (2013/14-2015/16), has tripled. Furthermore, pairs occupying sites on the Mornington Peninsula that were identified as having the highest frequency of off leash dog observations and as having no success in over a decade of monitoring have now successfully produced fledglings (Maguire *et al.* 2014; BirdLife Australia database 2016-2018).

The draft BCR Management Plan proposes banning dog access from 43% of the Reserve's coastline to protect a significant number of breeding birds (and other species of resident and migratory shorebirds, waterbirds and Orange-bellied Parrots, see Figure 2). The remaining coastline outside of the proposed CONSERVATION ZONE also represents significant habitat for shorebirds (also see Figure 2), but in the spirit of co-existence, it is proposed that dogs will have off leash access to Killarney main beach and on-leash access to shorebird habitats at the eastern and western ends of the Reserve. It is highly recommended that these be closely monitored for compliance and breeding success data collected as an indicator of impact to review the effectiveness of this strategy.

## Major comments with regard to the Draft Management Plan

- This Reserve has **local, statewide, national and international significance to several species and groups of birds**.

- BirdLife Australia show high support for actions taken to mitigate threats and to improve the protection of birds and their habitat within the Reserve.

- BirdLife Australia show high support for 43% of the onshore area to be protected in a CONSERVATION ZONE. This encompasses the area used by:
  - the Orange-bellied Parrot (Rutledges Cutting has been identified as one of five priority sites in Victoria for the species, Adams and Purnell 2016);

- the bulk of Hooded Plover breeding sites (28 of 44 breeding sites in total within the Reserve);
- the largest known winter flocking site for Hooded Plovers with flocks varying across the winter months from 20-61 birds (adults and juveniles), see Appendix 3;
- at least 24 red-capped plover breeding sites;
- 2 pied oystercatcher breeding sites, and;
- major roost and foraging sites for migratory shorebirds including internationally significant sites for Sanderling and Sharp-tailed Sandpiper, nationally significant sites for Ruddy Turnstone and Double-banded Plovers (New Zealand migrant, visits in our autumn/winter months).

The plan states (page 10), "the conservation zone covers the areas where the highest cultural and environmental values are found. The intention of this zone is to ensure a very strong management emphasis on protection of the environment and identified values. Recreation and nature-based tourism are permitted when managed in a way that is sensitive to the identified values." We support this statement. Figure 2 reveals the high density of threatened bird sites within this zone.

- High support for the proposed CONSERVATION ZONE to be free of high impact threats including hunting, off-road vehicles, dogs, horses, camping, and dune boarding.

- High support for:
  - Cultural Heritage protection;
  - Joint management;
  - Education and interpretation;
  - Monitoring and research;
  - Rationalisation and closure of inappropriate beach access;
  - Dog control;
  - A permit system for recreational horse riding (in areas where this is sustainable);
  - Pest animal and weed control.

- BirdLife Australia does not support commercial race horse training within the Reserve, including permitting this activity within the CONSERVATION ZONE. Under the draft management plan, the length of beaches available to racehorse training would be increased by 250% (from 2 km to 5 km) and the number of horses by 400% (from 65 to 256 each day). That represents 25% of the Reserve's beaches, with nothing in the plan to stop future expansion or to review compliance and impacts of the commercial horse training on the Reserve's natural and visitor values. The draft plan is permitting racehorses in to 750 metres of fragile dunes at Levy's Beach where in the past they have caused severe dune erosion. The plan permits racehorse training within the Conservation Zone at Rutledge's Cutting. This is incongruent with the recommendations of the conservation zone.

  Throughout the draft plan, damage caused by racehorses is referred to but the plan fails to address how increasing the area available to them will mitigate these impacts. Worse still, the plan's risk assessment (page 29) reveals that the current proposed management plan won't reduce the threat of this commercial activity. Prior to management plan implementation, the risk to coastal dune vegetation, cultural heritage, resident and migratory shorebirds from racehorse training is rated EXTREME. After the management plan is put in place, the rating remains EXTREME. In other words, no effort has been made to address the threat commercial race horse training poses to multiple values of the Reserve, including visitor safety, and instead, it has been expanded within the Reserve.

Since access was granted to commercial race horse trainers in 2016, there have been numerous breaches of licensing conditions, high risks to public (and volunteer) safety and the channeling of limited resources and state government staff in to surveillance and infrastructure. This has stretched local Parks Victoria and DELWP beyond capacity and taken already limited support and resources away from environment and visitor services. Expanding the number of training beaches will make conditions even harder to monitor and be costly to the local economy and values of the Reserve.

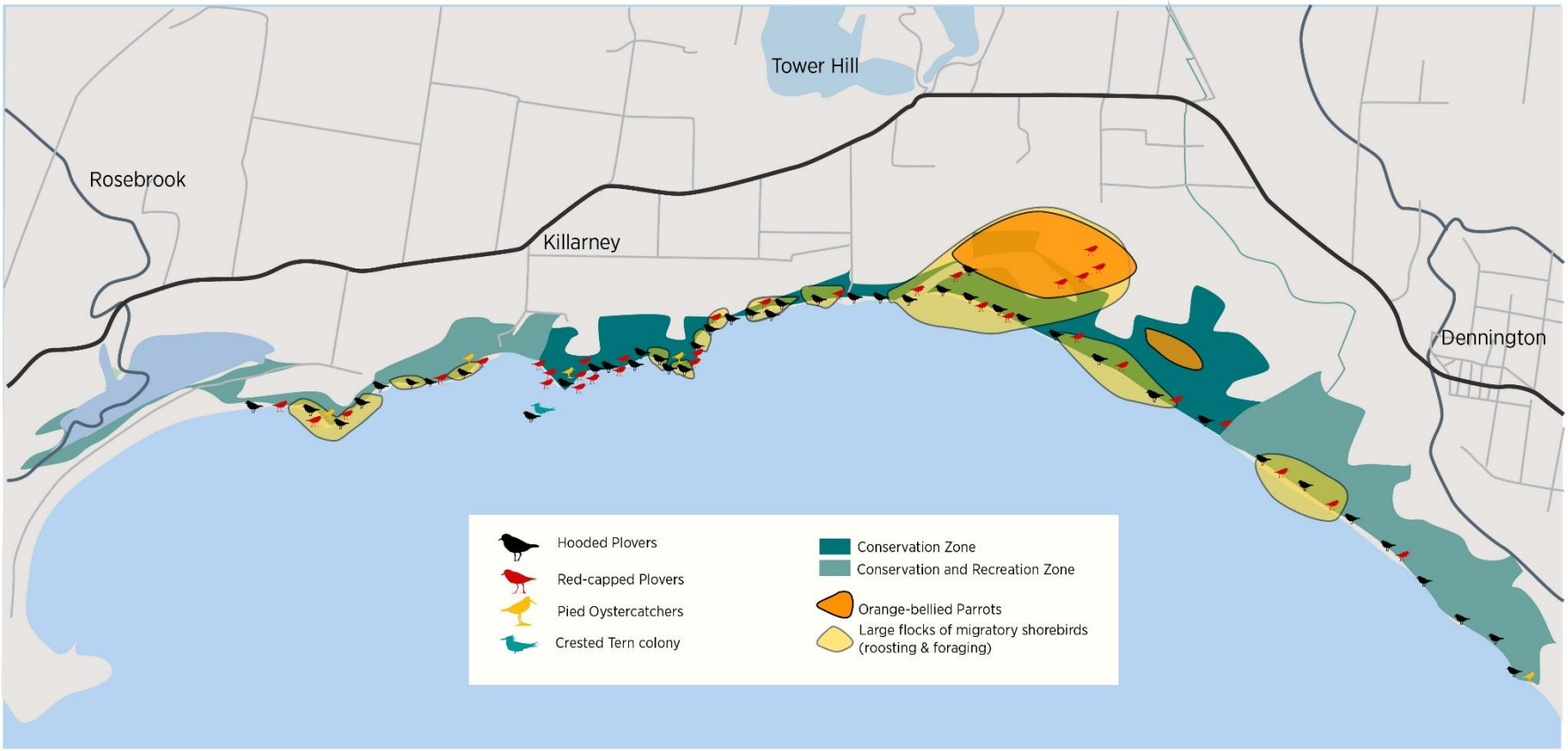
## About the vision – Belfast Coastal Reserve, 15 years from now (page 7):

- We largely support the Vision statement, with the exception of the statement: 'the location, timing and intensity of activities such as horse riding has been managed to avoid conflicts between uses, and to reduce the risk of damage to the environment and cultural sites'. Given the sensitivity of this coastal Reserve, its value to birds which are highly prone to disturbance and with highly camouflaged eggs and chicks, it would be more appropriate to avoid specifying horse riding in the vision for the Reserve's future. The Reserve cannot sustain commercial racehorse training and the term 'horse riding' does not accurately reflect this commercial and high impact usage. The impacts of recreational horse riding are also high, increasing and challenging to manage. In future, it may become evident that the Reserve cannot sustain this activity. Throughout the plan there is repeated reference to the severe impacts that horses have on the Reserve's natural, cultural and recreational values. Reference to this activity, in particular, should be removed from the vision statement and it should be kept broad to refer to appropriate management of recreational activities and balancing potential conflicts.
- The vision mentions the recovery of threatened species: 'The area continues to provide important habitat and refuge for native species, particularly threatened migratory birds that breed and feed here.' This is inaccurate as migratory shorebirds do not breed in Australia. Only resident shorebirds nest within Australia and the Reserve is indeed critical habitat for these species.

## Key management theme #1: Cultural landscape and living heritage (pages 13-24):

- We strongly support the goals and strategies within this chapter of the draft plan including maintenance of geological features, recognising Traditional Owner and community connections to it, ensuring cultural landscape values are protected in heritage management, and establishing partnerships with Traditional Owners to protect and conserve heritage features.
- Page 22 states "there are several areas of the Belfast Coastal Reserve where Aboriginal cultural heritage is being negatively impacted by visitors, particularly related to dune access. This impact ranges from relatively low (foot traffic) to extremely high (four-wheel drive traffic and repeated horse traffic)." The proposed Conservation Zone would benefit these cultural heritage sites, with the exception of permitting racehorse training which conflicts with these values.

Figure 2. BirdLife Australia Shorebirds 2020 data and Beach-nesting Birds data from 2010-2018, and Orange-bellied parrot data from 2004-2014. The proposed CONSERVATION and CONSERVATION AND RECREATION ZONES have been displayed on the map.



- The statement "There are currently risks and impacts to Aboriginal cultural heritage from existing authorised activities including recreational horse riding, licensed horse riding tours and licensed commercial racehorse training….Due to this, Gundijmarra Traditional Owners are not supportive of racehorse training" clearly demonstrates the stance of local Traditional Owners on racehorse training in the Reserve. We strongly support the right for Traditional Owners to protect their cultural heritage and to be directly involved in guiding the management of this Reserve.

## Key management theme #2: Healthy Country:

- "The Reserve is home to over 50 species listed as threatened in the advisory lists maintained by DELWP", "The Australian Government's Threatened Species Strategy identifies 20 priority EPBC-listed bird species for conservation, four of which have been recorded in the Reserve: Orange-bellied Parrot, Hooded Plover, Australasian Bittern and Eastern Curlew" and "The area between Port Fairy and Warrnambool has been identified as a Key Biodiversity Area … as defined by global scientific criteria". These statements highlight the significance of the Reserve and is why We believe the proposed CONSERVATION ZONE is required.
- The Hooded Plover and Eastern Curlew are both species for which disturbance from recreation has been identified as a key threat and a high priority for mitigation.
  Objective 3 of the Wildlife Conservation Plan for Migratory Shorebirds 2014 is "Anthropogenic threats to migratory shorebirds in Australia are minimised or, where possible, eliminated". Note the Eastern Curlew is particularly sensitive to disturbance, being a large shorebird and having one of the longest average Flight Initiation Distances (FID) of all the shorebirds (Glover *et al.* 2011).
  The Australian Government's Conservation Advice for the Hooded Plover specifies "Manage the use of (and access to) key beaches for recreation when plovers are breeding – e.g. **discourage or prohibit vehicle access, horse riding and dogs from beaches**; implement temporary beach closures; erect fencing to prevent people entering" as a key management action required.
  This is further support for the CONSERVATION ZONE to reduce the impact of dogs and horses on the Hooded Plover and key migratory shorebird sites. It is also further support for the prohibition of commercial racehorse training in the Reserve which conflicts with threatened species management advice from the Australian Government.
- The plan states on page 27 for key management outcomes as "the protection of vulnerable fauna such as Hooded Plover will require reducing threats to these species through controls on the key impacting activities of dogs, horses and people". The plan later contradicts this outcome in Table 6.1 by allowing commercial horse training, classified as an EXTREME Risk, within a CONSERVATION ZONE that has been identified as a priority section of coast for breeding Hooded Plovers.
- The strategy "reduce the impacts of fragmentation in dunes, foredunes and wetlands and prevent erosion" needs to include removing horses from the dunes and wetlands. These heavy, hard-hoofed animals are associated with increased rates of erosion (page 30).
- The plan fails to mention how threats of commercial racehorse training will be mitigated, monitored and evaluated in the 'Habitat Protection Strategies" table on page 32 although the plan labels the threat as EXTREME.
- We strongly support the goal "The impact of visitors at key locations is reduced to allow for an increase in the extent and richness of vulnerable fauna, and the occupation of most of their potential habitat' on page 34. In particular, "to reduce disturbance to vulnerable fauna including migratory birds, shorebirds and Orange-bellied Parrot, and their habitat by implementing park zoning and access regulations". The plan should explicitly state here that

access regulations will include prohibiting dogs and all horses from CONSERVATION ZONES. Furthermore, Hooded Plover should be specifically named in this particular strategy, as it is a primary indicator species for disturbance impacts.

- We strongly support the strategy to "protect Hooded Plover nests and chicks from trampling through erection of temporary fencing and signage around individual breeding sites across the Reserve (following best practice protocols)". However, several points should be made here:
  - this is a task currently being carried out primarily by volunteers, estimated at over $90,000 of in-kind volunteer effort on average per annum. In order for this to be sustainable in the long-term, volunteers need to be well supported, resourced and to have the support of a planning framework that addresses the threats that fencing/signage does not address (e.g. disturbance, off leash dogs entering fenced zones);
  - breeding areas along Levy's beach currently aren't fenced because of difficulties with access and transporting equipment;
  - some areas of beach are too narrow for fencing given tides can be high, and these will remain at risk of trampling;
  - chicks do not remain within a fenced area and while fences may be left up or reconfigured to 'symbolise' there are chicks in the area, the chicks will most likely be at the water's edge or on the wrack line feeding, and thus, still at risk of trampling. Therefore, to effectively mitigate threats of horses and dogs, it is critical to have areas free of these threats.
- We strongly support the strategy to "undertake targeted Hooded Plover nest monitoring…use monitoring results to inform/adapt management of visitor activity". This monitoring is shown to be one of the best indicators of coastal health more broadly (Schlacher *et al.* 2014), but also allows for an adaptive management approach to recovery of this threatened species, with capacity to identify changes to threat profiles and the effectiveness of investment in recovery actions. This monitoring allows for an early warning system to detect crashes in population numbers and is especially important for species that are long-lived where threats operate primarily on recruitment rates.
- As mentioned on page 13 "the dune systems of the Reserve have good capacity for dune retreat and redistribution of sand given there is limited infrastructure built directly in the primary dune". This again highlights the value of this system in the long-term for species of beach-nesting birds as well as migratory shorebirds. It is predicted that areas of shorebird habitat are likely to be lost in the future due to rising sea levels associated with climate change. Thus the areas of coastline that have capacity for resilience and retreat would become of even higher significance to these species. Protection of this critical habitat is a priority at a local, statewide and national level. This lends further support for bolstering protection of the population of shorebirds using this Reserve, in particular the area within the CONSERVATION ZONE.
- This chapter does not discuss in enough detail the importance of habitat to migratory shorebirds, their vulnerability to disturbance, the value of specific habitat zones to particular species of migratory shorebirds (e.g. rocks to Ruddy Turnstones, ocean beaches to Sanderling and Double-banded Plovers, Wetlands to Sharp-tailed Sandpipers), the habitat requirements and value to Australasian Bittern, nor does it outline the rarity of Orange-bellied Parrot sightings on the mainland in recent years, yet that this site has been one of the few locations where OBPs have been sighted during the period of critical decline. We believe it is important to include information about these values to assist Reserve users in understanding the significance of the area and the need for regulations.
- The Reserve contains 30% of the EVC 'Swamp Scrub/Aquatic Herbland Mosaic', which is considered an Endangered EVC. This EVC is sensitive to trampling and disturbance. Note

"remnant native vegetation can be readily degraded by human, animal and vehicle disturbance…research has shown that low levels of horse trampling can cause a significant reduction in vegetation height with fewer plant species found on trampled sites" (page 30). This is further support for removing horses from the CONSERVATION ZONE where this EVC occurs around Rutledges Cutting, Saltwater Swamp and Kellys Swamp.

- The 'Coastal Dune Scrub' EVC accounts for 55% of the Reserve and is noted as being degraded by historical land use, rabbit grazing, trampling and Marram Grass invasion. However, the area between Rutledge's Cutting and Warrnambool is highlighted as having "large and important populations of Spinifex on primary dunes". It is this section of coastline where commercial racehorse training is being permitted and recreational horse riding. This is contradictory and conflicts with protecting the highest value remnants of this native Coastal Dune Scrub vegetation.
- Page 32 strategy to 'undertake invasive weed management through: …containing the expansion of Marram Grass' is not an accurate nor adequate statement. Marram Grass and Sea Spurge have been identified as a major threat to the Hooded Plover and other beach-nesting birds, limiting habitat availability and degrading future habitat suitability. These weeds need to be better addressed by the draft management plan. In fact, the plan states "it is forecast that on current trends almost nothing of the indigenous flora will survive on these dunes unless invasive species are actively controlled, eliminated or contained" (page 30). Marram grass currently has invaded the full extent of the dune system within the BCR so that referring to limiting or containing expansion is ineffective and a negligible action. Following the recommendations of Cousens *et al.* (2013), "to tackle marram grass infestation of the coast around western Victoria as a whole would require enormous logistical and economic investment… Instead, targeting hooded plover territories for marram grass removal at a smaller scale with the aim of improving habitat would have outcomes that could be directly measured, and if effective, would relate weed control directly to improving biodiversity values of that investment". Furthermore, a key recommendation of Cousens *et al.* (2013) was: "More scientifically rigorous studies of the main weedy/invasive species are needed; in southern Australia sea wheatgrass and marram grass would seem to be the most urgent of these. Where control is initiated, there should be more deliberate attempts to estimate the impacts of management action (and inaction). Critically, the response of dunes dominated by weeds to storm events needs to be quantified to enable managers to respond appropriately to coastal erosion". We would like to see a strategy added that includes targeted rehabilitation of Hooded Plover breeding sites through control of the invasive weeds, Marram Grass and Sea Spurge.
- Reducing threats and impacts are a commonly used measure to build resilience to climate change within natural systems. Sea-level rise may reduce the width of beaches and intensify the impacts of horses on that habitat. The most obvious way to build resilience is to remove horses from this sensitive coastal system.
- Key threats to Hooded Plover breeding success on page 35 should include broader references and there are many published papers in peer-reviewed journals that could be used here. There has been an extensive review of threats in several publications that could be drawn upon (see dog and horse literature reviews in Appendix 4).
- Page 36 is a comprehensive summary of key research findings around the threats and the value of the Belfast Coastal Reserve to the Hooded Plover. The statement describing the reserve as "the highest priority for conservation and recovery of the declining Eastern mainland population" is an accurate statement.
- The strategy to 'undertake biannual migratory shorebird, biennial beach-nesting bird counts and regular population monitoring. Use monitoring results to evaluate trends in predation and fauna populations'. Population counts are one indicator of population health and are important for tracking longer term trends. Adult survival is generally high and so changes to

population numbers are slow to respond. Immigration of birds from other areas does occur within the Hooded Plover population, so that increases in numbers of birds is not a direct measure of the area's success (Weston *et al.* 2009). Breeding success of beach-nesting birds is the most powerful indicator of health of the local population (Schlacher *et al.* 2014). Use of remote cameras at nests can identify nest predators and trends in their impact (Weston *et al.* 2017). It is recommended that this be incorporated in to the strategy for achieving the goal of reducing the impact of predation (page 34).

- Page 42 includes the strategy of "ensuring effective responses to emerging threats such as erosion risk to dunes, access and facilities". This must be sympathetic to the needs of shorebird species within the Reserve and not conflict with habitat values. Certain erosion control methods have been identified as a threat to Hooded Plover and other beach-nesting bird habitat, such as brush matting (Maguire 2008).
- Page 39 mentions the establishment of 'a volunteer intertidal reef habitat monitoring program'. Note this would require strict guidelines in order to minimise disturbance to the shorebirds and seabirds using these reefs, in particular during the nesting season of resident shorebirds.
- It is critical that the beach wrack within the Reserve is protected. There is no mention of the value of wrack in the current plan. The Management Plan should specify that wrack harvesting is not permitted within the Reserve. This is particularly relevant given the expansion of the wrack harvesting industry over the border on the Limestone Coast, South Australia, and the concerns over impacts to shorebird habitat as a result of this practice.

## Key management theme #3: Recreation and use (pages 45-69):

- We strongly support many of the goals and strategies that relate to the recreational use of the Belfast Coastal Reserve in this chapter.
- Based on over a decade of threat monitoring in the Reserve and our social compliance data, BirdLife Australia strongly recommend the Minister adopt a CONSERVATION ZONE in the identified area of the BCR, namely between the Killarney Boat Ramp to East of Rutledges Cutting. The immediate area around Mills Reef is also of high significance and would also benefit from increased restrictions. The proposed zoning however offers the best co-existence approach to balancing threats to Threatened species within the Reserve.
- We strongly support the goal "Opportunities for a range of recreational visitor activities are provided with minimal impacts on natural values, cultural values and other users". However, this relies on the proposed CONSERVATION ZONE being implemented, education and enforcement of dog leashing in the CONSERVATION AND RECREATION ZONES, and a permit system for recreational riders with strict conditions (see below).
- We strongly support the proposed location for the CONSERVATION ZONE. This encompasses the core area used by the Orange-bellied Parrot, the majority of Hooded Plover breeding sites (up to 28 of 44 identified sites within the Reserve), the largest known winter flocking site for Hooded Plovers, at least 24 red-capped plover breeding sites, 2 pied oystercatcher breeding sites, and major roost and foraging sites for migratory shorebirds including internationally significant sites for Sanderling and Sharp-tailed Sandpiper, nationally significant sites for Ruddy Turnstone and Double-banded Plovers (New Zealand migrant, visits in our autumn/winter months).
- We strongly support the prohibition of hunting within the Reserve.

***Racehorse training***

- We do not support access for commercial racehorse training. We strongly condemn the authorisation of beach use by horse trainers at Golfies, Rutledges Cutting and Hoon Hill/Levys beach.

- The draft plan recommends strict controls on where and how recreational uses are to be managed in the future, whereas commercial racehorse training will be expanded. This does not make sense. Table 6.1 Summary of activities proposes that commercial horse training will be allowed within the CONSERVATION ZONE at Rutledges Cutting. This contradicts the vision for the Reserve and the EXTREME assessment of risk that this activity poses to key values of the Reserve.
- A $1.2 million synthetic sand track was opened in 2017 for horse trainers and therefore they will not lose their *competitive advantage* if this activity is removed from the Reserve. Furthermore, Darren Weir has built an artificial sand course on his new property at Maldon to replicate the beach conditions. Instead, the EXTREME risks to the cultural, environmental and public safety assets could be mitigated by removal of this activity. Commercial racehorse training should not be occurring in critical habitat for threatened species. The latter can't be replaced.
- The statement "Riding of horses for recreational or commercial purposes was viewed as a threat to dune health, cultural heritage, shorebirds and public safety, especially if riders did not comply with regulations, codes of conduct or licence conditions" does not match the risk assessment table (page 29) that indicates, even with regulations in place, commercial racehorse training poses EXTREME risks to each of these key values of the Reserve. Even if horses, ridden recreationally or otherwise, are at the water's edge at low tide, there are still risks to the flightless chicks of the Hooded Plover, which feed on the exposed intertidal reefs, along the water's edge and wrack line. In the first few weeks after hatching, these chicks will crouch on the spot when approached by threats and this can be anywhere from the rocky platforms, water's edge to the upper beach or foredune. Riders will not be able to see these highly camouflaged chicks to avoid crushing them. Furthermore, the deep craters made in the sand by hooves are a hazard to chicks trying to run away from threats toward cover (Weston 2003). Disturbance by large numbers of permitted riders would have chicks in hiding for long periods, unable to access the waterline to feed.
- There is no mention of the low compliance of horse trainers under current license conditions nor any long-term plan for reviewing impacts and removing commercial horse training if conditions are breached and/or further evidence reveals this is unsustainable and damaging. There is a loose statement to "revoke licence for continual levels of non-compliance". We would question how 'continual' is defined: how many times are trainers permitted to revoke conditions and jeopardise threatened species, public safety and cultural heritage before their access is denied?
- In order for horse training on beaches to meet the Track Safety Guidelines for WorkSafe practice, it is a requirement to have separate access for horse entry and also for horses to be separated from the public on beaches. There would be a requirement for barriers, signage, first aid on-site, emergency plans and communications as identified in Track Safety Guidelines. These are costly and largely unfeasible in a beach environment. We would be disappointed to see the limited resources available for management of the Reserve allocated to maintaining a commercial enterprise that has high impacts on the Reserve's wildlife and environment.

***Dogs in the Reserve***

- We strongly support the goal of the draft management plan to restrict dogs in locations that are of high value to beach-nesting birds and other wildlife. The plan should ensure that the appropriate zoning for high conservation areas for beach-nesting birds, such as Hooded Plovers, are dog and horse free. The area between Killarney boat ramp and Big Baldy at Levys beach contains up to 28 Hooded Plover breeding sites (BirdLife Australia 2014-2018 data). This density of breeding sites is unprecedented and highly significant. There are alternative areas within the Reserve that are available and suitable for dog walking with less

impact on beach-nesting and migratory birds. For example, the CONSERVATION AND RECREATION ZONE between Big Baldy to the eastern end of Shelly beach Warrnambool contains up to 8 breeding sites.

- The high density of Hooded Plover breeding sites within the CONSERVATION ZONE warrants prohibition of dogs and horses to maximise the chance of the breeding pairs successfully producing fledglings. This would occur through directly reducing disturbance, incidences of crushing nests and predation of flightless chicks by dogs, and indirectly by enabling more widespread fox control in areas that are now dog free. It would also ensure limited resources are better channelled into protecting the integrity of this important natural area, and would reinforce the significance of the zone to locals and visitors. Within the Mornington Peninsula National Park, dogs have been banned for two breeding seasons (from November 2016), and the population has rebounded. Fledging success rates were steeply declining in the park (average of 6 fledglings produced from 2006/07-2015/16). However, since the ban has been in place, fledging production has doubled (average of 12.5 fledglings 2016/17-2017/18)) and if compared to the three prior seasons (2013/14-2015/16), has tripled. Furthermore, pairs occupying sites on the Mornington Peninsula that were identified as having the highest frequency of off leash dog observations and as having no success in over a decade of monitoring have now successfully produced fledglings (Maguire *et al.* 2014; BirdLife Australia database 2016-2018). This is strong justification for prohibiting dogs from the CONSERVATION ZONE in the Belfast Coastal Reserve to improve breeding success of this threatened species.
- We strongly support prohibition of dogs in the proposed CONSERVATION ZONE as this will also allow for greater fox control to occur within this area, as currently baiting cannot occur adjacent to any walking tracks where dogs may be walked on-leash. This was one major benefit of prohibiting dogs within the Mornington Peninsula National Park, enabling a more effective fox control project, with benefits for a broad range of wildlife.
- We strongly support the plan's identification of a designated 'off-leash dog beach' on page 49. Providing locals and visitors with a designated beach to enjoy with their dogs provides an alternative to the high value CONSERVATION ZONE where dogs will directly negatively impact the breeding of multiple species of beach-nesting birds and disturb large flocks of roosting and foraging migratory shorebirds.
- We strongly advocate for the creation of a more inviting dog walker experience and facilities for dog walkers. We recommend a walking circuit could be created in the reserve that includes an on beach and off beach component. For example, this could potentially occur along the old vehicle track that runs between the Golf course access and the Killarney campground. If a circuit walk for dog walkers was created here, with a walk that included on-leash time on the beach and then a walk that returned via the old track on the dune, it would take pressure off the CONSERVATION ZONE, and would provide dog walkers with a more attractive alternative. Changes to regulations and access are met with more social acceptance when alternatives are presented (Maguire et al. *in press*).
- Currently, the proposed CONSERVATION AND RECREATION ZONES allow on-leash dog access and this is compatible with the conservation values of the zones, promoting a co-existence approach to balanced recreational use. These zones have lower densities of beach-nesting birds compared to the proposed CONSERVATION ZONE. However, compliance with dog leashing will still be critical to reducing lethal impacts to the 16 breeding sites of the Hooded Plover within the CONSERVATION AND RECREATION ZONES. Sixteen breeding sites still constitutes a significant proportion of the population of this nationally threatened species and under EPBC and Wildlife Act legislation, disturbance to these breeding birds is illegal. We strongly advocate for sufficient resources to be allocated to enforcement of the regulations in the Reserve.

***Recreational horse riding***

- We strongly support the proposed CONSERVATION ZONE as a horse free area.
- We strongly support the statement "while horse riders may be required to ride below the tide-line on beaches to avoid nesting habitat, or stay a distance away from marked nest sites, compliance with this guideline may be poor during a high tide…when the area of available space on the beach can be limited and riders may advance higher on the beach into nesting habitat. It is therefore critical that the most significant areas for shorebird breeding are protected from disturbances including those from horses." This is further support for no horses permitted in the proposed CONSERVATION ZONE which is very narrow. The geomorphology of the coast within the CONSERVATION ZONE consists of many rocky embayments, small headlands and a narrow beach that then opens out on to the estuary at Rutledges Cutting (see photos Appendix 5). Horses riding above the tide line along these narrow beaches and regularly cutting across each headland due to the multiple 'pinch' points, has been well documented during beach visits as part of the Hooded Plover monitoring program. We believe the avoidance of critical breeding habitat cannot be effectively achieved in this particular beach morphology (see photos in Appendix 1).
- We support the statement "close the beach to horse training and riding groups when Hooded Plover nests extend onto narrow sections of beach…or when climatic conditions or tidal conditions make access unsuitable". This would deem the beaches around Rutledges Cutting in winter unfit for horse access due to the extreme tidal inundations and hazards to rider safety. This would also deem the beaches between Golfies and Gormans Rd primarily unsuitable due to their narrow width and the survival risk brought in to play by having nesting birds and horses (and also beach users including our staff and volunteers) in the same narrow zone. This lends further support for the proposed CONSERVATION ZONE.
- If recreational riders are permitted in the CONSERVATION AND RECREATION ZONES, we strongly support a horse riding permit system (free of charge) that includes a strict set of conditions, an agreement to abide by these including a shorebird induction, and tracking of compliance with these conditions. Within parts of the reserve, namely between Pelicans and Gormans rd, we have had to alter our best practice protocols for protecting nesting sites of the Hooded Plover, by pre-empting where the birds might nest and fencing these areas off before nests are found. This is because horses are riding along the upper beach in these stretches, and there is little sand that is left untrampled (see examples in Appendix 1). Unless small sections are fenced off, the birds would have nowhere to nest. This is sometimes successful but ultimately the birds need to decide where the best location is to place the nest that will maximise predator avoidance and tidal inundation. In the Levys section of the Reserve, nests are rarely fenced because of the difficulties in transporting fencing materials and regularly checking this more difficult to access section of the Reserve. This means it is critical that riders are not reliant on fenced zones to avoid crushing nests and instead permit conditions are necessary to mitigate risks.
- In addition, there are no restrictions in place to protect the highly mobile, flightless chicks of resident shorebirds that need to feed at the water's edge, rock platforms and wrack line. Permit conditions for recreational riders in the CONSERVATION AND RECREATION ZONES will be critical to minimising chick mortality.
- In Kilcunda coastal reserve a permit system effectively ensures all riders undergo a shorebirds induction and follow strict conditions to minimise risk. Similar inductions and conditions have been set for small commercial trail riding groups (e.g. Gunnamatta Trail Rides on the Mornington Peninsula and Rundell's Mahogany Trail Rides in Dennington) and compliance is closely monitored over time to ensure compliance. There have been incidences of non-compliance meaning the permit conditions need to be regularly enforced with the groups. This requires investment in monitoring and regular ranger liaison with the groups.

- BirdLife Australia recommends the following conditions for recreational riders:
  - Restricted to water's edge, however there must be a restriction around times of tide because a water's edge restriction would still have horses in the nesting zone at times of high tide.
  - Rides should aim for times of low tide. Avoid times of high tide, including the 1-hour period before and after the high tide.
  - Only a walking pace to slow canter should be permitted.
  - Riders are to follow the water line and not cut across any corners.
  - No form of training, lunging, figure 8s, barrel racing, rolling, etc. Recreational riding needs to be formally defined in the plan.
  - No commercial activity.
  - An induction needs to be completed which includes rider safety, public risk management, and shorebird awareness.
  - Cap permit numbers annually.
  - Maximum of two horses abreast.
  - 6 or more horses in a group are categorised as an event, and extra rules apply.
  - Horses are to be ridden at least 10-15m from the base of the dune.
  - No trampling of native vegetation. Access to the beach must be along formal tracks.
  - No sulkies or horse-drawn vehicles.
- Page 51 states that recreational horse riders are principally individuals or small groups. This is not a true reflection of the trail rider groups that use the area and have attempted in the past to establish permanent and advertised trails for horse groups throughout the Reserve. These trail riding groups have 20 horses at a time riding in the Reserve. These numbers pose a significant risk to the birds, vegetation, dunes and cultural heritage sites.

***Specific site details***

- Section 6.4 addresses specific sites:
  **Golfies beach access**: We do not support commercial race horse training in this area. The section of beach and intertidal rocks around Mills Reef are of high migratory shorebird value as well as containing a high density of nesting sites of resident shorebirds (Hooded Plover and Pied Oystercatcher), which warrants mentioning here.
  **Golf course East beach access**: the old vehicle track heading east, that was closed off by Moyne Shire to prevent illegal vehicle access to the beach, could be converted in to a dog walking circuit. This would provide a circuit that would be appropriate in terms of minimising conflict with other Reserve users and sensitive wildlife, and providing an opportunity for a longer walk.
  **Killarney beach access and Camping reserve**: this could be linked with Golf course East beach access via the old vehicle track, to provide a dog walking path with appropriate, minimal infrastructure to provide a safe and pleasant dog walking experience (including dog poo bag dispensers). There are safe and structured carparks at either end to support this as an increased dog use area.
  We strongly support the use of Killarney beach as a high visitor beach recreation area. This beach has lower value to wildlife than the adjacent beaches. This would be viewed as a sacrificial beach.
  **Basin beach access plus Pelicans and Towilla way**: it should be stated that this is a hotspot for shorebirds such as Sanderling and Ruddy Turnstone, in particular the threatened Hooded Plover, along this coastline. We strongly support the strategy to "prohibit dogs and horses from The Basin, Pelicans and Towilla Way beaches to protect Hooded Plover and other shorebird habitat", the strategy to "increase compliance patrolling" and to "reinstate bluestone rock barrier to limit illegal beach access by vehicles". The bluestone rock barriers have been highly effective in reducing the detection of vehicles in the Reserve when

comparing data before and after rock barriers were implemented (BirdLife Australia database 2006-2017).

**Rutledges Cutting, Gormans Road carparks number 1, 2 and 3**: reference is made to the value of the site for several species but this also needs to include the high value of this site to wintering Hooded Plovers, with the largest flock recorded here of anywhere in the species range. The statement "racehorse training was previously permitted eastwards from this site…but this is not permitted during the Hooded Plover season" is an irrelevant statement given this site is also of highest significance during autumn and winter months to wintering Hooded Plovers, migratory Double-banded Plovers and to nesting Red-capped Plovers from July to September. These species need to be mentioned in the description of this site as other sites have reference to species of significance. We do not support commercial racehorse training to licensed users in this highly sensitive estuary environment as it poses EXTREME risks to highly significant threatened species habitat, and public and rider safety.

**Kellys Swamp Track west of Big Baldy**: reference is made to "horse riding has both created new tracks and caused deep incising of existing tracks in several places", again highlighting the damage done by horses to this sensitive coastal environment. We support removal of horses from this sensitive section of wetland and coast.

**Kellys Swamp Track between Big Baldy and Spookys beach access**: We do not support commercial race horsing at Hoon Hill due to EXTREME risks to cultural heritage, dune erosion, shorebird habitat and public and rider safety.

Levys beach: We do not support commercial race horsing at Levys beach due to EXTREME risks to cultural heritage, dune erosion, shorebird habitat and public and rider safety.

***Additional comments***

- The statement "there are however mixed opinions in the community about the ongoing impact of dogs and horses on the Reserve" sends a confusing message to readers. Evidence-based statements and published references about the threats posed by dogs and horses are not opinion and should not be categorised in the same way as uninformed and reactive opinions. The CONSERVATION ZONE is one of the most critical areas of habitat for a number of highly threatened and nationally significant species. Conservation advice from the Australian Government supports the removal of high impact threats, namely dogs and horses, from critical habitat.
- Page47-48: There are many undesirable activities that have occurred and still occur in the Reserve and a management plan will enable these to be clearly identified as inappropriate and prohibited. The Reserve has high rates of illegal camping occurring at Killarney boat ramp and Gorman's road carparks, as well as sporadic presence of Abalone divers. Considerable investment has been made in tackling illegal vehicle activity in the Reserve including the installation of gates, bluestone barriers, large boulders at Gormans road access points, and intensive, highly coordinated compliance patrols that involved Victoria Police. These should be mentioned, as other recreational activities that have been historically unregulated are discussed, such as horse training, so perhaps by including mention of the historical issues in the Reserve, horse and dog groups won't feel singled out.
- Illegal vehicle access, including by trail bikes, continues to be a problem within the Reserve and we support efforts to reduce this through maintenance and additions of bluestone barriers, signage, gates and enforcement patrols.
- Page 48-49 could include more of the social research about compliance of dog walkers (see section below). 43% of the onshore area has been chosen to be dog free and there is much research to support the need for this approach.
- Section 6.6 discusses Risks and Safety. We would like to advocate for Emergency Beach Number signs (yellow triangles mounted on posts) at access points for the safety of beach

users as well as our staff and volunteers who spend more than 3,000 combined hours per year in the Reserve.

- It is noted on page 65 that Hooded Plover density and fledgling success will be used as indicators. Density is a longer term measure, taking years to respond to damaging threats given species fidelity to sites and longevity. Fledging success is a strong indicator of health of the Reserve. We also recommend using nest failure rates which are likely to reveal levels of disturbance and impacts to the lifetime fitness of the birds (via high energetic costs of disturbance and loss of body condition). Energetic demands are high associated with the brood-rearing phase or replacement clutches that follow nest failure (Weston & Elgar, 2006; Bulla *et al.*, 2015; Yasue & Dearden, 2008). Brood-rearing Hooded Plovers lose condition and forage infrequently (Weston & Elgar, 2006). Thus, disturbance during brood rearing can be particularly damaging to lifetime fitness of the adult birds.
- Section 6.7 explores Information, interpretation and education. We strongly support better signage and interpretation, and a more consistent approach by land managers. We believe BirdLife Australia should be named as a Delivery Partner given our expertise in education and community engagement around shorebirds and beach-nesting birds. We think this section also needs to include ranger patrols and the opportunity for rangers to provide educational information to beach users. In recent years, a seasonal ranger has been employed to educate beach users about beach-nesting birds, and we advocate that this continues as it is critical for assisting beach users to understand the need for the CONSERVATION ZONE and the coexistence approach in the CONSERVATION AND RECREATION ZONES.
- Section 6.8 on Tourism should include more reference to highlighting the tourism value of the Reserve in terms of its unique avifauna. Similar to the attraction of the whales, penguins and shearwater colonies in adjacent parts of the coast, the Reserve offers high nature-based tourism value to the area.

## Social implications and community perceptions

### *General beach use*

Using data collected from 667 visits made during 2006-2011, most beach users in the Reserve were identified as walkers, with dog walkers, anglers, horse riders and surfers being the next most common recreational groups (Table 2).

Table 2. The main recreational activities people were observed participating in within the across 21 monitored Hooded Plover sites within the Belfast Coastal Reserve. In total, 667 visits over five seasons of data collection (2006/07 – 2010/11) detected 1,814 people.

| **Walkers** | **58.40% (1203)** |
|---|---:|
| Dog walkers | 17.33% (357) |
| Anglers | 12.14% (250) |
| Horses | 11.02% (227) |
| Swim/Surf | 4.22% (87) |
| Sitting/Sunbaking | 1.99% (41) |
| Dune boarding | 0.19% (4) |
| Jetski/Windsurfing | 0.05% (1) |
| Quad Bike/4WD | 0.05% (1) |

Surveys of beach users who use the Belfast Coastal Reserve were carried out in spring and summer 2009/2010 as part of a bigger statewide survey by James Rimmer from Gordon Institute of TAFE (Maguire *et al.* 2013). These surveys revealed that respondents (n=24) had high overall awareness of the hooded plover and many had first seen the species at Killarney. The biggest identified knowledge gap was around chick ecology and the need for chicks to roam and access the water's edge and wrack line (this was in line with statewide results, Maguire *et al.* 2015). Respondents were regular users (several times a week to several times a month), mainly using the reserve for walking and swimming/surfing, and 41.7% were dog owners. When asked to rate the effectiveness of a comprehensive list of management options for recovering Hooded Plovers, respondents thought regulations/restrictions would be the most effective (average=4.4, on scale of least effective 1 to most effective 5), specifically enforcement of regulations rated the highest (average=4.7) and 'no dogs' and 'no horses' restrictions rated the next most effective (average=4.5 and 4.6, respectively). On-ground options were ranked much lower (average=4.0, on scale of least effective 1 to most effective 5), and educational approaches even lower (average=3.5, on scale of least effective 1 to most effective 5). Respondents strongly agreed with hooded plover conservation being important to coastal biodiversity (average score=4.9, on scale of disagree 1 to agree 5) and strongly disagreed with the statement that the birds should move to a safer spot to nest (average score=1.4, on scale of disagree 1 to agree 5). These results from locals were similar to beach users from other parts of Victoria (Maguire *et al.* 2013).

***Dog walker compliance***

Significant investment in public education and the signing and fencing of protected zones around Hooded Plover nesting sites have not been as successful with dog walkers in the BCR compared to other parts of Victoria. This is in part thought to be due to the lack of regulations in place to support recovery efforts. There are four times as many off leash dogs observed in Hooded Plover breeding sites than on leash dogs and this is highest of any other park monitored (Maguire *et al.* 2014). Appendix 6 provides a record of interactions between volunteers and beach users during nest visits in the south west region. Recording the nature of the interaction or conversation, type of beach user and change in behaviour after a conversation is recorded by volunteers on their data sheets or in the online data portal. This reveals a range of positive and negative feedback to information about the birds. Overall for sites within south west Victoria, responses to educational information received a positive response and behaviour change in 46% of interactions with dog walkers and negative response/no change to behaviour in 54% of interactions with dog walkers. If we look at sites within the BCR alone, then 37% of interactions with dog walkers have been positive and resulted in behaviour change, while 63% have been negative and not resulted in behaviour change. This differs from the Victorian average, which is 75% for a positive response from dog walkers and 25% for a negative/no behaviour change response. Comments such as 'not their fault/needed some beach free of seaweed for dogs', 'foxes, gulls, crows and high tides were to blame for impacts on the Hoodies' and 'My dog isn't interested in birds (just wallabies)' suggest that a strong regulatory framework is needed to alter behaviours within around 60% of dog walkers.

Williams *et al.* 2009 revealed that while leashing of dogs can significantly improve conservation outcomes for Hooded Plovers, few dogs are leashed on beaches: 82% of 2,847 dogs on Victorian beaches, 1994–2008. In a survey of 385 dog owners across Victoria, exploring their sense of obligation to leash dogs on beaches, most dog owners saw no conflict between off leash dog exercise and wildlife conservation. In general, respondents considered their own dog to be much less of a threat to wildlife while they considered dogs in general to be a high threat. Dog owners were more likely to feel obliged to leash their dog when they believed other people expected dogs to be leashed.

Maguire *et al. in press* compared levels of compliance with dog regulations (3,516 checks, 69 ocean beaches) under six prevailing management regimes in Victoria, Australia. Compliance was low to moderate across all dog management 'types', but varied significantly. The highest compliance rates

were associated with 'no dog' areas. Despite poor overall compliance, dog regulations appeared to be associated with different rates of occurrence and relative abundances of dogs, suggesting they may effectively displace dog walkers, i.e. assigning suitable off leash dog areas can shift dog walkers away from more sensitive areas.

Analysis of threat records from signed Hooded Plover nesting sites within the BCR has revealed high numbers of dogs off leash observed in comparison to dogs on leash (0.16 dogs on leash per visit versus 0.67 dogs off leash per visit, see Table 1, 2006-2011 data) and these have continued to rise over time, with 0.35 dogs on leash per visit versus 1.47 dogs off leash per visit (n=973, Table 3).

Table 3. The total numbers observed during Hooded Plover site visits over five seasons, and average numbers per visit of people, dogs on leash, dogs off leash, horses and of these horses, those observed above the high tide mark.

| | **Season** | **People** | **Dogs on leash** | **Dogs off leash** | **Horses** | **Horses above HTM** |
|---|---|---|---|---|---|---|
| Total | ***2017-2018*** | 1339 | 122 | 674 | 185 | 83 |
| Average | n=427 | 3.14 | 0.29 | 1.58 | 0.43 | 0.19 |
| Total | ***2016-2017*** | 957 | 56 | 649 | 372 | 204 |
| Average | n=349 | 2.74 | 0.16 | 1.86 | 1.07 | 0.58 |
| Total | ***2015_2016*** | 149 | 9 | 79 | 47 | 16 |
| Average | n=72 | 2.07 | 0.13 | 1.1 | 0.65 | 0.22 |
| Total | ***2014_2015*** | 444 | 18 | 152 | - | - |
| Average | n=89 | 4.99 | 0.2 | 1.71 | - | - |
| Total | ***2013-2014*** | 100 | 35 | 39 | 31 | 16 |
| Average | n=36 | 2.78 | 0.97 | 1.08 | 0.86 | 0.44 |

***Horse riders***

Table 3 above also shows the number of horses observed during Hooded Plover site checks, with 0.86 horses per visit over the past five seasons (note this is only a snapshot of use) and of these, around half are using the beach above the high tide mark.

The introduction of a permit system (around 2010/2011) for engaging with Rundell's Mahogany Trail Rides led to greater opportunity to meet with the group, provide education and the local ranger and BirdLife Australia would liaise each season with the group to reinforce permit conditions and understanding of the birds' needs. This dramatically changed behaviour of the group, whereby they had previously ridden in the dunes and on the upper beach within nesting territories, they slowly began to change their behaviour over time. It must be noted however that this group still breach their permit conditions to date, for example, taking larger groups in than authorised (see Mahogany Trail Rides Facebook post December 21st 2017). Monitoring and enforcing the permit is an ongoing task. Past efforts to hold information sessions with recreational trail riding groups have not been as successful. They have resulted in rangers and volunteers being intimidated and talked over, making it a challenging and unsafe environment for education. A permit system and investment in inductions with riders, liaison ahead of each season and compliance monitoring are all critical components of successfully changing this group's behaviour toward riding in the habitat of a highly threatened, disturbance-prone species.

In conclusion, while BirdLife Australia has evidence of improved beach user behaviour in areas where we have been most active and a resultant increase in breeding success rates, there have been multiple barriers identified to improving the social uptake of management interventions for the species in the BCR. These are:

- The lack of regulations within the reserve. Currently there is no capacity to adequately regulate high impact recreational activities in the reserve, nor to enforce these.
- Low compliance with dog leashing signage around critical breeding areas. Volunteers and BirdLife staff frequently observe off-leash dogs chasing nesting birds and running through nesting sites (see Appendix 1).
- Reports of beach user aggression and vandalism of fences and signs, as well as destruction of nests.
- Low awareness and ownership of the issue by high-impact beach user groups such as dog walkers and horse riders. This is despite investment in educational events, ranger patrols, access to publications about the species, and repeated exposure to educational messaging on signage. Unfortunately the public consultation phase for the Draft Management Plan has seen a small group of angry dog walkers and horse riders critiquing, denying and deflecting all evidence around threats posed to the Hooded Plover by dogs and horses. Denial of a problem acts as an immediate barrier to change within this group.

## Key management theme #4: Managing in partnership:

- We strongly support the first goal in this chapter: "Coordinated management of the Reserve enables efficiencies in program delivery and is supported by consistent land status and regulations". We however think that the strategies that aim to achieve this are flawed. The plan recommends retaining the fragmented management across the City of Warrnambool, Moyne Shire Council and Parks Victoria and leaving the Reserve under the Crown Lands (Reserves) Act. The Reserve should become a park under the National Parks Act due to its significant environmental, threatened species and cultural heritage values. This is a recommendation of the Victorian National Parks Association.
- We do not support the current 5 and 10 year reviews of implementation of the plan. These are too long a time frame for threatened species likely to be impacted by the plan. A one to two yearly review cycle is required. Ten years for example is the average longevity of a Hooded Plover, and if the plan has failed to protect this nationally threatened species, a ten year time frame could spell a lifetime of breeding failure for birds within the Reserve.
- We strongly support goals to ensure that "Traditional Owners caring for their Country is an integral part of the Reserve's management" and that "Community skills, knowledge and assistance provide stewardship and help in that management". However, if commercial racehorse training is retained inside the Reserve, their efforts would continue to offer a band-aid solution instead of tackling the source of threats. It is likely that community groups who have been rehabilitating the coastal environment within the Reserve, partaking in citizen science projects including bird monitoring, and who actively erect fences and signs around vulnerable Hooded Plover breeding sites, will be demoralised if this management plan does not adequately address EXTREME threats to the assets they invest heavily in protecting. For example, the Friends of the Hooded Plover invested 5,700 hours to volunteering in 2017 (across the entire region Warrnambool to Portland), which equates to around $170,000 in in-kind investment.
- Page 74 mentions Friends of the Hooded Plover Far West Victoria. This could be expanded to:
  Friends of the Hooded Plover (FoHP) Far West Victoria is a group of volunteers established by BirdLife Australia from 2010, who monitor the Hooded Plovers and other beach-nesting birds within the reserve, collecting data on their breeding success and carrying out a threat

assessment on each visit to breeding sites. This enables scientists at BirdLife Australia to evaluate breeding data in relation to the threat environment and investment into threat mitigation. The group set up protective signage and fencing around vulnerable nesting and chick sites as per best practice protocols and operate under multiple permit and ethics approvals given the sensitive nature of working with a threatened species. Volunteers with the group also educate beach users while out on the beach monitoring, as well as help at community events such as dogs' breakfasts and school visits/excursions. FoHP Far West Victoria work closely with land managers and with other FoHP groups across the Victorian and South Australian coast in an integrated recovery program for the Hooded Plover. The group were finalists in the Victorian Coastal Awards 2014 for their contribution to the Natural Environment and have been nominated for a Victorian Coastal Award for Biodiversity Conservation in 2018.

## Key management theme #5: Research and monitoring:

- We strongly support this chapter's goal and strategies and most of the indicators to be used to evaluate the effectiveness of the management plan. However, the plan fails to explain how it will lower the EXTREME risk presented by commercial racehorse training revealed in the table on page 29.
- This section needs to also reflect the indicator species and monitoring that has been outlined in Chapter 5 (page 34) including biannual shorebird counts, biennial beach-nesting bird population counts, Hooded Plover breeding success monitoring coupled with site-based threat assessments. It should also be stated that all monitoring data needs to be adequately analysed, evaluated and management adapted to improve outcomes in target populations.

**Thank you for the opportunity to provide feedback on the Draft Management Plan for the Belfast Coastal Reserve. If you wish to discuss any part of our submission in further detail, please contact Dr Grainne Maguire, Program Leader – Coastal Birds, BirdLife Australia National Office.**

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## References

Adams, A.L. and Purnell, C. (2016). Orange-bellied Parrots (*Neophema chrysogaster*): Review of current and alternative survey methods. Unpublished report for the Department of Environment, Land, Water and Planning by BirdLife Australia.

Antos, M. J., Ehmke, G.C., Tzaros, C.L. and Weston, M.A. (2007). Unauthorised human use of an urban coastal wetland sanctuary: Current and future patterns. Landscape and Urban Planning 80: 173–183.

Arnberger, A. and Eder, R. (2008). Assessing user interactions on shared recreational trails by long-term video monitoring. Managing Leisure 13: 36-51.

Arnberger, A., Brandenburg, C. and Eder, R. (2005). Dog walkers as management challenge in urban forests. In P. Neuhöferová, (Ed.), Management of Urban Forests Around Large Cities (pp. 3-5.). Czech University of Agriculture, Prague.

Baird, B. and Dann, P. (2003). The breeding biology of Hooded Plovers, *Thinornis rubricollis*, on Phillip Island, Victoria. Emu 103: 323-328.

Beintema, A. J. and Visser, G. H. (1989) Growth parameters in chicks of Charadriiform birds. Ardea 77: 169–180.

Bergstrom, P. W. (1991). Incubation temperatures of Wilson's plovers and killdeers. Condor 91: 634-641.

Brickner, I. (2000). The impact of domestic dogs (Canis familiaris) on wildlife welfare and conservation: a literature review. With a situation summary from Israel. Thesis, Tel Aviv University, Israel.

Bridson, L. (2000). Minimising visitor impacts on threatened shorebirds and their habitats. Conservation Advisory Science Notes No. 301. Department of Conservation, Wellington.

Bulla, M., Cresswell, W., Rutten, A.L., Valcu, M. and Kempenaers, B. (2015). Biparental incubation-scheduling: no experimental evidence for major energetic constraints. Behavioural Ecology 26: 30 – 37.

Burger, J. (1981). Effects of human disturbance on colonial species, particularly gulls. Colonial Waterbirds 4: 28–36.

Burger, J. (1986). The effect of human activity on shorebirds in two coastal bays in the northeastern United States. Environmental Conservation 13: 123-130.

Burger, J. (1991). Foraging behavior and the effect of human disturbance on the Piping Plover *(Charadrius melodus)*. Journal of Coastal Research 7: 39-52.

Cairns, W. E. and MacLaren, I. A. (1980). Status of the Piping Plover on the east coast of North America. American Birds 34: 206-208.

Coombes, E.G., Jones, A.P. and Sutherland, W.J. (2008). The biodiversity implications of changes in coastal tourism due to climate change. Environmental Conservation 35(4):319-330.

Cousens, R., Kennedy, D., Maguire, G. and Williams, K. (2013). Just how bad are coastal weeds? Assessing the geo-eco-psycho-socio-economic impacts. Rural Industries Research and Development Corporation (RIRDC) Publication No. 13/032. Canberra. Australia.

Craig, D. P., Stern, M. A., Mingo, K. A., Craig, D. M. and Rosenberg, G. A. (1992). Reproductive ecology of the western Snowy Plover on the south coast of Oregon. Submitted to Oregon Department of Fish and Wildlife, Roseburg, OR, and Coos Bay District, Bureau of Land Management, North Bend, OR. 13 pp plus tables and maps.

Cribbin, A. C. M. (2012). An assessment of the efficacy of using conditioned aversion of foxes to the eggs of beach-nesting birds; a broad scale test. Honours Thesis. Deakin University, Melbourne, Australia.

Cuttriss, A., Maguire, G.S., Ehmke, G. and Weston, M.A., 2015. Breeding habitat selection in an obligate beach bird: a test of the food resource hypothesis. Marine and Freshwater Research, 66(9), pp.841-846.

Defeo, O., McLachlan, A., Schoeman, D.S., Schlacher, T.A., Dugan, J., Jones, A., Lastra, M. and Scapini, F. (2009). Threats to sandy beach ecosystems: a review. Estuarine, Coastal and Shelf Science 81: 1-12.

Diamond, J.M. (1989). Nine hundred kiwis and a dog. Nature 338: 554.

Dodge. F. (2003). Factors that mediate compliance to temporary beach closures: refining a technique to manage human disturbance of shorebirds. Honours Thesis. Deakin University, Melbourne, Australia.

Dowding, J. E. and Davis, A. M. (2007). New Zealand dotterel (Charadrius obscurus) recovery plan, 2004–14. Threatened Species Recovery Plan 58. Department of Conservation, Wellington. 28 p.

Dowling, B. and Weston, M., A. (1999). Managing a breeding population of the Hooded Plover *Thinornis rubricollis* in a high-use recreational environment, Bird Conservation International 9: 255-270.

Ehmke, G., Maguire, G.S., Bird, T., Ierodiaconou, D. and Weston, M.A., 2016. An obligate beach bird selects sub-, inter-and supra-tidal habitat elements. Estuarine, Coastal and Shelf Science, 181, pp.266-276.

Flemming, S. P., Chiasson, R. D., Smith, P. C., Austin-Smith, P. J. and Bancroft, R. P. (1988). Piping plover status in Nova Scotia related to its reproductive and behavioral responses to human disturbance. Journal of Field Ornithology 59: 321-330.

Garnett, S., Szabo, J. K., and Dutson, G. (2011). The Action Plan for Australian Birds 2010. Birds Australia, CSIRO publishing, Collingwood.

Glover, H.K., Weston, M.A, Maguire, G.S., Miller, K.K. and Christie, B.A. (2011). Towards ecologically meaningful and socially acceptable buffers: Response of shorebirds in Victoria, Australia, to human disturbance. Landscape and Urban Planning 103: 326-334.

Hanisch, D. (1998). Effects of human disturbance on the reproductive performance of the Hooded Plover. Unpubl. BSc. Honours thesis, University of Tasmania.

Hansen, B.D., Clemens, R.S., Gallo-Cajiao, E., Jackson, M.V., Kingsford, R.T., Maguire, G.S., Maurer, G., Milton, D.A., Rogers, D.I., Weller, D.R., Weston, M.A., Woehler, E.J., Fuller, R.A. (2018) Shorebird monitoring in Australia: a successful long-term collaboration among citizen scientists, governments and researchers. In 'Monitoring Threatened Species and Ecological Communities', Editors: Legge, S.,

Henry, S. (2006). Dogs on Beaches: Barriers to compliance with dog regulations on Victorian beaches with regard to beach-nesting bird conservation. Unpublished Honours Thesis, The University of Melbourne, Melbourne.

Hoopes, E. M. (1993). Relationships between human recreation and Piping Plover foraging ecology and chick survival. M.S. Thesis. University of Massachusetts, Amherst, Massachusetts. 106pp.

Ikuta, L.A. and Blumstein, D.T. (2003). Do fences protect birds from human disturbance? Biological Conservation 112: 447–452.

Jimenez, J. E., Conover, M. R. and Messmer, T. A. (2001). Exclusionary methods to reduce predation on ground-nesting birds and their nests. Logan: Utah State University, Berryman Institution Publication No. 20.

Lafferty, K. (2001). Disturbance to wintering western Snowy Plovers. Biological Conservation 101: 315-325.

Lafferty, K. D., Goodman, D. and Sandoval, C. P. (2006). Restoration of breeding by Snowy Plovers following protection from disturbance. Biodiversity and Conservation 15: 2217–2230.

Lambert, A. and Ratcliff, B. (1979). A survey of Piping Plovers in Michigan. Report located at the Michigan Department of Natural Resources, Lansing. 36 pp.

Lindenmayer, D.B., Robinson, N.M., Scheel, B.C., Southwell, D.M., Wintle, B.A. CSIRO Publishing: Clayton South, Victoria.

Loegering, J. P. and Fraser, J. D. (1995). Factors affecting Piping Plover chick survival in different brood-rearing habitats. Journal of Wildlife Management 59: 646-655.

Lord, A., Waas, J. R. and Innes, J. (1997). Effects of human activity on the behaviour of northern New Zealand Dotteral *Charadrius obscurus aquilonius* chicks. Biological Conservation 82: 15-20.

Lord, A., Waas, J. R., Innes, J. and Whittingham, M. J. (2001). Effects of human approaches to nests of northern New Zealand dotterels. Biological Conservation 98: 233-240.

Maguire, G. S. (2008). A practical guide to managing beach-nesting birds in Australia. Birds Australia, Melbourne, Australia.

Maguire, G.S., Miller, K.K., Weston, M.A. and Young, K. (2011). Being beside the seaside: Beach use and preferences among coastal residents of south-eastern Australia. Ocean & Coastal Management 54: 781-788.

Maguire, G.S., Rimmer, J.M. and Weston, M.A. (2013). Stakeholder perceptions of threatened species and their management on urban beaches. Animals 3: 1002–1020.

Maguire, G., Cullen, M. and Mead, R. (2014). Managing the Hooded Plover in Victoria: A site by site assessment of threats and prioritisation of management investment on Parks Victoria managed land. Report to Parks Victoria. BirdLife Australia, Carlton, Victoria.

Maguire, G.S., Rimmer, J.M. and Weston, M.A. (2015). Stakeholder knowledge of threatened coastal species; the case of beach-goers and the Hooded Plover *Thinornis rubricollis*. Journal of Coastal Conservation 19: 73–77.

Maguire, G.S., Miller, K.K. and Weston, M.A. (in press). Only the strictest rules apply: investigating regulation compliance on beaches to minimize invasive dog impacts on threatened shorebird populations. Chapter in 'Impacts of Invasive Species on Coastal Environments: Coasts in Crisis'. Journal of Coastal Research, Springer.

Murphy, R. K., Greenwood, R. J., Ivan, J. S. and Smith, K. A. (2003) Predator exclusion methods for managing endangered shorebirds: Are two barriers better than one? Waterbirds 26: 156–159.

Mueller, N. S. (1982) Chick shelters decrease avian predation in Lead tern colonies on Nantucket Island, Massachusetts. J. Field Ornith. 53: 58–60.

Natt, V. and Weston, M. A. (1995). The results of the 1994 Hooded Plover *Thinornis rubricollis* survey for South Australia. The Stilt 27: 36-8.

Page, G. W. (1988). Nesting success of Snowy Plovers in central coastal California in 1988. Report of the Point Reyes Bird Observatory, Stinson Beach, CA. 7 pp.

Page, G.W., Warriner, J., S., Warriner, J., C. and Halbeisen, R., M. (1977). Status of the Snowy Plover on the northern California coast. Part I: Reproductive timing and success. California Department of Fish and Game Nongame Wildlife Investigations, Sacramento, CA. 6 pp.

Persons, P. E. (1995). Western Snowy Plover population size and nesting success in 1994 at Vandenberg Air Force Base, California. A monitoring report prepared for U.S. Fish and Wildlife Service, Ventura, CA. 21 pp.

Retallick, R. W. R. and Bolitho, E. E. (1993). Disturbance of Hooded Plovers by domestic dogs. Stilt 23: 23.

Sastre, P., Ponce, C., Palacín, C., Martín, C.A. and Alonso, J.C. (2009). Disturbances to great bustards (Otis tarda) in central Spain: human activities, bird responses and management implications. European Journal of Wildlife Research 55 (4): 425-432.

Schlaepfer, M.A., Runge, M.C., Sherman, P.W. (2002). Ecological and evolutionary traps. Trends in Ecology and Evolution 17: 474-480.

Schlacher, T. A., Richardson, D. and McLean, I. (2008). Impacts of off-road vehicles (ORVs) on Macrobenthic Assemblages on Sandy Beaches. Environmental Management 41: 878-892.

Schlacher, T.A., Schoeman, D.S., Jones, A.R., Dugan, J.E., Hubbard, D.M., Defeo, O., Peterson, C.H., Weston, M.A., Maslo, B., Olds, A.D., Scapini, F., Nel, R., Harris, L.R., Lucrezi, S., Lastra, M., Huijbers, C.M., and Connolly, R.M. (2014). Metrics to assess ecological condition, change, and impacts in sandy beach ecosystems. Journal of Environmental Management 144: 322-335.

Schlacher, T.A., Hutton, B.M., Gilby, B.L., Porch, N., Maguire, G.S., Maslo, B., Connolly, R.M., Olds, A.D., Weston, M.A. (2017). Algal subsidies enhance invertebrate prey for threatened shorebirds: A novel conservation tool on ocean beaches? Estuarine, Coastal and Shelf Science (2017) doi: 10.1016/j.ecss.2017.04.004.

Schmidt, T. (2017). An assessment of determining survival and fate of hooded plover chicks using radio-tags. Honours Thesis, Deakin University, Burwood, Victoria.

Schneider, T.J. (2013). The use of Victoria's sandy shores by domestic dogs (Canis familiaris). Honours Thesis. Deakin University. Melbourne, Australia.

Schulz, M. (1992). Hooded Plover - Flora and Fauna Guarantee Action Statement No. 9.

Schulz, M. and Bamford, M. (1987). The Hooded Plover - An RAOU conservation statement. RAOU Report 35.

Sime, C.A. (1999). Domestic dogs in wildlife habitats. In: Joslin G, Youmans H (coordinators) Effects of recreation on Rocky Mountain wildlife: A review for Montana committee on effects of recreation on wildlife, Montana Chapter of the Wildlife Society, pp. 8.1–8.17.

Stoyle, M. G. (2002). A report on the 2002 breeding season at the Little Tern colony, Beacon Lagoons Nature Reserve Eastington, East Yorkshire. Yorkshire, UK: Spurn Bird Observatory Trust.

Szabo, J.K., Butchart, S.H.M, Possingham, H.P., Garnett, ST. T. (2012). Adapting global biodiversity indicators to the national scale: A Red List Index for Australian birds. Biological Conservation 148: 61-68.

Taborsky M. (1988). Kiwis and Dog Predation: Observations in Waitangi State Forest. Notornis 35: 197-203.

Taylor, K., Anderson, P., Taylor, R., Longden, K. and Fisher, P. (2005). Dog access and nature conservation. English Nature Research Report (No. 649), English Nature.

Taylor, E.C., Green, R.E. and Perrins, J. (2007). Stone-curlews *Burhinus oedicnemus* and recreational disturbance: developing a management tool for access. Ibis 149: 37–44.

Taylor, G.F., Marsden, I.F. and Hart, D.E. (2012). Management of vehicle and horse users on sand beaches: Implications for shellfish populations.

U.S. Fish and Wildlife Service. (1996). Piping Plover *(Charadnus melodus),* Atlantic Coast Population, Revised Recovery Plan. Hadley, Massachusetts. 258 pp.

U.S. Fish and Wildlife Service. (2007). Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (*Charadrius alexandrinus nivosus*). In 2 volumes. Sacramento, California. xiv + 751 pp.

Visser, G. H and Ricklefs, R. E. (1993a) Temperature regulation in neonates of shorebirds. The Auk 110: 445–447.

Visser, G. H. and Ricklefs, R. E. (1993b) Development of temperature regulation in shorebirds. Physiol. Zool. 66: 771–791.

Welty, J. C. (1982). The life of birds. Saunders College Publishing, Philadelphia, Pennsylvania. 754 pp.

Weston, M.A. (2000). The effect of human disturbance on the breeding biology of Hooded Plovers. Ph.D. Thesis. Victoria: University of Melbourne, Melbourne, Australia.

Weston, M. A. (2003). Managing the hooded plover in Victoria: A review of existing information. Parks Victoria Technical Series No. 4. Parks Victoria, Melbourne, Australia.

Weston M. A. and Elgar M. A. (2005). Disturbance to brood-rearing Hooded Plover *Thinornis rubricollis*: responses and consequences. Bird Conservation International 15: 193-209.

Weston, M.A. and Elgar, M.A. (2006). Parental care in Hooded Plovers (*Thinornis rubricollis*). Emu 105: 283 - 292.

Weston, M. A. and Morrow, F. (2000). Managing the Hooded Plover in western Victoria. Threatened Bird Network report to Parks Victoria, Melbourne.

Weston, M.A., Ehmke, G. C. and Maguire, G. S. (2009). Manage on beach or two? Movements and space-use of the threatened hooded plover (*Thinornis rubricollis*) in south-eastern Australia. Wildlife Research 36: 289-298.

Weston, M. A., Ehmke, G. C., and Maguire G. S. (2011). Nest Return Times in Response to Static Versus Mobile Human Disturbance. Journal of Wildlife Management 75(1): 252–255.

Weston, M.A., Dodge, F., Bunce, A., Nimmo, D.G. and Miller, K.K. (2012). Do temporary beach closures assist in the conservation of breeding shorebirds on recreational beaches? Pacific Conservation Biology 18: 47-55.

Weston, M.A., Ekanayake, K.B., Lomas, S., Glover, H.K., Mead, R.E., Cribbin, A., Tan, L.X.L., Whisson, D.A., Maguire, G.S. and Cardilini, A.P.A. (2017). Case studies of motion-sensing cameras to study clutch survival and fate of real and artificial ground-nests in Australia, Bird Study DOI: 10.1080/00063657.2017.1387517

Wills, D. E., Murray, J. and Powlesland, R. G. (2003). Impact of management on the breeding success of the northern New Zealand dotterel (*Charadrius obscurus aquilonius)* on Matakana Island, Bay of Plenty. Notornis 50: 1–10.

Williams, K.J.H., Weston, M.A., Henry, S. and Maguire, G.S. (2009). Birds and beaches, dogs and leashes: Dog owners sense of obligation to leash dogs on beaches in Victoria, Australia. Human Dimensions of Wildlife 14: 89-1013.

Woolington, M. C. (1985). A preliminary investigation of the effect of recreational use on nesting Snowy Plovers at Sutton and Siltcoos beach areas, Oregon. Oregon Department of Fish and Wildlife Nongame program. 37 pp.

Yalden, D. W. and Yalden, P. E., (1990) Recreational disturbance of breeding Golden Plovers *Pluvialis apricarius*. Biological Conservation 51: 243-262.

Yasue, M. and Dearden, P. (2008). Parental roles of Malaysian Plovers during territory acquisition, incubation and chick-rearing. Journal of Ethology 26: 99 – 112.

**Appendix 1.** Photos of threats to Hooded Plovers with nests and chicks. The photos below include a selection taken by staff and volunteers, plus images from remote nest cameras (Scoutguard images) left in situ two metres from nests to monitor nest fates over the 28-day incubation period (permit # 10004991 (2009-2013), 10007212 (2014-2017) and current permit 10008428 (to Aug 2020)).

Golfies – dog in fenced area

Golfies - dog in fenced area

Towilla – dog in fenced area

Pelicans – dogs off lead at point opposite fence

Pelicans – dogs off lead next to fenced area

Pelicans – dogs off lead next to fenced area

Pelicans – five dogs off lead, 1 on lead

Pelicans – dogs running, about to chase flock Sanderling

Dog approaching fence, owners in distance

Dog in fenced area, owners in distance


Gormans – dog off leash on water's edge, owner distant


Gormans – dog off leash enters nesting area


Gormans – dog off leash runs around nesting area


Gormans – dog off leash runs around nesting area


Killarney midway to Basin - Hoodie on nest (image 1)


Killarney midway to Basin - Dog runs over nest crushes 2 of 3 eggs (image 2)

Rusty Rocks – chick (image 1)

Rusty Rocks – dog off lead approaches (image 2)

Mills Reef – bird on nest (image 1)

Mills Reef – dog running near nest (image 2)

Mills Reef (woodbine rd) – dog by nest

Mills Reef (woodbine rd) - Dog and owner

Mills Reef (woodbine rd) – position nest


Golfies - Dog off lead upper beach


Gormans East


Campground west


Mills Reef – dog knocked camera


Mills reef – dog knocked camera near nest


Mills Reef – camera knocked over


Mills reef – different dog near camera


Mills Reef – dog near camera that was on nest


Basin point – dog at camera

Basin Point - dog off lead around fenced nesting area

Basin Point – dog off lead around fenced area

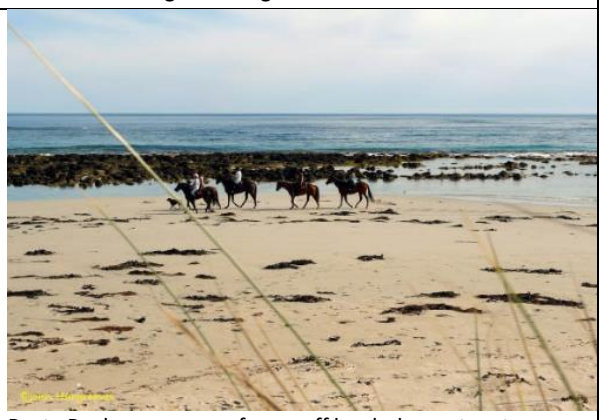
Basin Point – more dogs off lead passing fenced area

Basin Point - walker & dogs off lead passing fenced area

Basin Point – dogs roaming around fenced area

Basin Point – dogs roaming around fenced area

Basin Point – dog roaming around fenced area


Rusty Rocks – common for an off leash dog or two to accompany recreational riders

Gormans Rd – bird on nest (image 1)

Gormans Rd – bird off nest, off leash dog passing by (image 2)

***Photos of illegal vehicles/trail bikes on beach and of vehicle damage on beaches and dunes (taken by staff and remote cameras).***

Gormans - Vehicle on beach passing nest at night

Gormans - Vehicle on beach passing nest at night

Gormans nest – vehicle on beach at night


Basin

Rutledges - Trail bike (photo Chris Tzaros)


Gormans nest - Trail bike at water's edge

Rutledges estuary

Rutledges estuary

Basin West

Gormans

Rutledges, tracks near nest (photo John Amor)

Rutledges

Towilla

Towilla

Rutledges

Levy's dune near Rutledges

Rusty rocks

Basin east

| | |
|---|---|
|  Basin east |  Rutledges |
|  Rutledges heading east along entire Levys stretch |  Rutledges heading west |
|  Basin east |  This photo was taken by Grainne Maguire at Rutledge's Cutting on 7/03/2018 |

Levys beach

Levys beach

Levys beach

Levys beach

***Photos of horses ridden on upper beach/base dune within nesting zones and at Cutting edge (this location has been identified as the most valuable winter foraging site for Hooded Plovers), taken by Grainne Maguire.***


Basin point in nest zone (remote camera)

Towilla to Gormans

| | |
|---|---|
|  Towilla to Basin |  Rusty rocks |
|  Basin west |  Basin east |
|  Levys beach |  Levys beach |

| | |
|---|---|
|  Levys beach |  Levys beach |
|  Rutledges cutting |  Rutledges cutting |
|  Basin east |  Basin east (4WD track & horse prints upper beach) |

**Appendix 2.** 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 Victorian coastline, and the temporal distribution, over the next five years, 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 |
|---|---|---|---|---|---|
| ***Human-related threats*** | | | | | |
| 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 – illegal access | 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) | Highly localised | Seasonal peaks |
| Weed: Marram Grass | Loss or modification of habitat (i) | H | High (5) | Widespread | Constant |
| Beach cleaning and kelp harvesting | Crushing of eggs or chicks (d); collisions with and death of adults (d); disturbance (i); loss or modification of habitat (i) | H, R, S | High (5) | Absent (PV beaches) | Absent (PV beaches) |
| 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 |
| Stock (cattle, sheep, goats, camels) | Crushing of eggs or chicks (d); modification of habitat (i) | R, H | High (4) | Absent (PV beaches) | Absent (PV beaches) |
| Feral deer | Crushing of eggs or chicks (d); modification of habitat (i) | R, H | High (4) | Highly localised | Constant |
| Cats (feral and domestic) | Depredation of eggs, chicks or adults (d) | R, S | High (4) | Localised | Constant |
| Vehicles on beaches – SLSCs | Crushing of eggs or chicks (d); collisions with and death of adults and juveniles (d); disturbance (i) | R, S | High (4) | Localised | Constant, seasonal peaks |
| Weed: Sea Spurge | Loss or modification of habitat (i); increased likelihood of nest depredation (i) | H | High (4) | Localised | Constant |
| Weed: Sea wheat-grass | Loss or modification of habitat (i); increased likelihood of nest depredation (i) | H | 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) | Localised | Constant |

| SOURCE OF THREAT | IMPACT (D= DIRECT, I=INDIRECT) | LIFE STAGE (H=HABITAT, S= ADULT SURVIVAL, R=REPRO. SUCCESS) | SEVERITY (RATING) | SPATIAL DISTRIBUTION | TEMPORAL DISTRIBUTION |
|---|---|---|---|---|---|
| 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) | Localised | Constant, seasonal peaks |
| Driftwood removal | Crushing of eggs or chicks (d); disturbance (i); loss or modification of habitat (i) | H, R | High (3) | Localised | Occasional |
| Introduced rodents | Depredation of eggs and newly-hatched chicks (d) | R | Moderate (2) | Highly localised | Constant |
| Vehicles on beaches – land manager access | Crushing of eggs or chicks (d); collisions with and death of adults and juveniles (d); disturbance (i) | R, S | Low * (1) | Localised | Constant |
| Vehicles (air) | Disturbance (i) | R | Low (1) | Localised | Constant |
| Vehicles (water) | Disturbance (i) | R | Low (1) | Localised to launching sites | Constant |
| ***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 (4) | 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 |

| Source of threat | Impact (d= direct, i=indirect) | LIFE STAGE (H=HABITAT, s= ADULT SURVIVAL, R=REPRO. SUCCESS) | Severity (RATING) | spatial distribution | temporal distribution |
|---|---|---|---|---|---|
| Avian predators: Other | Depredation of eggs (d); crushing of eggs (e.g. Emus) (d) | R | Low (1) | Localised | 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 |

**Appendix 3.** Photos of Hooded Plover flocks using Rutledges Cutting in winter (photos Glenn Ehmke, Toni Ryan, Grainne Maguire).

## Appendix 4 Reviews of dog and horse impacts relevant to beach-nesting birds and their ecology

### Recreationists with dogs

In November 2012, 155 satellite trackers were placed on dog collars ('igotu' loggers) in a voluntary participation project comparing the movement of dogs in on-leash and off-leash areas along the Bellarine Peninsula and Surf Coast (Schneider 2013). On average dogs spend half an hour on the beach during a given walk, travel ~850 metres from an access point and in this distance, cover 2.5 kilometres of beach in their zigzag movements. On average, dogs run into the dunes from the beach 1.5 times per walk. A key finding of this study was that there was no significant difference in the space use by dogs on on-leash and off-leash beaches because on on-leash beaches the majority of dogs were off-leash (i.e. regulations were not effectively minimizing dog movements).

The greater use of the upper beach and dune means that there is a higher likelihood of dogs off lead crushing eggs and chicks and potentially depredating the eggs and chicks they encounter. Domestic dogs have been known to partially or entirely destroy shorebird nests, including those protected with symbolic fencing (e.g. Western Snowy Plover nests, cited in U.S. Fish and Wildlife Service 2007; experimental beach-located nests, Weston *et al.* 2012; Hooded Plover nests, B. Baird pers. comm., T. Ryan pers. comm.; BirdLife Australia remote camera data 2010-2011).

The predatory impacts of domestic dogs are documented for birds worldwide, including devastating impacts on threatened species populations (Taborsky 1988; Diamond 1989; Genovesi and Duprae n.d. in Brickner 2000). Dogs have been observed eating Hooded Plover eggs (Hanisch 1998; T. Ryan pers. comm.), and eating model (quail) eggs from artificial nests mimicking Hooded Plover nests on beaches (Stojanovic unpublished data 2007; Weston *et al.* 2012; Cribbin 2012).

While records of chick fates are rare (as observers are rarely present when the chicks die), there have been five observations of chicks at different beaches being chased and killed by off leash dogs (Mornington Peninsula x 2, Fleurieu Peninsula x 3; BirdLife Australia database 2013-2018). In addition, necropsies on four Hooded Plover chick bodies have revealed dog attack and trauma/haemorrhaging as the cause of death (Rod Collins Deakin University unpublished necropsies 2014-2018). One of these necropsied chicks was the subject of a radio-tracking study where Tom Schmidt, the Deakin University researcher, tracked the signal to a rubbish bin at the beach entry point, to find the body of the chick hidden at the bottom of the bin in a bag of dog faeces (Schmidt 2017). Unleashed dogs have also been observed killing Piping Plover chicks (Cairns and McLaren 1980; U.S. Fish and Wildlife Service 1996) and New Zealand Dotterel chicks (Wills *et al.* 2003).

Domestic dogs are known to chase adult beach-nesting birds (Retallick and Bolitho 1993; Weston and Morrow 2000; G. Maguire pers. obsv.; G. Ehmke pers. comm.), which can lead to prolonged absences from the nest or brood. Chasing and the unpredictable movement, proximity and speed (Burger 1986; Glover *et al.* 2011) of unrestrained dogs are traits that do not promote 'habituation', the process of wildlife learning to reduce response intensities or frequencies with increasing exposure to the stimulus (Lafferty 2001; Sastre *et al.* 2009). Rather, these attributes promote 'sensitization', or enhanced response frequencies or intensities with increasing exposure to stimuli (Glover *et al.* 2011).

Walkers accompanied by dogs often evoke greater responses from ground-dwelling birds than people alone (Sime 1999; Lord *et al.* 2001; Taylor *et al.* 2007; Sastre *et al.* 2009). Glover *et al.* (2011) showed that of eight shorebirds tested, stimulus type (walker, jogger, walker with leashed dog) significantly influenced Flight Initiation Distance (FID) of three species (another two approached significance). Excluding joggers, all three species had the highest FID when approached by a person

with a leashed dog, rather than by a walker. Lambert and Ratcliff (1979) and Taylor *et al.* (2005) suggest that it is likely that dogs are seen by ground-dwelling birds as much more of a threat than people, as dogs are more likely to catch and kill them or their chicks.

Western Snowy Plovers flushed more frequently and remained off their nests longer when a person was accompanied by a dog than when alone (Page *et al.* 1977). Adult Piping Plovers and their chicks ceased feeding 52 % of the time when dogs were within 50 m compared to 31 % when people were within the same proximity (Hoopes 1993). Hoopes (1993) also found that the response distance of Piping Plovers was greater for dogs (46 m) compared with people (23 m), and that the reacting birds moved more than double the distances and remained away from the nest longer when disturbed by dogs compared to people. Similarly, Yalden and Yalden (1990) found that breeding plovers in the United Kingdom flushed from the nest at greater distances when a walker was accompanied by a dog. Lord *et al.* (2001) studied the impact of three treatment types (walking, running or leading a dog) on northern New Zealand Dotterels and found that people who were accompanied by a dog caused the greatest level of disturbance in terms of flush distance, length of time away from the nest and distraction display intensity.

On Victorian beaches, 18-19% of encounters with Hooded Plover nests or broods (0.47 per hour) involved dogs (Weston and Elgar 2005a, 2007). The highest frequencies of Hooded Plover nest absences were in response to people accompanied by unleashed dogs (Weston and Elgar 2007). Hooded Plovers appear to respond with higher rates of nest absences in response to encounters with unleashed dogs compared to leashed dogs. Incubating Hooded Plovers left the nest in 21 % of encounters with leashed dogs, similar to that for encounters with walkers, while 38.4 % of encounters with a walker accompanied by an unleashed dog caused the incubating bird to leave the nest for as long as 30 minutes (Weston and Elgar 2007). Furthermore, unleashed dogs (with walkers) caused the brooding of chicks to cease on 51.4 % of encounters, compared with 33.3 % for leashed dogs (Weston and Elgar 2005a). This suggests that the birds differentially perceive the behaviour of dogs rather than their mere presence, and that off-leash movement is perceived as a greater threat.

Unrestrained dogs roam within coastal habitats perhaps more than any other stimulus type (except possibly raptors; Coombes *et al.* 2008). Of 380 coastal residents in south-eastern Australia, 36.8% owned a dog of which 93.6% took their dog to the beach (Maguire *et al.* 2011). On Australian beaches (90%, Weston and Elgar 2005a; 82%, Williams *et al.* 2009) or US beaches (93%; Lafferty 2001), the majority or at least a substantial proportion of dogs are unrestrained, and this includes areas where dogs are not permitted off-leash or at all, such as national parks (88%, 1991-98, Dowling and Weston 1999; 64%, Arnberger *et al.* 2005), recreation reserves (22%, Austria, Arnberger and Eder 2008), wetland reserves (100%; Antos *et al.* 2007) and buffers (68%, Weston *et al.* 2009). Walkers and joggers without dogs were most common on beaches in Victoria, Australia, where active Hooded Plover nests occurred (16.9% and 13.4% respectively), yet walkers and joggers accompanied by unleashed dogs occupied more levels of the beach. Thus, in at least many parts of the world, wildlife most frequently encounter free-roaming dogs regardless of prevailing local regulations (Natt and Weston 1995; Dowling and Weston 1999; Weston 2003; Lafferty *et al.* 2006; U.S. Fish and Wildlife Service 2007; Weston *et al.* 2012).

Dodge (2003) revealed that 20 % of dog owners were non-compliant with Hooded Plover protective signage and fencing, and 99 % of this non-compliance was through not leashing their dog. In New Zealand, Bridson (2000) discovered that most people thought that dogs were a threat to breeding New Zealand Dotterels, including those that regularly walked their dogs at the beach. Between 68-78 % of respondents thought that dogs should be excluded from 'wildlife refuge' beaches, but largely because of the disruption this caused to their own recreational experience. More than 90 % of respondents believed in fining dog owners in breach of regulations, however, many thought that

only owners of 'big dogs', uncontrolled dogs or those caught chasing birds should be prosecuted (Bridson 2000). In her interviews with dog owners from coastal Victoria, Henry (2006) discovered that the majority of respondents did not feel obliged to leash their dogs at the beach. This was potentially explained by conflicting values about wildlife conservation, human recreation and dog access to beaches, the commonly held belief that people's own dog(s) are less of a threat to beach-nesting birds than dogs in general, and a strong belief that unleashed exercise is beneficial for dog health (Williams *et al.* 2009). Several external barriers to compliance were identified, including the social influence of beaches generally being perceived by the broader dog-owner community as a good place for unleashed dogs, lack of provision of information about the threats that dogs pose to beach-nesting birds, lack of, or at least lack of awareness, of designated off-leash areas and lack of enforcement. Enforcement of dog regulations on beaches by the managing agencies is often lax or non-existent (Weston 2003; U.S. Fish and Wildlife Service 2007).

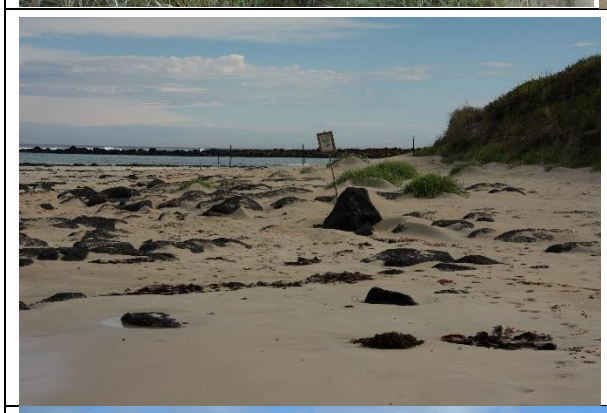
**Recreationists on horses**

Horses ridden on beaches and dunes can have direct impacts on the breeding success of beach-nesting birds (Maguire 2008). 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; 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 heavy, hoofed animals, also have an impact on the physical habitat. If ridden in the dunes, they contribute to heavy erosion, and when ridden on the soft sand of the beach, leave craters that make chick navigation across the beach difficult (Weston 2003).

Horses have crushed and disturbed Western Snowy Plover nests (Point Reyes Bird Observatory unpubl. data; Page 1988; Persons 1995; Craig *et al.* 1992; Woolington 1985), and Snowy Plovers are consequently more likely to fly away from approaching horses (Page 1988; Lafferty 2001). Horses ridden along the base of the foredune have been observed to crush Hooded Plover nests in western Victoria (Maguire pers. obsv.). Furthermore, on horse beaches between Warrnambool and Narrawong VIC, only 7% of eggs have fledged chicks successfully (7 chicks from 96 eggs, 12 pairs). This is almost half that of horse-free beaches in this same section of coast (13 chicks from 99 eggs, 9 pairs; Maguire *et al.* 2014).

Horses trample beach infauna such as shellfish (Taylor *et al.* 2012). Only one study exists regarding this, from New Zealand and which investigated horses and Surf Clams. On average, horse riding resulted in 36.9% mortality within a single hoof print. Extrapolative modelling predicted that the long-term presence of horse riders (and vehicles) would be highly detrimental to shellfish. Shellfish, and other beach infauna, form important parts of food webs on beaches so processes which disrupt these constitute stressors to beach ecologies (Defeo *et al.* 2008; Schlacher *et al.* 2008).

**Appendix 5.** Photos of the beach habitat within Belfast Coastal Reserve which highlight how narrow the area is (photos Grainne Maguire).




PLEASE KEEP CLEAR
Sensitive Shorebird Nesting Area

**Appendix 6.** A summary of the interactions between volunteers and beach users recorded during monitoring visits and reported via the MyBeachBird portal to BirdLife Australia's Hooded Plover database 2006-2018. Cells highlighted grey are within the Belfast Coastal Reserve. Detailed comments have been removed from this version for confidentiality reasons, but originals were supplied to Parks Victoria.

| Site name | Year | Positive & Effective | Negative/ behaviour unchanged | Type of user |
|---|---|---|---|---|
| Warrnambool Levys | 2006-07 | 1 | | horse rider |
| Warrnambool Levys | 2006-07 | | 1 | dog walker |
| Warrnambool Levys | 2006-07 | 1 | | horse rider |
| Warrnambool Levys | 2006-07 | | 1 | dog walker |
| Killarney Basin West | 2007-08 | | 1 | dog walker |
| Killarney Pelican point | 2007-08 | | 1 | dog walker |
| Port Fairy Mills Reef | 2007-08 | 1 | 1 | dog walker |
| Port Fairy Mills Reef west | 2007-08 | 1 | | fishermen |
| Warrnambool Levys W | 2007-08 | 1 | | horse rider |
| Warrnambool Levys W2 | 2007-08 | | 1 | horse rider |
| Warrnambool Levys W2 | 2007-08 | | 1 | horse rider |
| Warrnambool Levys W3 | 2007-08 | | 1 | horse rider |
| Killarney | 2008-09 | 1 | | horse rider |
| Killarney Basin West 1st | 2008-09 | 1 | | walker |
| Port Fairy Mills Reef West | 2008-09 | | 1 | dog walker |
| Golf Ball Beach, Port Fairy | 2009-10 | | 1 | dog walker |
| Killarney | 2009-10 | 1 | | walker |
| Killarney | 2009-10 | 1 | | dog walker |
| Killarney | 2009-10 | | 1 | dog walker |
| Killarney | 2009-10 | | 1 | dog walker |
| Rutledge Cutting | 2009-10 | 1 | | school group |
| Rutledge Cutting | 2009-10 | 1 | | walker |
| Rutledge Cutting | 2009-10 | | 1 | dog walker |
| Rutledge Cutting | 2009-10 | | 1 | dog walker |
| Rutledge Cutting | 2009-10 | 1 | | dog walker |
| Rutledge Cutting | 2009-10 | | 1 | dog walker |
| Rutledge Cutting | 2009-10 | | 1 | dog walker |
| Rutledge Cutting | 2009-10 | 1 | | walker |
| Rutledge Cutting | 2009-10 | | 1 | dog walker |
| Rutledge Cutting | 2009-10 | 1 | | vehicle |
| Rutledge Cutting | 2009-10 | | 1 | dog walker |
| Rutledge Cutting | 2009-10 | | 1 | dog walker |
| Boat Ramp West | 2010-11 | 1 | | dog walker |
| Boat Ramp West | 2010-11 | 1 | | sunbather |
| Killarney | 2010-11 | 1 | | bird watchers |
| Mills Reef West | 2010-11 | 1 | | shell collectors |

| Site name | Year | Positive & Effective | Negative/ behaviour unchanged | Type of user |
|---|---|---|---|---|
| Old Log Beach | 2010-11 | 1 | | dog walker |
| Killarney Boat Ramp 2 (east of point) | 2013-14 | | 1 | dog walker |
| Killarney Camping Ground West | 2013-14 | | 1 | dog walker |
| Killarney Pelicans | 2013-14 | 1 | | dog walker |
| Tower Hill Gormans Rd Far West | 2013-14 | 1 | | dog walker |
| Tower Hill Rutledges Cutting West Pt | 2013-14 | 1 | | dog walker |
| Killarney Basin Boat Ramp (East) | 2014-15 | | 1 | dog walker |
| Killarney Basin Rusty Rocks 2 (point) | 2014-15 | | 1 | dog walker |
| Killarney Boat Ramp 3 (Point) | 2014-15 | 1 | | dog walker |
| Killarney Camping Ground West | 2014-15 | 1 | | walker |
| Killarney Camping Ground West | 2014-15 | | 1 | dog walker |
| Killarney Camping Ground West | 2014-15 | 1 | | bird watchers |
| Killarney Camping Ground West | 2014-15 | | 1 | dog walker |
| Killarney Camping Ground West | 2014-15 | | 1 | dog walker |
| Killarney Camping Ground West | 2014-15 | 1 | | dog walker |
| Killarney Camping Ground West | 2014-15 | | 1 | walker |
| Killarney Camping Ground West | 2014-15 | 1 | | walker |
| Killarney Camping Ground West | 2014-15 | | 1 | surfer |
| Killarney Camping Ground West | 2014-15 | | 1 | dog walker |
| Port Fairy Mills Reef East (Golf Course) | 2014-15 | 1 | | horse rider |
| Port Fairy Mills Reef East (Golf Course) | 2014-15 | 1 | | dog walker |
| Port Fairy Mills Reef East (Golf Course) | 2014-15 | | 1 | dog walker |
| Port Fairy Mills Reef Far West | 2014-15 | 1 | | dog walker |
| Tower Hill Gormans Rd West | 2014-15 | 1 | | dog walker |
| Tower Hill Gormans Rd West | 2014-15 | 1 | | sunbather |
| Tower Hill Gormans Rd West | 2014-15 | | 1 | dog walker |
| Tower Hill Gormans Rd West | 2014-15 | 1 | | school group |
| Tower Hill Rutledges Cutting West Pt | 2014-15 | | 1 | dog walker |
| Tower Hill Towilla East (Seachange) | 2014-15 | | 1 | dog walker |

| Site name | Year | Positive & Effective | Negative/ behaviour unchanged | Type of user |
|---|---|---|---|---|
| Tower Hill Towilla East (Seachange) | 2014-15 | 1 | | horse rider |
| 100m west of campground | 2015-16 | 1 | | dog walker |
| Killarney Basin Rusty Rocks 2 (point) | 2015-16 | | 1 | dog walker |
| Killarney Old Log Beach 1 (west end) | 2015-16 | 1 | | walker |
| Killarney Old Log Beach 1 (west end) | 2015-16 | 1 | | dog walker |
| Port Fairy Mills Reef East (Golf Course) | 2015-16 | | 1 | dog walker |
| Port Fairy Mills Reef East (Golf Course) | 2015-16 | | 1 | horse rider |
| Port Fairy Mills Reef Far West | 2015-16 | 1 | | dog walker |
| Port Fairy Mills Reef West | 2015-16 | 1 | | dog walker |
| Tower Hill Gormans Lane East | 2015-16 | 1 | | dog walker |
| Tower Hill Gormans Rd West | 2015-16 | 1 | | horse rider |
| Tower Hill Rutledges Cutting (mouth) | 2015-16 | 1 | | dog walker |
| Tower Hill Rutledges Cutting (mouth) | 2015-16 | | 1 | dog walker |
| Tower Hill Towilla East (Seachange) | 2015-16 | 1 | | walker |
| Tower Hill Towilla East (Seachange) | 2015-16 | | 1 | horse rider |
| Killarney W Camp Ground 1 | 2016-17 | | 1 | dog walker |
| Killarney Boat Ramp 1 (west of point) | 2017-18 | | 1 | dog walker |
| Killarney Boat Ramp 2 (east of point) | 2017-18 | | 1 | dog walker |
| Killarney Boat Ramp 3 (Sisters Pt) | 2017-18 | 1 | | fishermen |
| Killarney Boat Ramp 3 (Sisters Pt) | 2017-18 | | 1 | dog walker |
| Killarney E Midway | 2017-18 | 1 | | nurdler (collecting nurdles) |
| Killarney E Reef Pt East Side (Old Log 2) | 2017-18 | 1 | | dog walker |
| Killarney E Reef Pt East Side (Old Log 2) | 2017-2018 | 1 | | walker |
| Killarney E Reef Pt East Side (Old Log 2) | 2017-18 | 1 | | playing games/beach tent |
| Killarney W Camp Ground 1 | 2017-18 | 1 | | dog walker |
| Killarney W Camp Ground 2 (West) | 2017-18 | 1 | | dog walker |
| Port Fairy East Beach (Golfies) | 2017-18 | | 1 | dog walker |
| Port Fairy Mills Reef (Point) | 2017-18 | | 1 | dog walker |
| Port Fairy Mills Reef (Point) | 2017-18 | 1 | | dog walker |

| Site name | Year | Positive & Effective | Negative/ behaviour unchanged | Type of user |
|---|---|---|---|---|
| Port Fairy Mills Reef East | 2017-18 | | 1 | playing games/beach tent |
| Tower Hill Basin Boat Ramp (East Side 1) | 2017-18 | 1 | | nurdler (collecting nurdles) |
| Tower Hill Basin Boat Ramp (East Side 1) | 2017-18 | | 1 | dog walker |
| Tower Hill Gormans Lane West | 2017-18 | | 1 | dog walker |
| Tower Hill Rutledge Cutting East 2 (Spinifex) | 2017-18 | | 1 | dog walker |
| Tower Hill Rutledge Cutting East 3 Turnaround | 2017-18 | 1 | | dog walker |
| Tower Hill Rutledge Cutting West Pt | 2017-18 | 1 | | horse riders |
| Tower Hill Towilla East (Seachange) | 2017-18 | | 1 | dog walker |
| Tower Hill Towilla East (Seachange) | 2017-18 | 1 | | nurdler (collecting nurdles) |
| Warrnambool Levys E Shellys | 2017-18 | 1 | | nurdler |
| Warrnambool Logans beach | 2006-07 | 1 | | dog walker |
| Warrnambool Logans beach | 2006-07 | 1 | | walker |
| Port Fairy time and tide | 2007-08 | 1 | | dog walker |
| Port Fairy time and tide | 2007-08 | 1 | | dog walker |
| Warrnambool Logans whale | 2007-08 | 1 | | surfer |
| Port Fairy time and tide | 2008-2009 | 1 | | walker |
| Warrnambool Logans Chows | 2008-09 | 1 | | dog walker |
| Warrnambool Logans Saddle | 2008-09 | 1 | | collecting firewood |
| Logans Beach | 2009-10 | 1 | | dog walker |
| Logans Beach | 2009-10 | 1 | | dog walker |
| Logans Beach | 2009-10 | 1 | | fishermen |
| Port Fairy | 2009-10 | 1 | | walker |
| Pt Fairy | 2009-10 | | 1 | dog walker |
| Time and Tide 1 | 2010-11 | | 1 | dog walker |
| Logans beach | 2011-12 | | 1 | dog walker |
| Point Richie | 2013-14 | | 1 | dog walker |
| Port Fairy South Beach (Main) | 2013-14 | 1 | | dog walker |
| Warrnambool Logans Platform | 2013-14 | 1 | | dog walker |
| Warrnambool Logans Saddle 1 | 2013-14 | 1 | | dog walker |
| Warrnambool Logans Saddle 1 | 2013-14 | | 1 | dog walker |
| Goose Lagoon Ab Farm Drain Bay East 1 (Drain) | 2014-15 | | 1 | walker |

| Site name | Year | Positive & Effective | Negative/ behaviour unchanged | Type of user |
|---|---|---|---|---|
| Point Richie | 2014-15 | 1 | | dog walker |
| Warrnambool Hopkins Mouth East | 2014-15 | 1 | | fishermen |
| Port Fairy Time and Tide 1 (main) | 2015-16 | 1 | | dog walker |
| Port Fairy Time and Tide 1 (main) | 2015-16 | 1 | | dog walker |
| Port Fairy Time and Tide 3 (far west end) | 2015-16 | 1 | | dog walker |
| Port Fairy Time and Tide 3 (far west end) | 2015-16 | 1 | | walker |
| Warrnambool Logans Quinns Access | 2015-16 | 1 | | walker |
| Port Fairy South Beach (Powling St) | 2016-17 | 1 | | walker |
| Port Fairy East Beach (Tip Site) | 2017-18 | 1 | | dog walker |
| Port Fairy East Beach (Tip Site) | 2017-18 | | 1 | dog walker |
| Port Fairy South Beach (Main) | 2017-18 | 1 | | walker |
| Port Fairy South Beach (Powling St) | 2017-18 | 1 | | walker |
| Port Fairy Time and Tide 1 (main) | 2017-18 | 1 | | dog walker |
| Warrnambool Logans Platform East | 2017-18 | | 1 | dog walker |
| Warrnambool Logans Reef | 2017-18 | | 1 | Dog walker |
| Warrnambool Pt Ritchie | 2017-18 | 1 | | dog walker |
| Warrnambool Pt Ritchie | 2017-18 | 1 | | dog walker |