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Managing the Hooded Plover in Victoria

A Review of Existing Information

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Managing the Hooded Plover in Victoria: a Review of Existing Information

Michael A. Weston

Birds Australia

November 2003

Executive Summary

- Counts of Hooded Plovers in Victoria have ranged from 334 to 538 birds, forming 11.1-17.9% of the estimated eastern population of 3000. More or less conservative estimates of the total population give different values i.e., 6.7- 29.9%.
- It is estimated that 88.2% (396) of adults in Victoria occur on Parks Victoria land. This means Parks Victoria manages land holding more Hooded Plovers than any other land manager in Victoria.
- Hooded Plovers are widely distributed across Parks Victoria sites, with no Park or Reserve holding more than 9.4% of the State's population, and no Park or Reserve holding more than 10.6% of the population found on Parks Victoria land.
- Those sites holding more than 5.0% of the State population (i.e. 5.7% of the Parks Victoria population) are: Discovery Bay Coastal Park, Eumeralla (Yambuk) Coastal Reserve, Mornington Peninsula National Park, San Remo –Pt Smythe Coastal Reserve, Nooramunga Marine and Coastal Park, Mcloughlins Beach - Seaspray Coastal Reserve, and Croajingolong National Park.
- Available survey protocols are reviewed, and it is concluded that the best survey protocol is to add an autumn count to the existing biennial counts, and improve the methodology of the biennial counts. This survey protocol is presented in detail.
- Eight sources of threat (risk) were identified, and these acted in nineteen different ways. Most threats reduce reproductive success, with relatively few acting on flying birds.
- Some risks are localised while others are widespread. The site-by-site distribution of risks is presented. Across the Parks Victoria estate, four risks have high impacts relative to those of other risks. These are humans, introduced predators, habitat modification and domestic dogs.
- Seven kinds of management are available, and they constitute 111 specific management actions. Management techniques are categorised according to site-specificity and threat-specificity, cost, effectiveness and potential for disruption to breeding birds. The effectiveness of 69.4% (77) of management techniques is unknown because they have not been tested. In total, 29.7% (33) have been shown to be effective, and 0.9% (1) has been shown to be ineffective. Twenty one management

techniques would benefit many pairs of Hooded Plovers, and 20 management techniques are applicable to more than one risk.

- Apart from vehicle management which is implemented to some extent in every coastal park or reserve, 68 relevant management actions are currently being implemented on Parks Victoria land, and at least one management action is being implemented at 52.1% of Parks Victoria sites.
- Management options and their implications are presented for each site. Like the site-by-site variation in risks, suitable management options vary from one site to the next. Predator and visitor management are the most broadly applicable options, and the options focussing on the management of humans, dogs and introduced predators are expected to confer the greatest benefit to Hooded Plover populations. Current management options for habitat and native predators are not highly effective.
- The managements presented could be used to stabilise existing populations, or to increase them to pre-1980 levels. The merits of these two approaches are discussed.
- Significant amounts of information on the Hooded Plover are unpublished. There is a great deal of published information, but only a small proportion is highly relevant to conservation and management of the species. There is a growth in major published studies, indicating that more information on managing and conserving Hooded Plovers will become available.
- A critical review of the available information suggests that 1) populations are declining because of low breeding success, and 2) habitat is likely to limit the amount of breeding.
- Fourteen research needs are identified to address the critical information gaps. These research needs are prioritised, and five are deemed to be most important. Of these, only two focus specifically on unknowns about the species (chick fate and factors influencing territory stability); the remainder examine the effectiveness of management techniques.

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Chapter 1 – Introduction to the Hooded Plover

SUMMARY

This chapter describes the appearance, habitat and basic life history of the Hooded Plover. The current Victorian and National conservation status of the species is presented. Counts of Hooded Plovers in Victoria have ranged from 334 to 538 birds, forming 11.1-17.9% of the estimated eastern population of 3000.

The Hooded Plover *Thinornis rubricollis* (after Christidis & Boles 1993) is a medium sized plover endemic to Southern Australia (Marchant & Higgins 1993). Its closest living relative is the Endangered New Zealand Shore Plover *T. novaeseelandiae*, a species which is now confined to the Chatham Islands (Marchant & Higgins 1993).

IDENTIFICATION

Adult Hooded Plovers are distinctive. They have pink legs, red orbital rings, a black head, predominantly grey upperparts and white underparts. The bill has a black tip and an orange-red base. Importantly, the nape (the area at the back of the neck) is white. Inexperienced observers have mistaken Ruddy Turnstones *Arenaria interpres* for Hooded Plovers (Cameron & Weston 1999, R. Johnstone pers. comm.).

Juvenile (post-fledging) Hooded Plovers are basically grey versions of adults. They lack the bright eye ring, and the red at the base of the bill is diffuse and dull. Juveniles can be mistaken for Double-banded Plovers *Charadrius bicinctus*, Sanderling *Calidris alba*, and the vagrant Ringed Plover *Charadrius hiaticula* (Marchant & Higgins 1993, Cameron & Weston 1999). For less experience observers, the key to differentiating juvenile Hooded Plovers from other grey beach-dwelling wading birds is the white nape of the juvenile Hooded Plover.

Unattended Hooded Plover chicks can be confused with the chicks of beach-breeding Red-capped Plovers *Charadrius ruficapillus*. However, Hooded Plover chicks can be identified by the presence of a white nape.

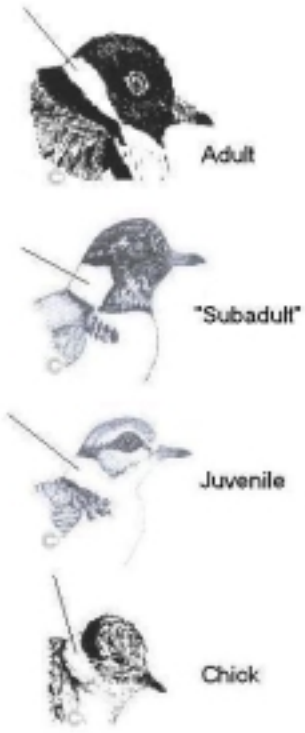
An identification guide indicating the white nape in all age-classes is shown in Figure 1.1 (reproduced here from Weston & Paton 2001).

HABITAT

In Western Australia the species makes extensive use of salt-lakes, some of which are hundreds of kilometres inland (Newbey 1996, Singor 1999). However, in eastern Australia, Hooded Plovers are largely confined to high-energy ocean beaches (Marchant & Higgins

1993). Thus, in Victoria, the species is almost exclusively confined to a narrow strip of coastal habitat.

In coastal areas of Victoria, Hooded Plovers spend a great deal of time on the beach. They prefer wide beaches, and appear to have a preference for beaches with beach-cast seaweed (Marchant & Higgins 1993). However, Hooded Plovers also forage on rocky areas (e.g., at Point Franklin, Otway National Park, MAW pers. obs.).



Adult: Black head, orange/red eye ring, white nape, grey upperparts, white underparts, reddish legs.

"Subadult": Mostly black head with distinct grey and white flecks, dull orange/red eye ring, white nape, grey upperparts, white underparts, reddish/grey legs.

Juvenile: Grey head, dull eye ring, white nape, grey upperparts, white underparts, grey legs.

Chick: appearance changes with age. Young chicks downy, highly patterned, white nape. Older chicks resemble juveniles.

Figure 1.1. The white nape which occurs in all age-classes of Hooded Plovers. This useful cue helps inexperienced observers identify Hooded Plovers from other superficially similar shorebirds. The figure is reproduced here, with permission, from Weston & Paton (2001) – K. Bartram was the illustrator.

BREEDING BIOLOGY

There has been a recent upsurge in the knowledge of Hooded Plover breeding biology, some of which has been published (e.g., Dowling & Weston 1999, Weston & Morrow 2000, Weston 2000a) but much of which is yet to be published. Notably, Victorian studies, including those conducted by Parks Victoria, lead the way in understanding and managing breeding populations of Hooded Plovers.

Hooded Plovers nest in solitary pairs, and defend breeding territories (Marchant & Higgins 1993). They have a protracted breeding period, with nests in Victoria being found at least

from August to March (Dowling & Weston 1999). Thus, they breed for at least eight months of the year.

Hooded Plovers lay two or three eggs, and occasionally lay one or four eggs (Weston *et al.* 1998). Their nests are usually simple scrapes on the beach or in nearby dune areas (Marchant & Higgins 1993). In eastern Australia, they almost exclusively nest on or adjacent to ocean beaches, with very occasional nests up creek mouths (e.g., at Harmers Haven, MAW pers. obs.) and in near-coastal lakes (e.g., Lake Victoria, Point Lonsdale, J.M. Pratt pers. comm.). Thus, most Hooded Plover nests are on the beach, in the foredunes or in the dunes (Weston 2000a). Only in Western Australia do they commonly nest in inland areas (Marchant & Higgins 1993, Newbey 1996, Singor 1999). This species has an unusually long incubation period (*c*. 26-28 days, Weston 2000a) thus exposing the eggs to a high risk of failure (Lane 1987). Like most other shorebirds, chicks leave the nest almost as soon as they hatch and are able to start feeding immediately (Marchant & Higgins 1993). Chicks are thought to fledge at about 35 days after hatching, at which time they often leave their natal territory (Marchant & Higgins 1993, Weston 2000a).

The nest and chick periods are the major periods of mortality (Dowling & Weston 1999, Weston 2000a). Adult survival seems high, and adults are probably long-lived (Baker-Gabb & Weston 2001, Weston 2000a).

FEEDING ECOLOGY

Foraging ecology is an essential component of the life history of a bird. Little is known of the foraging ecology of the Hooded Plover (Marchant & Higgins 1993) despite some early work conducted at Wilsons Promontory National Park (Schulz *et al.* 1984). The analysis of some foraging and dietary research based on faecal samples (Sova & Weston 1998) is currently underway, and a paper on the foraging behaviour of the species on salt-lakes in Western Australia has been published (Weston & Elgar 2000). Bear (2000) examined diet and prey distribution in Tasmania, and J. Chapple is currently doing honours research on foraging ecology in Tasmania (P. Park in litt.).

Basically, Hooded Plovers feed at all levels of the beach, from the water's edge to the base of the foredune (Schulz *et al.* 1984). They sometimes feed in the foredunes and even the dunes, where single adults, pairs and even flocks have been recorded foraging (MAW unpubl. data). They eat a wide variety of invertebrates, and flotsam and jetsam (see Marchant & Higgins 1993). The presence of beach-washed seaweed seems to be an important component of their habitat and foraging ecology, with rotting seaweed providing food for invertebrates which plovers then prey upon (see Marchant & Higgins 1993).

CONSERVATION STATUS - VICTORIAN

In Victoria, the Hooded Plover is listed as Threatened under Schedule 2 of the *Flora and Fauna Guarantee Act 1988* and an Action Statement has been prepared for the species (Schulz 1992). The Flora and Fauna Guarantee (FFG) scientific committee responsible for determining the appropriate conservation status for the species, concluded that the Hooded Plover is:

- Significantly prone to future threats which are likely to result in extinction, and
- Very rare in terms of abundance and distribution.

CONSERVATION STATUS - NATIONAL

The national conservation status of the Hooded Plover is in a state of flux. The Hooded Plover was formerly listed as Rare (Garnett 1993). In January 2000 the species was removed from the federal *Endangered Species Act* on the basis that secure populations occur in western Australia (M. Delahunt in litt.). Thus, the species was not listed as threatened under the new federal *Environment Protection and Biodiversity Conservation Act* ([EPBC] 2000).

A number of factors may mean that the national conservation status of the Hooded Plover should be reinstated and probably upgraded (i.e., changed to a more threatened level). These considerations have arisen as a result of an increased level of knowledge about the species. This new information stems from recent and in some cases unpublished studies. The factors that may lead to an upgrading of conservation status are:

1. A range contraction in eastern Australia has been recognised (Blakers *et al.* 1984), but there had been no examination of the extent of contraction until Cameron & Weston (1999) reviewed historical records from New South Wales and Queensland. This review suggested that a range contraction of over 900 km in the first half of the 20th century had occurred. This estimate was higher than previous uncritical estimates. However, McAllan (in press) has criticised the treatment of historical reports by Cameron & Weston (1999), leading to a lively debate about the extent of range contraction (Weston in press).
2. Population decline had not been recognised, however a population decline has been demonstrated in at least one section of the Victorian coast (Weston 1993).
3. Wading bird population experts had cast doubt on the current estimate of the total population size (5000 birds, Watkins 1993) due to the lack of data on the western populations of Hooded Plovers, which were suspected to have been underestimated. Recent population estimates in WA (Newbey 1996, Singor 1999) have produced

estimates from Western Australia in line with previous estimates. Thus, the current population estimate seems realistic, and not an underestimate.

4. Low reproductive success had been suspected for some time, but only anecdotal accounts were available (e.g., Schulz & Bamford 1987, Lane 1987). Several recent studies have uncovered poor reproductive success (Dowling & Weston 1999, Weston 2000a, Weston & Morrow 2000, B. Baird pers. comm., P. Kambouris pers. comm.).

5. No subspecies are currently recognised, but Marchant & Higgins (1993) detailed some morphological and plumage differences between eastern and western Australian birds, suggesting that two subspecies exist. Critically, conservation status is applied at the subspecies level (Garnett 1993). Changes in subspecific taxonomy will probably mean the conservation status of the species, and the subspecies, will have to be reassessed at the national level (M. Delahunt in litt.).

6. One state authority in the Hooded Plovers range, New South Wales, has classified the species as Critically Endangered, and recently a State Recovery Plan has been prepared (Baker-Gabb & Weston 2001). Currently only about 70 Hooded Plovers remain in New South Wales (Baker-Gabb & Weston 2001).

In a recent, comprehensive review of the conservation status of Australia's birds, Garnett & Crowley (2000) reclassified the conservation status of Hooded Plovers. Importantly, they recognised two subspecies – an eastern and a western form (after Mathews 1913-14). The eastern form, which is the only subspecies that occurs in Victoria, was classified as Vulnerable. It is possible that the new conservation status classifications of Garnett & Crowley (2000) will be adopted under the EPBC Act in their entirety (S.T. Garnett pers. comm.). Failing this, there are plans to renominate the Hooded Plover for listing under the EPBC Act (by MAW).

THE IMPORTANCE OF VICTORIAN POPULATIONS

The number of birds counted on the AWSG biennial counts in Victoria since 1980 has varied from 334 to 538 birds (Weston & Morrow 2000, Weston & Paton 2001). If the most recent population estimate is used (Garnett & Crowley 2000), Victoria has held 11.1% to 17.9% of the estimated eastern population. More or less conservative estimates of the total population (Table 1.1) give different values, ranging from 6.7% to 29.9%.

Table 1.1. Previous total national population estimates of Hooded Plovers.

Estimate (number of birds)	Source
1800	Lane (1987)
2500	Newman & Patterson (1984)
5000	Bransbury (1983)
5000	Watkins (1993)
3000	Garnett & Crowley (2000)[a]

[a] Eastern subspecies only

Chapter 2 – The Need for Strategic Management of the Hooded Plover

SUMMARY

Hooded Plovers and their managers are widely dispersed. Managers have limited resources and a multitude of management decisions to make about this species. It is essential that management actions be directed at sites where they are most needed, and at the most critical issues.

Hooded Plovers are widely dispersed along the coast of Victoria. Similarly, those responsible for on-the-ground management of the species and its habitat are also dispersed. Threatening processes for the species could be localised, or there may be general threats operating over most or all of the habitat in Victoria. The widespread, low-density distribution of this species represents a challenge for managers, who have limited resources and a multitude of management decisions to make about this species.

Hooded Plovers occur at a number of sites managed by Parks Victoria. The importance of each of these sites to the statewide conservation of Hooded Plovers is not well understood by Parks Victoria. Parks Victoria undertakes a number of management actions at sites in Victoria where Hooded Plovers are known to occur. These actions are intended to help conserve Hooded Plovers, and include predator control and visitor management.

Management actions require resources, and preclude those resources from being used elsewhere. It is essential that management actions be directed at sites where they are most needed, and at the issues most critical to the sites where actions are directed. To ensure management actions intended to conserve the Hooded Plover are effective, it is essential that resources are directed to priority issues at the most important sites.

Parks Victoria needs to understand the factors threatening Hooded Plover populations, and the effectiveness of different management techniques in minimising these threats so management actions can be planned to help ensure survival of Hooded Plovers across the State.

This report is intended to provide strategic direction to Parks Victoria, both at the level of the site, and across the Parks Victoria estate. This report also identifies information gaps and research needs for effective management of the Hooded Plover in Victoria.

DEVELOPMENT OF A STRATEGIC MANAGEMENT APPROACH

A body of information exists on Hooded Plovers, largely collected by groups such as Birds Australia, the Australasian Wader Study Group (AWSG), the Phillip Island Nature Park, the Little Tern Taskforce, private individuals and Parks Victoria staff. This information includes estimates of population size, distribution, site usage, breeding success and survival in relation to management actions. Although some of this information has been analysed and published, there remains a need for thorough synthesis of what is known about Hooded Plovers across the state.

This project gathers together existing information to give an understanding of the contribution that different populations make to the conservation of Hooded Plovers in Victoria. This report examines what is known about survival and breeding success of Hooded Plovers at sites where different management techniques have been applied and discusses the usefulness of those different techniques for the conservation of the species. This report will also identify gaps in the current knowledge base so future research can be directed towards collecting information needed to manage Hooded Plovers in Victoria.

FACTORS TO BE CONSIDERED IN A STRATEGIC APPROACH

A number of factors need to be considered when developing a practical strategic approach to Hooded Plover management.

Factors which threaten Hooded Plovers need to be identified, so management techniques can be developed or applied to address these. Therefore, all threats need to be identified (Chapter 8). The spatial distribution of these threats, and the risk they pose to Hooded Plover conservation also need to be identified (Chapters 8 and 9).

The number of birds affected by a threatening process or a management action is also an important consideration. For example, some management actions may benefit only one pair of Hooded Plovers while at another site the same management may have benefits for a number of pairs. In order to provide information on the population of Hooded Plovers at different Parks Victoria sites, and across the Parks Victoria estate, the distribution of Hooded Plovers is presented on a site-by-site basis (Chapters 3 and 4).

The management techniques available need to be documented. The effectiveness of these techniques under different circumstances needs to be determined as far as possible given the current level of understanding (Chapters 11 and 12).

Many management techniques address particular threatening processes. For example, increased public awareness may reduce disturbance but is unlikely to reduce depredation by

foxes. This, combined with the possible spatial variation in threatening processes, means that the spatial distribution of suitable management actions needs to be determined (Chapter 13).

Finally, information gaps and research needs are identified as part of the strategic approach to managing Victoria's Hooded Plovers (Chapters 14, 15 and 16).

PROJECT OBJECTIVES

The objectives of this project were developed by Parks Victoria. The objectives of this project are:

1. To improve Parks Victoria's understanding of the contribution each Parks Victoria Land management unit (site) makes to the conservation of Hooded Plovers.
2. To improve Parks Victoria's understanding of factors that affect survival and breeding success of Hooded Plovers.
3. To improve the understanding of the effectiveness of different management techniques in enhancing survival and breeding success of Hooded Plovers.
4. To improve the understanding of the threatening processes affecting Hooded Plovers at each site, and across the Parks Victoria estate, and determining the relative risks posed by those threatening processes at each site, and across all land managed by Parks Victoria.
5. To identify gaps in information needed to improve management of Hooded Plovers.
6. To provide consistent approaches to the management of Hooded Plovers across all land managed by Parks Victoria, particularly in relation to population monitoring.

Chapter 3 – The Importance of Parks Victoria Managed Land to the Victorian Population of Hooded Plovers

SUMMARY

The information currently available on the distribution of Hooded Plovers across land tenures is limited. This chapter estimates the proportion of Victorian Hooded Plovers that occur on Parks Victoria managed land. Overall, 88.2% (396) of adults occurred on Parks Victoria land. This means Parks Victoria manages land supporting more Hooded Plovers than any other land manager in Victoria.

The management of coastal lands in Victoria is complex. In 1994, there were about 160 separate agencies, municipalities and Committees of Management involved in running the coast, acting under 29 separate acts of Parliament (Birrell 1994).

Nearly 96% of the Victorian coast is in public ownership, and about 50% is managed under the *National Parks Act 1975* (Victorian Coastal Council 1997). In 1994, 30% of the Victorian coast was in National Parks, 40% in other parks and reserves, 20% was under the control of Committees of Management, 6% was managed by the Commonwealth Government and Port authorities, and 4% was in private hands (Birrell 1994).

Hooded Plovers occur on a variety of land tenures in Victoria. However, the distribution of Hooded Plovers across land tenures is poorly known despite considerable effort at counting Hooded Plovers. This is because:

- some boundaries between land tenures are difficult or impossible to determine in the field (Weston & Morrow 2000),
- most counters are volunteers without access to GPS technology (Weston & Morrow 2000),
- some volunteer counters may not perceive such information as important (MAW pers. obs.),
- count sections are usually arranged on the basis of logistics (e.g., access, length of section), and therefore often do not correspond with discrete units of coastal management, and;
- maps have not normally been supplied with data sheets.

Traditionally, the biennial count data has been pooled within eleven broad sections of coast (e.g., Table 3.1). This provides little information about the distribution of the species across land tenures.

This chapter estimates the proportion of Hooded Plovers occurring on land managed by Parks Victoria.

Table 3.1. The number (adults plus juveniles) of Hooded Plovers counted along the Victorian coast, 1996-2000 (after Weston & Paton 2001).

Section	1996	1998	2000
NSW Border – Point Hicks	12	40	22
Point Hicks – Marlo	20	18	15
Marlo – 90 Mile Beach	27	38	62
McLaughlin's Beach – Snake Is.	30	33	-
Wilsons Promontory	1	5	5
Darby River - San Remo	73	66	68
Phillip Is.	11	11	22
Point Leo - Point Nepean	49	58	42
Queenscliff – Cape Otway	16	16	33
Cape Otway – Warrnambool	14	19	23
Warrnambool – SA Border	81	114	131
TOTAL	334	418	423

TERRITORY VERSUS TENURE

All Hooded Plover territories include the beach, the intertidal zone and adjacent dunes. The beach is sometimes used for nesting, but is used for foraging by adults and chicks. The intertidal zone is used for foraging by adults and chicks. The dunes are sometimes used for nesting and are the most important hiding place for chicks.

Coasts are essentially linear, and many land tenures on the coast are defined in a linear fashion based on height data (e.g., mean tidal heights). For example, Barwon Coast Committee of Management has jurisdiction to the high tide mark (W. Chapman in litt.). Thus, many Hooded Plover territories include at least two types of land tenure. For the purposes of this report, Parks Victoria managed land is defined as any coastal land that may contain part or all of a Hooded Plover territory.

PUBLISHED INFORMATION ON THE DISTRIBUTION OF HOODED PLOVERS ACROSS LAND TENURES

Lane (1981) reported the results of the inaugural (1980) biennial AWSG Hooded Plover count, and determined the proportion of the State's Hooded Plover population in selected National Parks (see Table 3.2). Overall, 170 birds, or 37.1% of the Victorian population of Hooded Plovers occurred in five National Parks.

Table 3.2. The proportion of the Victorian Hooded Plover population in selected National Parks in 1980 (after Lane 1981).

Park	Percentage of Victorian population
Discovery Bay Coastal Park	7.9
Cape Schank Coastal Park (now Mornington Peninsula National Park)	1.5
Wilsons Promontory National Park	10.5
Gippsland Lakes Coastal Park	4.6
Croajingolong National Park	12.7

Of Hooded Plovers in western Victoria in late 1999, 26.3% of adults were in Discovery Bay Coastal Park, 42.9% were in Gazetted Reserves and 30.8% were in other land-tenures (Weston & Morrow 2000). If the 1998 Victorian population estimate is used (402 birds), then 11.9% of the Victorian population was in Discovery Bay Coastal Park, and 19.4% of the Victorian population was in Gazetted Reserves in western Victoria.

Watkins (1993) identifies eight Victorian "Areas of International Importance" for the species. Only one of these, Discovery Bay Coastal Park, falls completely within one type of land tenure. The park is managed by Parks Victoria.

Currently, these are the only Victorian estimates of the proportion of the population occurring in different land tenures.

AN ATTEMPT TO DETERMINE THE POPULATION OF HOODED PLOVERS IN PARKS VICTORIA MANAGED LANDS

The need to determine the proportion of Victorian Hooded Plovers that occurred in Parks Victoria managed land was identified by Urquhart (2000). The biennial AWSG counts (described by Weston & Morrow 2000) were the natural vehicle for such data collection. Thus, for the 2000 biennial count, count sheets included a column for counters to indicate whether or not particular Hooded Plovers were in Parks Victoria managed land. All counters were asked (twice) to call the Parks Victoria information line to determine the land tenure of their count sections. As a check, the data sheets asked counters to indicate whether they had done so.

Of 79 counters in the 2000 biennial count, 40.5% (32) did not record land tenure despite being requested to do so. Of these counters, 53.2% did not check with Parks Victoria as to the tenure of their count sections. Overall, 323 adults were counted by counters who recorded land tenure. Of these 80.2% (259) were on land managed by Parks Victoria.

The above estimate is the best information to date on the distribution of the species across land tenures. It emphasises the high dependence of the species on Parks Victoria managed land. However, a more complete estimate is possible, and is desirable because the distribution across land tenures is unknown for 24.4% (104) of adults counted in 2000. This estimate is presented below.

AN ESTIMATE OF THE POPULATION OF HOODED PLOVERS IN PARKS VICTORIA MANAGED LANDS

The 2000 biennial AWSG Hooded Plover count clearly failed to adequately determine the land tenures in which all Hooded Plovers were found. However, an estimate of the population residing in Parks Victoria managed land can be made retrospectively.

Procedures

Parks Victoria managed land has been identified and mapped (Appendix 3). The count sheets were checked and the land tenures through which counting occurred were retrospectively assigned to count sections. Where count sections included a variety of land tenures one of two methods were used to estimate the number of Hooded Plovers in the section managed by Parks Victoria:

1. If GPS or other locational data were available from the relevant count sheet, this was used to determine how many birds were within the section managed by Parks Victoria, or;

2. If no locational data were available, an estimate was produced based on the length of the Parks Victoria section and the overall density of birds recorded.

In the 2000 count, the Corner Inlet section was not adequately counted due to an unavailability of boats to transport counters. For Corner Inlet the most contemporary count was made in 1998 (the previous biennial count). These data are presented in Table 3.3.

Table 3.3. The number of adult Hooded Plovers counted along the Victorian coast in 2000 and the Corner Inlet (McLaughlin's Beach – Snake Island) count for 1998.

Section	1998	2000
NSW Border – Point Hicks		22
Point Hicks – Marlo		14

Section	1998	2000
Marlo – 90 Mile Beach		62
McLaughlin's Beach – Snake Is.	33	-
Wilsons Promontory		5
Darby River – San Remo		68
Phillip Is.		22
Point Leo – Point Nepean		42
Queenscliff – Cape Otway		32
Cape Otway – Warrnambool		19
Warrnambool – SA Border		130
TOTAL	402	416

The distribution across land tenures will be derived from these data i.e. the 416 adults counted in the 2000 count plus the 33 counted in Corner Inlet in 1998. This gives a total of 449 adults.

Results

Overall, 88.2% (396) of adults occurred on Parks Victoria land. This means Parks Victoria manages land supporting more Hooded Plovers than any other land manager in Victoria.

Other land management authorities are responsible for managing land holding 11.8% (53) of the Victorian population of Hooded Plovers. The distribution of these Hooded Plovers is shown in Table 3.4. Phillip Island Nature Park manages 4.9% of the State population of Hooded Plovers, making it the second most important land manager in terms of the proportion of the Hooded Plover population managed.

Table 3.4. The distribution of adult Hooded Plovers which occur outside land managed by Parks Victoria (e.g., on land managed by Shires, other management authorities or on private land).

Area	Number of adults	Percentage of birds not managed by PV
Eastern Victoria	7	13.2
Phillip Is	22	41.5
Western Victoria	24	45.3

CONCLUSION

- Overall, 88.2% (396) of adults in Victoria occurred on Parks Victoria land. This means Parks Victoria manages land supporting more Hooded Plovers than any other land manager in Victoria.

Chapter 4 – The Importance of Sites Managed by Parks Victoria to the Victorian Population of Hooded Plovers

SUMMARY

The information on the distribution of Hooded Plovers across Parks Victoria land is limited. This chapter estimates the proportion of Victorian Hooded Plovers that occur on each site managed by Parks Victoria. Hooded Plovers were widespread across sites, with no site holding more than 9.4% of the State's population.

Not all Parks Victoria sites are expected to hold the same number of Hooded Plovers, because sites vary in size, and possibly in habitat quality. Additionally, the distribution of Hooded Plovers is not uniform in Victoria (see Weston 1993). Therefore, there is a need to determine the population of Hooded Plovers occurring in each Parks Victoria site. This chapter considers the distribution of birds during the breeding season (see Chapter 15 for a justification). The non-breeding distribution will differ from the distribution during the breeding season. The non-breeding distribution is less well known compared with the breeding distribution, and the non-breeding distribution is thought to be less relevant to conservation and management of Hooded Plovers (see Chapter 15). However, it should be noted that a catastrophic event, such as an oil spill, at a major non-breeding site (e.g., Cotters Beach, Wilsons Promontory) could have serious implications if mortality is high.

DEFINITIONS

In this report, "site" refers to a management unit, such as a Coastal, Marine or National Park or other land tenures managed by Parks Victoria. This chapter defines these sites explicitly by listing all of them. In some sites, the distribution of Hooded Plovers is patchy, while in others the birds are distributed across the site.

IDENTIFYING PARKS VICTORIA MANAGED LANDS

Table 4.1 presents the sections of the coast managed by Parks Victoria. In total 138 areas were identified. These sites were derived from maps of Parks Victoria land (generated by M. Kealy), with the addition of Rigby Island (near Lakes Entrance), a recently declared reserve that is managed by Parks Victoria but does not appear on the maps (E. Roe in litt.).

Some sites have more than one area on the coast (i.e. the site has more than one distinct section of coastline interrupted by other land tenures), and some areas are not suitable

Hooded Plover habitat. These areas resolve into 48 sites that are considered to have potentially suitable habitat.

Table 4.1. Parks Victoria managed land on the coast. The easternmost and westernmost longitudes of each site are provided. The presence of suitable habitat at a site is indicated by an asterisk. The identification number of each park is provided ("ID"). Sites are listed from west to east, based on the centroid of each park.

Park Name	ID	Western Longitude	Eastern Longitude	Size (ha)	Legal Status	Region	Suitable habitat?
Discovery Bay Coastal Park	3360	140º57'52"	141º34'56"	10542.6	Other Park – Schedule 3 National Parks Act 1975	West	*
Cape Nelson State Park	3330	141º31'25"	141º33'11"	238.3	State Park – Schedule 2B National Parks Act 1975	West	
Cape Nelson Lighthouse Reserve	3770	141º32'26"	141º33'0"	29.7	Lighthouse Reserve	West	
Cape Nelson Lighthouse Reserve	3770	141º32'26"	141º32'29"	29.7	Lighthouse Reserve	West	
Narrawong Coastal Reserve	3184	141º40'28"	141º51'10"	218.6	Coastal Reserve	West	*
Eumeralla (Yambuk) Coastal Reserve	3185	141º50'47"	142º3'4"	1469.6	Coastal Reserve	West	*
Lady Julia Percy Island W.R.	414	141º59'26"	142º0'44"	146.9	Nature Conservation Reserve – Wildlife Reserve	West	
Yambuk F.F.R	347	142º4'24"	142º5'58"	147.0	Nature Conservation Reserve – Flora and Fauna Reserve	West	*
Port Fairy - Warrnambool Coastal Reserve	3187	142º14'18"	142º30'26"	2345.5	Coastal Reserve	West	*
Port Fairy Maritime Complex H.A	3718	142º14'24"	142º14'43"	6.4	Historic and Cultural Features Reserve – Historic	West	*
Port Fairy Maritime Complex H.A	3718	142º14'24"	142º14'42"	6.4	Historic and Cultural Features Reserve – Historic	West	*
Bay Of Islands Coastal Park	3358	142º34'46"	142º52'16"	885.9	Other Park – Schedule 3 National Parks Act 1975	West	*

Park Name	ID	Western Longitude	Eastern Longitude	Size (ha)	Legal Status	Region	Suitable habitat?
Peterborough Coastal Reserve	3186	142º52'12"	142º52'51"	320.6	Coastal Reserve	West	*
Port Campbell National Park	3307	142º52'48"	143º9'21"	2412.9	National Park – Schedule 2 National Parks Act 1975	West	*
Otway National Park	3315	143º9'19"	143º27'43"	12337.1	National Park – Schedule 2 National Parks Act 1975	West	*
Otway National Park	3315	143º27'34"	143º37'16"	12337.1	National Park – Schedule 2 National Parks Act 1975	West	*
Cape Otway Lighthouse Reserve	3771	143º30'11"	143º31'10"	103.0	Lighthouse Reserve	West	
Otway National Park	3315	143º30'12"	143º31'14"	12337.1	National Park – Schedule 2 National Parks Act 1975	West	*
Elliot River - Addis Bay Coastal Reserve	3188	143º37'14"	143º50'22"	268.6	Coastal Reserve	West	*
Angahook - Lorne State Park	3325	143º50'11"	144º9'55"	21302.8	State Park – Schedule 2B National Parks Act 1975	West	*
Wye River Coastal Reserve	3421	143º53'22"	143º54'20"	13.9	Coastal Reserve	West	*
Lorne - Queenscliff Coastal Reserve	3189	143º58'20"	144º22'37"	2435.1	Coastal Reserve	West	*
Lorne - Queenscliff Coastal Reserve	3189	144º22'27"	144º36'1"	2435.1	Coastal Reserve	West	*
Port Phillip Bay Coastal Reserve	3190	144º22'36"	145º0'58"	1227.3	Coastal Reserve	City & Bays	
Limeburners Lagoon (Hovells Creek) F.F.R	112	144º24'31"	144º24'57"	29.8	Nature Conservation Reserve - Flora and Fauna	City & Bays	
Limeburners Lagoon (Hovells Creek) F.F.R	112	144º24'33"	144º24'52"	29.8	Nature Conservation Reserve - Flora and Fauna	City & Bays	
Lorne - Queenscliff Coastal Reserve	3189	144º30'5"	144º30'24"	2435.1	Coastal Reserve	West	*
The Spit W.R	564	144º30'29"	144º33'17"	392.5	Nature Conservation Reserve – Wildlife	City & Bays	

Park Name	ID	Western Longitude	Eastern Longitude	Size (ha)	Legal Status	Region	Suitable habitat?
Lorne - Queenscliff Coastal Reserve	3189	144º33'49"	144º34'1"	2435.1	Coastal Reserve	West	*
Lake Connewarre W.R.	552	144º22’58"	144º30’41"	3697.2	Nature Conservation Reserve - Wildlife	City & Bays	
Harold Holt - Point Lonsdale Fisheries Res.	3437	144º36'14"	144º41'29"	328.4	Fisheries Reserve	City & Bays	*
Lonsdale Lakes W.R.	556	144º34'38"	144º36'12"	194.6	Nature Conservation Reserve - Wildlife	City & Bays	*
Point Lonsdale Jetty	10249	144º36'49"	144º36'58"	0.7	Bay Managem’t Area	City & Bays	*
Point Lonsdale Jetty	10249	144º36'51"	144º36'58"	0.7	Bay Managem’t Area	City & Bays	*
Harold Holt - Swan Bay Fisheries Res.	3434	144º37'22"	144º42'9"	2312.7	Fisheries Reserve	City & Bays	
Swan Bay - Edwards Point W.R	546	144º37'53"	144º42'36"	277.4	Nature Conservation Reserve – Wildlife	City & Bays	
Swan Bay - Edwards Point W.R	546	144º37'56"	144º42'10"	277.4	Nature Conservation Reserve – Wildlife	City & Bays	
Mornington Peninsula National Park	3290	144º38'57"	145º1'28"	2579.8	National Park – Schedule 2 National Parks Act 1975	City & Bays	*
Swan Bay Jetty	10261	144º38'59"	144º39'45"	220.3	Bay Managem’t Area	City & Bays	
Portarlington Pier And Breakwater	10250	144º39'1"	144º39'12"				
Swan Bay - Edwards Point W.R	546	144º39'18"	144º39'25"	277.4	Nature Conservation Reserve – Wildlife	City & Bays	
Harold Holt - Swan Bay Fisheries Res.	3434	144º39'37"	144º41'26"	2312.7	Fisheries Reserve	City & Bays	
Queenscliff Port And Associated Facilities	10376	144º39'44"	144º40'7"	136.7	Bay Managem’t Area	City & Bays	*
Werribee South Jetty	10262	144º41'7"	144º41'10"				
Port Phillip Bay Coastal Reserve	3190	144º42'34"	144º42'36"	1227.3	Coastal Reserve	City & Bays	

Park Name	ID	Western Longitude	Eastern Longitude	Size (ha)	Legal Status	Region	Suitable habitat?
Port Phillip Bay Coastal Reserve	3190	144º42'43"	144º42'44"	1227.3	Coastal Reserve	City & Bays	
Portsea Pier	10251	144º42'43"	144º42'47"	0.4	Bay Managem't Area	City & Bays	
St. Leonards Jetty And Breakwater	10287	144º43'7"	144º43'14"				
Sorrento Pier	11019	144º44'36"	144º44'44"				
Harold Holt - Mud Islands Fisheries Res.	3435	144º45'23"	144º46'32"	587.8	Fisheries Reserve	City & Bays	
Mud Islands W.R.	559	144º45'31"	144º46'24"	53.6	Nature Conservation Reserve – Wildlife	City & Bays	*
Collins Settlement Site H.A	2858	144º45'38"	144º45'44"	0.7	Historic and Cultural Features Reserve – Historic	City & Bays	
Point Cook/Cheetham Wetlands	4074	144º45'53"	144º48'21"	867.0	Open Space Parkland (former MPW park)	City & Bays	
Point Cook Fisheries Res.	3439	144º47'6"	144º47'59"	126.2	Fisheries Reserve	City & Bays	
Point Cook Fisheries Res.	3439	144º47'6"	144º47'52"	126.2	Fisheries Reserve	City & Bays	
Port Phillip Bay Coastal Reserve	3190	144º49'15"	144º49'15"	1227.3	Coastal Reserve	City & Bays	
Rye Pier	10256	144º49'15"	144º49'17"	1.3	Bay Managem't Area	City & Bays	
Altona Pier	10237	144º49'43"	144º49'44"				
Mornington Peninsula National Park	3290	144º53'3"	144º53'8"	2579.8	National Park – Schedule 2 National Parks Act 1975	City & Bays	*
Williamstown Precinct	11006	144º53'39"	144º54'30"	103.2	Bay Managem't Area	City & Bays	
Rosebud Pier	10255	144º54'22"	144º54'26"	1.0	Bay Managem't Area	City & Bays	
Port Phillip Bay Coastal Reserve	3190	144º54'25"	144º54'26"	1227.3	Coastal Reserve	City & Bays	
Lagoon Pier	10244	144º56'12"	144º56'21"	0.9	Bay Managem't Area	City & Bays	
Dromana G221 Bushland Reserve	1762	144º56'28"	144º57'37"				

Park Name	ID	Western Longitude	Eastern Longitude	Size (ha)	Legal Status	Region	Suitable habitat?
Port Phillip Bay Coastal Reserve	3190	144º56'45"	144º57'37"	1227.3	Coastal Reserve	City & Bays	
Kerferd Road Pier	10243	144º56'55"	144º56'59"	0.3	Bay Managem't Area	City & Bays	
St. Kilda Pier And Breakwater	11020	144º57'41"	144º58'11"	49.9	Bay Managem't Area	City & Bays	
Dromana Pier	10240	144º57'44"	144º57'48"				
Brooks Jetty St. Kilda	10239	144º58'22"	144º58'25"	0.1	Bay Managem't Area	City & Bays	
Middle Brighton Pier And Breakwater	10245	144º58'47"	144º59'4"	20.6	Bay Managem't Area	City & Bays	
Sandringham Breakwater And Hampton Jetty	10257	144º59'31"	144º59'53"	11.6	Bay Managem't Area	Melb. Metro.	
Black Rock Jetty	10238	145º0'30"	145º0'30"				
Port Phillip Bay Coastal Reserve	3190	145º0'45"	145º0'56"	1227.3	Coastal Reserve	City & Bays	
Flinders - Somers Coastal Reserve	3191	145º1'19"	145º8'44"	203.4	Coastal Reserve	City & Bays	*
Fossil Beach G.R.	2907	145º1'26"	145º1'59"	41.3	Natural Features Reserve – Geological	City & Bays	
Flinders Jetty	10226	145º1'27"	145º1'35"				*
Mornington Pier And Jetty	11011	145º1'54"	145º2'2"				
Mordialloc Pier	11010	145º4'53"	145º5'16"	12.9	Bay Managem't Area	Melb. Metro.	
Frankston Pier	11005	145º6'43"	145º6'52"				
Patterson River Entrance Wall	11043	145º6'56"	145º7'11"	15.0	Bay Managem't Area	City & Bays	
Patterson River	4070	145º7'7"	145º7'11"	49.6	Open Space Parkland (former MPW park)	City & Bays	
Patterson River	4070	145º7'7"	145º7'18"	49.6	Open Space Parkland (former MPW park)	City & Bays	
Seaford Pier	10258	145º7'18"	145º7'23"	0.2	Bay Managem't Area	City & Bays	
Phillip Island Coastal Reserve	3193	145º9'44"	145º21'25"	125.0	Coastal Reserve	City & Bays	*
Phillip Island Coastal Reserve	3193	145º10'46"	145º10'51"	125.0	Coastal Reserve	City & Bays	*
Western Port Intertidal Coastal Reserve	3192	145º11'4"	145º29'59"	561.2	Coastal Reserve	City & Bays	

Park Name	ID	Western Longitude	Eastern Longitude	Size (ha)	Legal Status	Region	Suitable habitat?
Warrengine Creek Ss.R.	2773	145º11'9"	145º11'47"	28.6	Natural Features Reserve – Streamside	City & Bays	
Warrengine Creek Ss.R.	2773	145º11'19"	145º11'41"	28.6	Natural Features Reserve – Streamside	City & Bays	
Hastings Pier	10227	145º11'45"	145º11'55"				
Cowes Jetty	10225	145º14'16"	145º14'19"				*
North Western Port N.C.R	361	145º14'27"	145º29'55"	1458.3	Nature Conservation Reserve	City & Bays	
French Island National Park	3301	145º15'59"	145º29'59"	10162.9	National Park - Schedule 2 National Parks Act 1975	City & Bays	
Tankerton Jetty	10231	145º16'0"	145º16'19"	7.7	Bay Managem't Area	City & Bays	
Tankerton Jetty	10231	145º16'8"	145º16'22"	7.7	Bay Managem't Area	City & Bays	
South Warneet Jetty	10234	145º18'13"	145º18'19"				
Rhyll Jetty	10298	145º18'26"	145º18'30"				
North Warneet Jetty	10233	145º18'27"	145º18'30"				
San Remo - Pt Smythe Coastal Reserve	3194	145º21'41"	145º50'47"	1511.2	Coastal Reserve	East	*
Newhaven Slipway	11042	145º21'41"	145º21'44"				*
Newhaven Jetty	10229	145º21'45"	145º21'48"				*
San Remo Jetty	11017	145º21'45"	145º21'54"	1.3	Bay Managem't Area	East	*
San Remo - Pt Smythe Coastal Reserve	3194	145º21'46"	145º21'54"	1511.2	Coastal Reserve	East	*
Tooradin Jetty	10232	145º22'35"	145º22'37"				
Reef Island And Bass River Mouth N.C.R	366	145º24'10"	145º26'5"	195.4	Nature Conservation Reserve	City & Bays	
Corinella Pier	10297	145º25'18"	145º25'22"	1.4	Bay Managem't Area	City & Bays	
Corinella Pier	10297	145º25'18"	145º25'22"	1.4	Bay Managem't Area	City & Bays	
Lang Lang Jetty	10228	145º31'5"	145º31'10"	0.2	Bay Managem't Area	City & Bays	
San Remo - Pt Smythe Coastal Reserve	3194	145º33'6"	145º33'20"	1511.2	Coastal Reserve	East	*

Park Name	ID	Western Longitude	Eastern Longitude	Size (ha)	Legal Status	Region	Suitable habitat?
Bunurong Marine Park	3397	145º33'25"	145º41'54"	1714.0	National Parks Act 1975 Schedule 4 park or reserve	East	*
Andersons Inlet W.M.C.A	826	145º43'29"	145º50'44"	2344.9	Wildlife Managem't Co-operative Area	East	*
Cape Liptrap Coastal Park	3371	145º43'40"	146º2'4"	4223.2	Other Park – Schedule 3 National Parks Act 1975	East	*
Cape Liptrap Lighthouse Reserve	3773	145º55'17"	145º55'18"				
Waratah Bay - Shallow Inlet Coastal Reserve	3195	146º2'3"	146º9'19"	324.5	Coastal Reserve	East	*
Shallow Inlet Marine & Coastal Park	3393	146º9'14"	146º11'21"	2140.9	National Parks Act 1975 Schedule 4 park or reserve	East	*
Corner Inlet Marine & Coastal Park	3394	146º10'55"	146º26'13"	30149.7	National Parks Act 1975 Schedule 4 park or reserve	East	
Wilsons Promontory National Park	3308	146º11'11"	146º29'17"	48096.3	National Park – Schedule 2 National Parks Act 1975	East	*
Wilsons Promontory Marine Park	3391	146º11'21"	146º29'25"	7258.8	National Parks Act 1975 Schedule 4 park or reserve	East	
Wilsons Promontory Marine Reserve	3392	146º13'3"	146º19'51"	1012.6	National Parks Act 1975 Schedule 4 park or reserve	East	
Wilsons Promontory Islands R.N.A	3418	146º13'12"	146º22'1"	350.9	Remote and Natural Area – Schedule 6 National Park	East	
Port Franklin - Port Welshpool Coastal Reserve	3196	146º22'41"	146º27'7"	205.8	Coastal Reserve	East	*
Wilsons Promontory Lighthouse Reserve	3774	146º24'52"	146º25'28"	37.9	Lighthouse Reserve	East	
Wilsons Promontory Lighthouse Reserve	3774	146º24'52"	146º25'14"	37.9	Lighthouse Reserve	East	
Wilsons Promontory Lighthouse Reserve	3774	146º24'58"	146º25'31"	37.9	Lighthouse Reserve	East	

Park Name	ID	Western Longitude	Eastern Longitude	Size (ha)	Legal Status	Region	Suitable habitat?
Nooramunga Marine & Coastal Park	3395	146º28'8"	146º56'9"	29803.7	National Parks Act 1975 Schedule 4 park or reserve	East	*
Wilsons Promontory National Park	3308	146º29'10"	146º29'12"	48096.3	National Park - Schedule 2 National Parks Act 1975	East	*
Mcloughlins Beach - Seaspray Coastal Reserve	3197	146º56'0"	147º10'55"	594.5	Coastal Reserve	East	*
Jack Smith Lake W.R	668	146º59'29"	147º5'19"	2782.5	Natural Features Reserve – Wildlife	East	*
Jack Smith Lake W.R	668	147º0'20"	147º4'37"	2782.5	Natural Features Reserve – Wildlife	East	*
Gippsland Lakes Coastal Park	3362	147º12'5"	147º58'15"	17658.9	Other Park – Schedule 3 National Parks Act 1975	East	*
Rigby Island Reserve	?				Recently declared (E. Roe in litt.).	East	*
Lakes Entrance - Lake Tyers Coastal Reserve	3198	147º58'14"	148º4'17"	376.4	Coastal Reserve	East	*
Lake Tyers	3419	148º4'16"	148º11'14"	9793.8	State Park (proposed)	East	
Ewing Morass W.R	456	148º11'6"	148º11'15"	5011.5	Natural Features Reserve – Wildlife	East	*
Ewing Morass W.R	456	148º11'7"	148º27'30"	5011.5	Natural Features Reserve - Wildlife Reserve	East	*
Marlo Coastal Reserve	3199	148º27'32"	148º35'8"	647.8	Coastal Reserve	East	*
Cape Conran Coastal Park	3359	148º35'7"	149º1'35"	11523.9	Other Park - Schedule 3 National Parks Act 1975	East	*
Croajingolong National Park	3311	149º1'1"	149º58'26"	87428.2	National Park - Schedule 2 National Parks Act 1975	East	*
Point Hicks Lighthouse Reserve	3777	149º15'50"	149º17'7"	93.2	Lighthouse Reserve	East	
Mallacoota Coastal Reserve	3200	149º43'2"	149º45'53"	188.8	Coastal Reserve	East	*

DISTRIBUTION OF HOODED PLOVERS ACROSS PARKS VICTORIA SITES

The methods used to determine the number of Hooded Plovers at each site follow those of Chapter 3.

Table 4.2 presents the distribution of adult Hooded Plovers within Parks Victoria managed sites that contain suitable habitat for the species. Hooded Plovers were widely distributed across the State.

Table 4.2. The distribution of adult Hooded Plovers across sites from the 2000 count (except for Corner Inlet where the 1998 count result was used). Only those sites with suitable habitat are listed. Sites are listed from west to east, and are ranked according to how many adults were counted within them (1=highest rank, or most birds). The table also indicates whether the site estimate is based on density of birds (N=No, Y=Yes), whether the coverage in 2000 was complete, and whether records of Hooded Plovers from other sources are known for sites where birds were not recorded in 2000.

Park Name	Number of adults	Rank	Percentage of state population	Percentage of PV population	Density estimation	Incomplete coverage	Records from other sources
Discovery Bay Coastal Park	35	3	7.8	8.8	N	*	
Narrawong Coastal Reserve	11	10	2.4	2.8	N		
Eumeralla (Yambuk) Coastal Reserve	42	1	9.4	10.6	N		
Yambuk FFR	4	14	0.9	1.0	N		
Port Fairy - Warrnambool Coastal Reserve	14	9	3.1	3.5	N		
Port Fairy Maritime Complex H.A	0		0.0	0.0	N		
Bay Of Islands Coastal Park	10	11	2.2	2.5	N		
Peterborough Coastal Reserve	0		0.0	0.0	N		
Port Campbell National Park	9	12	2.0	2.3	N	*	
Otway National Park	14	9	3.1	3.5	N		
Elliot River - Addis Bay Coastal Reserve	0		0.0	0.0	N		
Angahook - Lorne State Park	0		0.0	0.0	N		
Wye River Coastal Reserve	0		0.0	0.0	N		

Park Name	Number of adults	Rank	Percentage of state population	Percentage of PV population	Density estimation	Incomplete coverage	Records from other sources
Lorne - Queenscliff Coastal Reserve	18	8	4.0	4.5	N		
Lake Connewarre W.R.	0		0.0	0.0	N	*	*
Lonsdale Lakes W.R.	0		0.0	0.0	N		*
Point Lonsdale Jetty	0		0.0	0.0	N		*
Queenscliff Port And Associated Facilities	0		0.0	0.0	N		*
Mud Islands Wildlife Reserve	0		0.0	0.0	N		*
Mornington Peninsula National Park	40	2	8.9	10.1	Y		
Harold Holt - Point Lonsdale Fisheries Reserve	2	15	0.4	0.5	Y		
Flinders - Somers Coastal Reserve	0		0.0	0.0	N		
Flinders Jetty	0		0.0	0.0	N		
Phillip Island Coastal Reserve	0		0.0	0.0	N		
Western Port Intertidal Coastal Reserve	0		0.0	0.0	N		
Cowes Jetty	0		0.0	0.0	N		
Rhyll Jetty	0		0.0	0.0	N		
Newhaven Slipway	0		0.0	0.0	N		
Newhaven Jetty	0		0.0	0.0	N		
San Remo Jetty	0		0.0	0.0	N		
San Remo - Pt Smythe Coastal Reserve	27	5	6.0	6.8	N		
Bunurong Marine Park	2	15	0.4	0.5	N		*
Andersons Inlet W.M.C.A	0		0.0	0.0	N		*
Cape Liptrap Coastal Park	14	9	3.1	3.5	N		

Park Name	Number of adults	Rank	Percentage of state population	Percentage of PV population	Density estimation	Incomplete coverage	Records from other sources
Waratah Bay - Shallow Inlet Coastal Reserve	2	15	0.4	0.5	N		
Shallow Inlet Marine & Coastal Park	0		0.0	0.0	N		*
Wilsons Promontory National Park	22	7	4.9	5.6	N		
Port Franklin - Port Welshpool Coastal Reserve	0		0.0	0.0	N		
Nooramunga Marine & Coastal Park	33	4	7.3	8.3	N		
Mcloughlins Beach - Seaspray Coastal Reserve	40	2	8.9	10.1	N		
Jack Smith Lake W.R	0		0.0	0.0	N		*
Gippsland Lakes Coastal Park	10	11	2.2	2.5	N		
Rigby Island Reserve	6	13	1.3	1.5	N		
Lakes Entrance - Lake Tyers Coastal Reserve	4	14	0.9	1.0	Y		
Ewing Morass W.R	1	16	0.2	0.3	N		
Marlo Coastal Reserve	2	15	0.4	0.5	Y		
Cape Conran Coastal Park	9	12	2.0	2.3	N		
Croajingolong National Park	23	6	5.1	5.8	N		
Mallacoota Coastal Reserve	2	15	0.4	0.5	N		

The greatest number of Hooded Plovers in any one site (42) was at Eumeralla (Yambuk) Coastal Reserve, and this represented 9.4% of the State's population and 10.6% of the population on Parks Victoria land. However, sites holding over 20 birds are widely distributed in western, central and eastern Victoria. Sites ranked according to how many Hooded Plovers were within them are shown in Table 4.3.

CAUTIONS

The count data used in this analysis provide a “snapshot” view of the distribution of Hooded Plovers in Victoria. Slight changes may occur from one year to the next (see Weston & Morrow 2000), but the broad pattern appears to be stable over time. Low populations in some areas may represent either a low natural carrying capacity of the site, or previous population decline.

Table 4.3. Parks Victoria managed land ranked according to how many adults are in each site (1=highest rank, or most birds). Only those sites where Hooded Plovers were recorded are shown.

Park Name	Rank
Eumeralla (Yambuk) Coastal Reserve	1
Mornington Peninsula National Park	2
Mcloughlins Beach - Seaspray Coastal Reserve	2
Discovery Bay Coastal Park	3
Nooramunga Marine & Coastal Park	4
San Remo - Pt Smythe Coastal Reserve	5
Croajingolong National Park	6
Wilsons Promontory National Park	7
Lorne - Queenscliff Coastal Reserve	8
Port Fairy - Warrnambool Coastal Reserve	9
Otway National Park	9
Cape Liptrap Coastal Park	9
Narrawong Coastal Reserve	10
Bay Of Islands Coastal Park	11
Gippsland Lakes Coastal Park	11
Port Campbell National Park	12
Cape Conran Coastal Park	12
Rigby Island Reserve	13
Yambuk F.F.R	14
Lakes Entrance - Lake Tyers Coastal Reserve	14
Harold Holt - Point Lonsdale Fisheries Res.	15
Bunurong Marine Park	15
Waratah Bay - Shallow Inlet Coastal Reserve	15
Marlo Coastal Reserve	15
Mallacoota Coastal Reserve	15
Ewing Morass W.R	16

CONCLUSIONS

- Hooded Plovers are widely distributed across Parks Victoria sites, with no site holding more than 9.4% of the State population, and no site holding more than 10.6% of the population found on Parks Victoria land.
- Those sites holding more than 5.0% of the State population (i.e. 5.7% of the Parks Victoria population) are: Discovery Bay Coastal Park, Eumeralla (Yambuk) Coastal Reserve, Mornington Peninsula National Park, San Remo - Pt Smythe Coastal Reserve, Nooramunga Marine and Coastal Park, Mcloughlins Beach - Seaspray Coastal Reserve, and Croajingolong National Park.

Chapter 5 – An Assessment of Survey Protocols Available for Hooded Plovers

SUMMARY

This chapter presents the survey protocols that have been used to survey Hooded Plovers. Eight types of surveys are identified and described. These survey types are compared and it is concluded that the best approach to developing a survey protocol for Hooded Plovers is to extend and improve the AWSG Biennial Hooded Plover counts.

Survey efforts on Hooded Plovers to date can be categorised into Biennial Counts, Additional Biennial-Style Counts, Autumn Counts, AWSG National Wader Counts, Continuous Counts, Random (Incidental) Counts, Opportunistic Counts and Historical Counts (after Urquhart 2000). This chapter describes and considers the different kinds of survey protocols, and assesses their potential to monitor Hooded Plover populations. Other protocols may be required to address specific research or monitoring goals.

AWSG Biennial Counts (National AWSG Biennial Hooded Plover Counts)

The Australasian Wader Studies Group (AWSG), a special interest group of Birds Australia, coordinates the national Hooded Plover survey. These surveys aim to monitor population trends in the breeding season, and have included the coasts of New South Wales, South Australia, Tasmania and Victoria. Of all the states, Victoria has been most frequently and most comprehensively covered. In Victoria, a count has been made every two years since 1980 (Weston 1993). The total coverage of Victoria achieved by these counts to date is over 7000 km.

These counts have been coordinated and conducted by volunteers, although Parks Victoria staff have counted substantial sections of coast, and provided logistical support. The current organisational structure of the AWSG biennial counts is shown in Figure 5.1. To date, Parks Victoria staff have only been involved in the fourth and fifth levels of organisation (see Figure 5.1). This is because the positions higher up the structure have been readily filled.

These counts represent one of the most successful on-going medium-term monitoring programs in Victoria.

Additional biennial-style counts

Some areas, such as western Victoria, have been counting Hooded Plovers in the breeding season between the biennial counts (see Weston & Morrow 2000, MAW unpubl. data). These counts have presumably represented an attempt to make counts annual. However,

the rate of change of Hooded Plover populations appears to be relatively slow. Therefore, such counts are thought to contribute little to the ability to detect population changes over time (Weston & Morrow 2000).

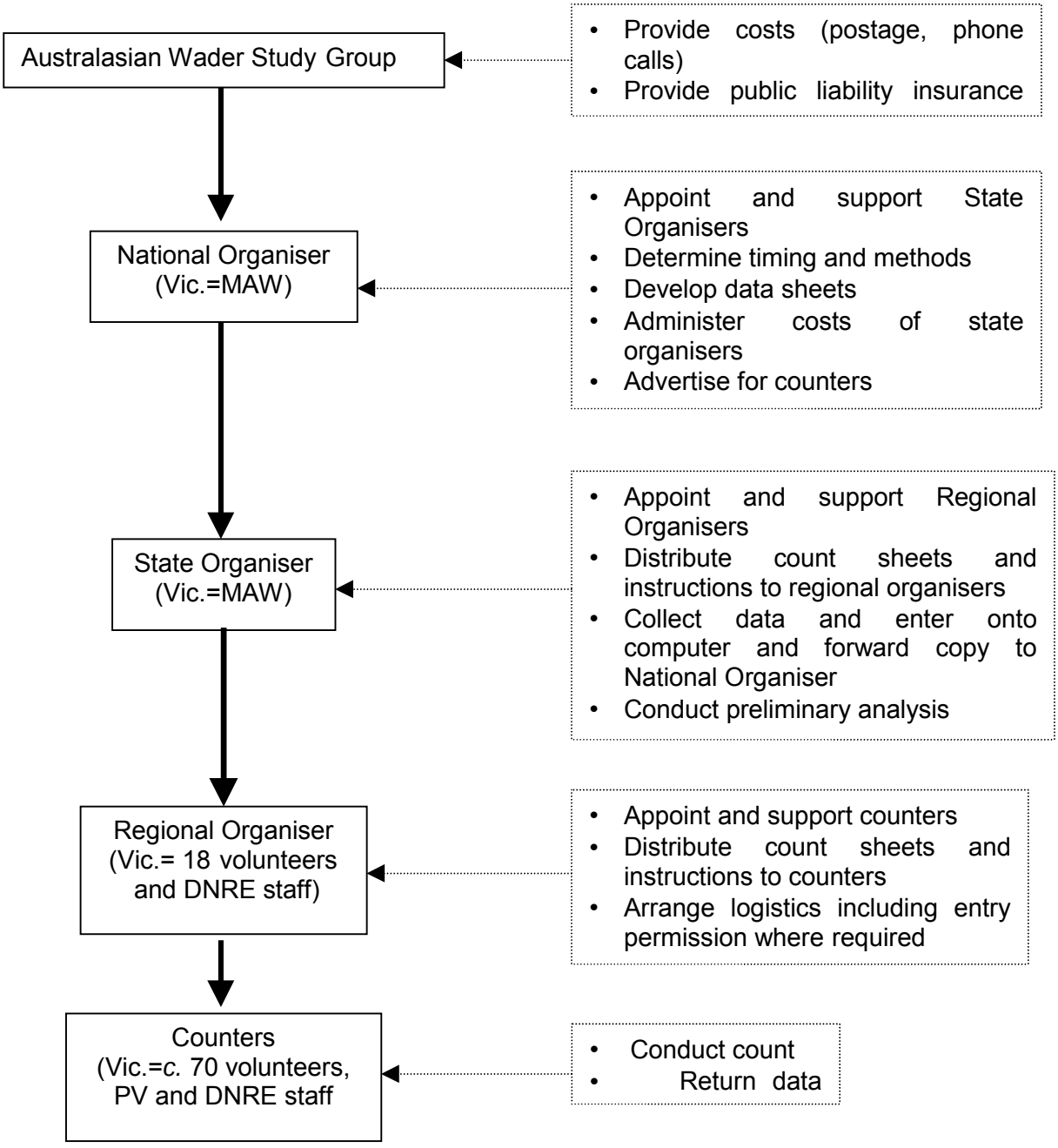


Figure 5.1. Current organisation of the AWSG biennial counts – the five level model. Responsibilities at each level are shown in dashed boxes.

Annual monitoring of Little Tern breeding sites in east Gippsland also provides information on Hooded Plovers numbers in those areas (P. Kambouris pers. comm.).

The issue as to whether to conduct annual or biennial counts is a controversial one, with some noted Hooded Plover workers advocating annual counts. Thus, an explicit comparison between the two approaches will be made. The costs of conducting annual counts would be about double that of conducting biennial counts, so the question becomes how much benefit would be derived from annual counts over biennial counts? For the purposes of this discussion, the benefit from the counts will be how well they monitor populations i.e., the ability to detect changes in the population (this is the primary objective). Detecting change in populations can involve a variety of statistical approaches, but here the most commonly used approach will be considered – the detection of trends (increases or decreases or stability over time).

Statistical power provides information on how well a sampling regime is able to detect trends. I used PASS (Power and Sample Size Software) to model the power of the biennial counts, using an effect size of 20% and an alpha level of 5%. Figure 5.2 shows the power obtained from an F-ratio test associated with a linear regression, and based on variation in the data observed from the state totals from the biennial counts, 1980-2000. The greatest increase in power associated with doubling sample size from 20 (the current sample size) to 40 (that which would have been achieved from annual counts) is greatest for a line with a slope of 0.9. In that case power would increase by only 0.02, a gain in power of 30.1% over the power associated with biennial counts. However, the actual slope evident in a regression of the data was less than 0.1, and doubling the sample size would increase power by only 0.5%. Thus, there is very little benefit to conducting annual counts over biennial counts in terms of the ability to detect population changes.

Autumn counts

There have been autumn counts in some parts of Victoria (Heislers & Weston 1993, Weston & Morrow 2000). These counts can determine the proportion of juveniles in the population if they are timed correctly (Weston 2000a). There is growing support among volunteers for additional autumn counts (e.g., R. Ressom in Weston & Morrow 2000, Anon. 2001a).

AWSG National Wader Counts

The AWSG runs National Wader Counts which are held twice a year, once in summer and once in winter. These counts are intended to monitor the populations of migratory waders. They concentrate on wetland and inlet areas, and much Hooded Plover habitat is therefore not covered. When Hooded Plovers are recorded, the count sheets often do not have enough locational data to accurately determine where the birds were located. The current national coordinator is Jenny Skewes (AWSG).

Continuous counts

A number of locations, such as the Mornington Peninsula National Park, Wilsons Promontory National Park and the Phillip Island Nature Park, conduct regular (fortnightly, monthly or quarterly) population counts. The above-mentioned locations have at least five years of data, and thus provide indications of localised population trends.

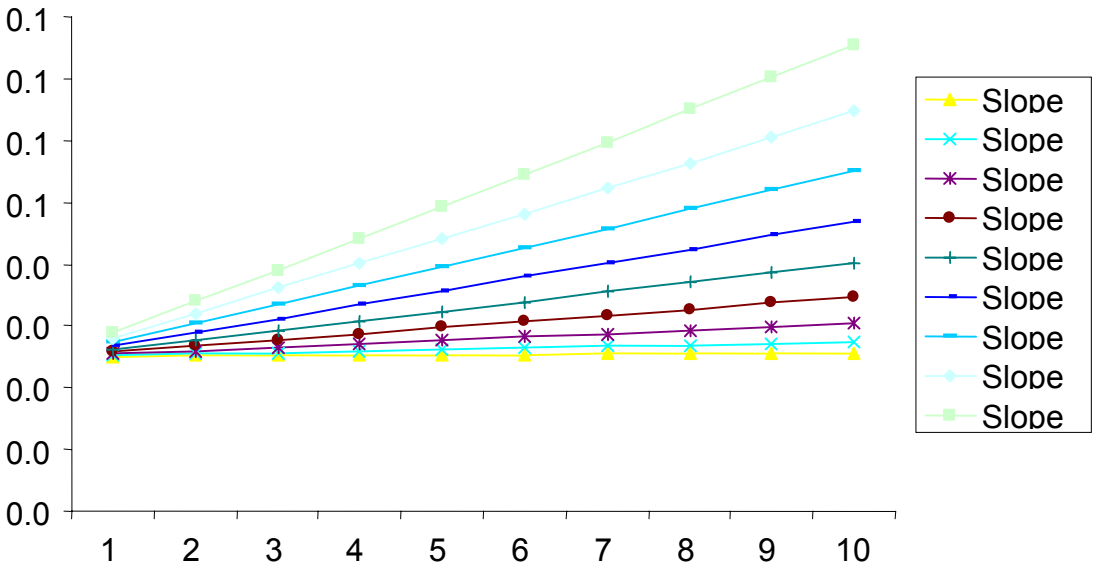


Figure 5.2. Statistical power expected from linear regression on Hodded Plover count data for different regression slopes and sample sizes.

The *Hooded Plover Monthly Count Project* (coordinated by MAW) involved monthly counts at a number of locations in Victoria and South Australia. Victorian locations include Venus Bay, Kilcunda and McLaughlin's Beach. Yarram region DNRE has a copy of the McLaughlin's Beach results, the rest of the data are held by MAW.

Significant shorebird breeding sites in east Gippsland are monitored annually between November and March (P. Kambouris pers. comm.).

These counts are nearly all conducted by volunteers (Threatened Bird Network volunteers, Bird Observer Club of Australia members and Friends Groups), but are coordinated by Parks Victoria or Birds Australia staff.

Incidental counts

A number of incidental population surveys occur in areas where research is being conducted (e.g., Central Victoria, Weston 2000a and western Victoria, Weston & Morrow 2000). These counts are not ongoing, but some cover substantial periods (e.g., at least monthly counts for over three years, Weston 2000a).

Opportunistic counts

Some areas do not have a formal monitoring process, but do record all opportunistic sightings of Hooded Plovers (Urquhart 2000). Counts of Hooded Plovers in inland Western Australia are largely opportunistic (Newbey 1996, Singor 1999).

Historical counts

Historical counts are here defined as those that occurred before 1980. A number of historical counts are scattered through the general bird literature (e.g., Belcher 1900). Some of these counts are published in unindexed publications, for example, in June 1971, 19 were counted between Black Rocks and Ant Spit, near Geelong (Smith 1972). Some are even published in obscure sources such as local newspapers. For example, in March 1954 hikers counted 64 Hooded Plovers between the Glenelg River Mouth and Cape Bridgewater (Learmonth 1954) – an area which is now within Discovery Bay Coastal Park. Historical counts are few and far between, they involve a great deal of search effort, and their coverage is patchy.

REQUIREMENTS OF A SURVEY PROTOCOL

The following are requirements of a survey protocol:

- counts provide information required for Parks Victoria such as the distribution of the species within Parks Victoria managed land, and across land tenures. The counts should also determine, as far as is practical, the location of Hooded Plover breeding territories so any management efforts can be easily targeted,
- counts are comparable and as accurate as possible,
- counts are ongoing, and;
- count data are processed systematically, stored appropriately, and the results are disseminated.

A number of other features are desirable in choosing a survey protocol:

- counts have a well-developed organisational structure so they are run efficiently and effectively,
- counts are supported by other organisations, so Parks Victoria can work in partnership with those organisations to conduct the counts, and;
- counts are cost-effective.

ASSESSING THE BEST SURVEY PROTOCOL

The different types of counts described above provide different levels and quality of information, and the results they produce are not always comparable. In addition to the above protocols, Parks Victoria also has the option of starting a new count program tailored to its needs. A comparison of these options is provided in Table 5.1.

Table 5.1 A comparison of existing survey protocols for Hooded Plovers in eastern Australia. H=high, M=medium, L=Low, Y=Yes, N=No, N/A=not applicable.

Type of Count	Purpose	Focus	Coverage of habitat	Reliability of result	Ongoing organis-ational structure?	Duration of counting (years)	Central-ised data storage	Cost (per km of habitat covered)
AWSG Biennial Counts	Monitor breeding population	Hooded Plovers	H	H	Y	20+	Y	L
Additional Biennial-style Counts	Monitor breeding population	Hooded Plovers	M	H	N	2	N	L
Autumn counts	Monitor non-breeding population	Hooded Plovers	M	H	N	2	N	L
AWSG National Wader Counts	Monitor population	Migratory waders	L	H	Y	20+	Y	L
Continuous Counts	Monitor seasonal trends or breeding success	Hooded Plovers	M	H	Y	10+	N	M
Incidental Counts	Varies - depends on research project	Hooded Plovers	M/L	H	N	<3	N	L
Opportunistic Counts	Determine distribution	Hooded Plovers	L	M	N	N/A	N	L
Historical Counts	Benchmark population size	Hooded Plovers	L	M	N	N/A	N	L

Table 5.1 clearly shows that the Biennial Counts are the best established and most suitable surveys for monitoring Hooded Plover populations. They have an established organisational structure, are cost-effective, and are reliable. Processes are already in place for data collection, entry and information dissemination. If Parks Victoria were to develop its own set of surveys, much of these processes would have to be replicated. It therefore seems most appropriate to use the Biennial Counts to monitor Hooded Plovers, and where necessary to extend and improve them (Chapters 6 and 7).

CONCLUSION

- the best approach to developing a survey protocol for Hooded Plovers is to extend and improve the AWSG Biennial Hooded Plover counts.

Chapter 6 – Development of a Survey Protocol for Volunteers and Parks Victoria Staff

SUMMARY

This chapter develops a population monitoring protocol for Hooded Plovers. A critical analysis of the biennial counts conducted to date is presented in order to identify areas where improvements can be made. The protocol extends and improves the AWSG biennial Hooded Plover counts. A biennial breeding-season count is proposed (late October or November) to assess the breeding distribution of the species. Another count (the following March or April) is proposed to determine the overall reproductive success of that breeding season. The suggested improvements in data collection, such as the widespread use of GPS units, will require improvements in counter training and communication.

All monitoring programs benefit from review and improvement. This chapter draws on the extensive experience of the author as National and Victorian (State) Organiser of the AWSG Biennial National Hooded Plover Counts from 1991 to 2001. During this time, much thought has been directed at trying to maximise the effectiveness of the counts, and many discussions have been had with counters (e.g., S. Paton) the other State Organisers (V. Natt and P. Straw) and those running other Hooded Plover programs (e.g., J. Raines).

A CRITICAL ANALYSIS OF THE BIENNIAL COUNTS

The biennial counts are the type of count most likely to fulfil the requirements of Parks Victoria. This is because they are regular, well-established and include all Parks Victoria managed coastal land (Chapter 5). As mentioned above, they have been a resounding success thanks to a massive commitment of volunteer counters and organisers. Many State and National organisers even pay expenses of the counts out of their own pockets. This critique is in no way intended to diminish their efforts, but rather it is intended to help overcome the few shortcomings of the counts. In many cases the problems were not foreseeable, and in some cases new technologies have emerged that allow the collection of new kinds of data.

Main problems with the biennial counts

- The data are collected on a very course spatial level. Count sections can be tens of kilometres long, and often the location of birds cannot be determined with any accuracy.

- The count sections have varied from count to count, and coverage has varied as well. This produces difficulties with the comparability of counts. This variation has often resulted from logistical considerations.
- The counts do not provide any useful measure of reproductive success – a crucial statistic from a management perspective (see Chapter 15).
- Lack of ongoing analysis. As count results become available, qualitative assessments can be easily made, but quantitative analysis should be made 1) after every two or three biennial counts or 2) if a dramatic decline is apparent (Weston & Morrow 2000).

Other problems with the biennial counts

- Data sheets have changed almost every count so different kinds of data have been collected (pre-formatted data sheets have been supplied on every count). This means counters have to adjust to a new kind of form each count. Nevertheless, the numbers of Hooded Plovers has always been recorded.
- Counters often fail to record the required and requested data on the sheets. The distance covered (not the distance between the starting and finishing points) is one of the most frequently omitted fields. When other data, such as the number of humans, is required many counters do not provide these data. Others provide general responses like “Lots”; these responses are not useful. In the 2000 count, many counters did not check the land tenure of their count section (Chapter 3).
- Although it is discouraged, a few counters approach nests or chicks. A few conduct the count with their dogs.
- Some problems with storage of count data have been detected. For example, the analysis of the datasheets for the May 1998 count revealed 171 adults and 27 juveniles for western Victoria, yet the actual numbers counted were 203 adults and 32 juveniles (after Ressom 1998). This suggests that not all sheets are available, or that some counters did not fill in sheets. Data omissions and errors can be checked by providing written feedback to counters and asking them to check the data recorded for their count section.

IMPROVING THE BIENNIAL COUNTS

There are a number of ways to improve the biennial counts, so they fulfil the objectives of Parks Victoria and the AWSG. These include: 1) methodological improvements and 2) conducting an additional biennial count to estimate reproductive success.

Methodological improvements

Methodological improvements that are desirable are:

- The development of a standard survey data sheet which is: 1) simple to use, and 2) flexible so other types of data can be collected as necessary. Additional types of data to be collected can be recorded on *separate* data sheets specifically designed for that purpose.
- Improve the resolution of the spatial information collected. Ensure the use of GPS units by as many counters as is feasible. Where GPS units cannot be used, then have counters mark on maps where they located Hooded Plovers, and where they counted.
- Counters need to be trained to conduct the surveys in a standardised way. Written procedures are rarely effective (MAW pers. obs.), but should also be supplied to counters. In a recent survey of Hooded Plover counters, 75.7% (n=37 responses) indicated that they were prepared to attend a training session (TBN unpubl. data).
- Communication needs to occur with counters in order to provide feedback on any persistent methodological problems, and to motivate them to continue to be involved and to collect data in a rigorous fashion.

Estimating reproductive success

It is known that the timing of the biennial counts (spring) does not allow the determination of reproductive success (Heislers & Weston 1993). However, post-breeding counts may allow the estimation of reproductive success achieved in the preceding breeding season. Post-breeding season counts of Hooded Plovers typically differ in two ways from breeding season counts: 1) they record more juveniles and 2) they record more adults (Weston & Morrow 2000).

Hooded Plovers can only be aged when in juvenile plumage, or in the transitional plumage between juvenile and adult ("subadult" plumage). Juvenile Hooded Plovers moult into adult plumage within a year (Weston 2000a). It has been suggested that reproductive success could be determined from the proportion of juveniles in post-breeding flocks (Garnett 1993, Heislers & Weston 1993, Cooper 1997, Weston 2000a). Weston (2000a) suggests that in eastern Australia such counts should be made in April or May. Any earlier, and juveniles that have not yet fledged may be missed; any later, and early-fledged juveniles may have already moulted into adult plumage (Weston 2000a).

Such estimates of breeding success do not account for juvenile mortality, and they would not provide useful data on a local scale because of the high mobility of juveniles (Weston

2000a). However, it is considered that they would provide a broad indication of the overall reproductive success achieved in a breeding season over the state. It is possible that such counts may measure the ultimate effectiveness of management across the state.

An autumn count could be conducted using the same protocol as is used for the biennial count. A particular emphasis would need to be placed on the identification of juveniles and "subadults" (see Chapter 1). This is particularly important because Double-banded Plovers start arriving on the beaches of eastern Australia in autumn, and some counters have confused juvenile Hooded Plovers with this species (Cameron & Weston 1999).

CONCLUSIONS

- The biennial breeding-season count in even years (i.e. 2000, 2002 etc) should continue in order to assess the breeding distribution of the species.
- An autumn count is proposed in odd years (i.e. 2001, 2003 etc) to determine the overall reproductive success of that breeding season (i.e. 2000/2001, 2002/2003 seasons etc).

Improvements in data collection, such as the widespread use of GPS units, are desirable. Training and communication are important components of increasing data quality.

Chapter 7 – A Survey Protocol for Volunteers and Parks Victoria staff

SUMMARY

This chapter outlines a population monitoring protocol for Hooded Plovers in four components. The organisation of the counts is presented. Improvements in the methodology are addressed by a revised data sheet, and an improved counter instruction sheet. These can be complemented by training of counters and improved communication, and a strategy for training and communication is presented.

The proposed survey protocol can be divided into four main elements:

- organisation and planning of the surveys,
- the methods that could be used,
- the counter training that could be offered to counters, and;
- the communication that is especially important when dealing with volunteers.

This chapter is intended to provide all necessary details of how to run a statewide survey for Hooded Plovers.

ORGANISATION AND PLANNING

Timing of counts

In even years, the count should be conducted in late October or early November. In odd years, a count should be conducted in late March or April. This is demonstrated in Table 7.1.

Table 7.1. The proposed schedule of statewide surveys, 2002-2009.

Year	March/April	October/November
2002		√
2003	√	
2004		√
2005	√	
2006		√
2007	√	
2008		√
2009	√	

Count dates

Counts have been conducted on weekends, because of the high proportion of volunteer counters that are employed full-time. It is recognised that not all Parks Victoria counters are available on weekends. Counts should as far as possible be conducted on or around the nominated weekend. Counts a few days either side of the nominated weekend are acceptable.

Nominated count weekends should avoid:

- public holidays (e.g., Melbourne Cup Day and Easter) – many counters are unavailable on these weekends.
- weekends with other major bird-watching events scheduled. The notorious example of such an event is the "Twitchathon" (or bird race) – many bird-watchers spend several weekends before the "Twitchathon" field-testing their routes, and the event itself takes an entire weekend.

Timing of organisational tasks

The timing of tasks associated with the organisation of the counts is shown in Table 7.2.

Table 7.2. A proposed timing of organisational tasks associated with the survey protocol. The months begin in May of an even year (e.g., 2002) and end in July of an odd year (e.g., 2003). Shaded cells indicate tasks that should be carried out in a particular month.

Year	Even Year (e.g. 2002)								Odd Year (e.g. 2003)						
Month	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**
Appoint Regional Organisers for both counts		■													
Confirm with Regional Organisers					■					■					
Send out instructions		■			■					■					
Distribute Data Sheets					■					■					
Identify and fill gaps					■					■					
Count						■	■				■	■			
Collate and enter data								■					■		
Provide feedback to Regional Organisers and counters														■	
Counter Training?				■											

Organisational structure

The organisational structure in place (Figure 5.1) is efficient, although it is proposed that Parks Victoria have more input at the level of State and Regional Organiser. It is proposed that the structure remains the same for the proposed autumn counts.

The additional count will mean more expenses for the AWSG and the State and Regional Organisers. It will also mean that State and Regional Organisers and counters will have to volunteer more time to the count program.

METHODS

This section focuses on the counters, and it assumes that they are all allocated a count section, and have the appropriate data sheets and instructions (as per Figure 5.1). Counters should receive count instructions, and at least two count sheets for every count section. These should be received by the counters about a fortnight before the count – any earlier and many are lost, and any later and the chances of counters reading through the material and resolving any confusion is reduced.

Count instructions

Count instructions are posted to all Regional Organisers and all counters (either directly or via the Regional Organiser). Regional Organisers should avoid faxing the instructions to counters as this has resulted in sections missing from the instructions in the past. The count instructions describe the survey technique and procedures to be used by counters. A set of count instructions has been prepared and is presented in Appendix 4.

Ideally count instructions should:

- be printed on waterproof paper or laminated,
- be no larger than A4 and preferably be B4. This makes them less difficult to read in windy or wet conditions.

Survey forms

Survey forms (or “data sheets”) are posted to all Regional Organisers and all counters (either directly or via the Regional Organiser). Every counter should have at least 2 survey sheets. Regional Organisers should avoid faxing the data sheets as this has resulted in sections missing from the instructions in the past.

Survey forms or data sheets need to be as simple as possible. The basic survey form is presented in Appendix 4. Each entry has a reference number which can be used to link the sheet to other data sheets (e.g., to the Threat Assessment Sheets of Weston & Morrow 2000). If it is deemed appropriate to collect additional data (e.g., on habitat) then this is achieved through providing additional data sheets and not by trying to incorporate new fields into the survey sheet. The latter approach has been used in the past and has resulted in complicated data sheets. Thus, the survey sheet developed here is 1) simple and 2) flexible.

The use of reference numbers is easily incorporated into spreadsheets or databases, and makes marking locations on a map easy.

Ideally survey forms should:

- be printed on waterproof paper,
- be no larger than A4 and preferably be B4. This makes them less difficult to fill in under windy or wet conditions.

Equipment needs

Ideally, all counters require the following equipment, in addition to general bushwalking equipment:

- Binoculars – a recent survey of counters indicated 100% (n=41) had binoculars and used them on the counts (TBN unpubl. data).
- GPS units – a recent survey of counters indicated 56.1% (n=41) had GPS units. GPS units are becoming increasingly cheap (*c*. $300) and available. Birds Australia has a number of GPS units available for hire. Of 41 counters, 97.1% were prepared to use a GPS if one was made available and if counter were trained appropriately (TBN unpubl. data). One option worth investigating is whether it is practical to lend GPS units to counters. In order to aid in the incorporation of GPS spatial data into any analysis of distribution across land tenures, the longitudes of the boundaries of each piece of land managed by Parks Victoria has been presented in Table 4.1 (latitudes were unavailable, M. Kealy pers. comm.).
- Maps – an alternative to using GPS units is to supply counters with maps and ask them to mark the locations of birds they encounter. This is probably not as accurate as the use of GPS units. In order to facilitate the dissemination of maps to counters, a series of coastal maps are presented in Appendix 3.

COUNTER TRAINING OPTIONS

No formal training of Hooded Plover counters has occurred previously. Informal training has occurred during public presentations and through a “buddy” system for some first-time counters.

Training is considered an important component of the survey protocol, because experience has shown that the protocol will not be adopted fully unless training occurs.

Training of counters is needed in the following areas:

- count technique i.e. how to count Hooded Plovers,
- use of GPSs and maps, and recording spatial data,
- use of data sheets i.e. how to record data, and;
- identification, particularly of juveniles.

Delivery of counter training

A number of options are available for the delivery of counter training. These are:

- Written procedures, which have been supplied on all biennial counts and have met with limited success. However, such written procedures may be a vital reference for counters who have been trained in other ways.
- Workshops are a very common way of training volunteers (e.g., the *Threatened Bird Network Volunteer Training Workshops* and the *Swift Parrot Volunteer Counter Workshop*). These workshops are time-consuming to organise, but if a portable training content is produced, the delivery of the workshops in a number of areas is possible. Regional Organisers could conduct these workshops.
- Video training modules is another option, but these are expensive and time consuming to produce. Additionally, it is often useful to have a trainer present when the video is shown to answer questions from counters.
- Web-based training modules are very useful (e.g., the *Red-tailed Black Cockatoo Education Kit*). However, they are expensive to produce and many volunteer counters do not currently have access to the Worldwide Web.

COMMUNICATION OPTIONS

Communication between volunteer counters and the organisers of the counts is essential. This communication is required to ensure that the counts run smoothly and that counters are aware of their responsibilities. It is also essential to motivate those counting on a voluntary basis.

Previous efforts at communication also form options through which Parks Victoria could promote good communication with counters. Communication with volunteers has been achieved through:

- Newsletters. Only a single edition of a National Hooded Plover newsletter was produced (Brown 1998). Reports to participants in the AWSG biennial counts have been supplied

for every count 1980-1998. The 2000 count report took the form of a newsletter (Weston & Paton 2001) and it is hoped to make the newsletter regular. In Western Australia, a regular newsletter (*WAHOOPS*) is sent to participants in the Western Australian Hooded Plover Survey. In a recent survey of Victorian Hooded Plover counters, 87.5% (n=40) indicated that they would be pleased to receive a newsletter (TBN unpubl. data).

- Talks. Talks have been given to bird-watching and natural history groups to which counters belong. Talks have been held in three states:

1. Victoria. Many talks have been presented over a period of ten years by MAW. These talks have mostly been aimed at areas where volunteer counters reside, and have served to provide feedback and motivation. The location of these talks is shown in Figure 7.1. These talks have been well attended and are popular. Coast Action and the Little Tern Taskforce have run similar programs.
2. New South Wales. In late 2000, the National Parks and Wildlife Service and the Threatened Bird Network funded a talk in Merimbula and a talk in Moruya, on the southern coast (see Figure 7.1).
3. Western Australia. A series of talks to local communities are funded as part of the Hooded Plover project (e.g., Anon. 2000a).

- Seminars. In recent years there has been a Hooded Plover seminar series, which is a collection of talks on Hooded Plover management and research, held every two years. So far, participants have come mainly from Victoria (but also South Australia) to this highly successful series of seminars and hundreds of people have been involved. The first meeting was hosted by Parks Victoria, and the subsequent meeting was hosted by the AWSG. The abstracts from the first meeting have been published (Anon. 1997) and the abstracts of the second meeting are included in the AWSG conference proceedings (Anon. 1999b) and were also published (Jessop & Collins 1999). Unfortunately, there seems to be no plans to continue this series of seminars.
- Meetings. A number of meetings that involve managers and volunteers occur. These include:

1. Regular meetings of the Little Tern Taskforce in east Gippsland.
2. Phillip Island Nature Park Hooded Plover Management Group meetings.
3. The Wilsons Promontory Hooded Plover working group meet irregularly at Yanakie, Victoria, and are attended by DNRE and Parks Victoria staff.

4. Annual meeting of the Friends of the Hooded Plover at Mornington Peninsula National Park. These meetings are hosted by Parks Victoria, and scientists and other Hooded Plover managers often attend these meetings.

5. The regular NSW Recovery Team meetings, which include representatives from the Far South Coast Birdwatchers and the Eurobodalla Natural History Society. These meeting sometimes occur two or three times a year.

Despite the above effort at communication, it is generally considered that not enough communication currently occurs with counters (Weston & Paton 2001, W. Chapman in litt., T. Rolland in litt.). The longevity of the counts depends critically on volunteer counters, thus communication is considered a critical component of the proposed survey protocol.

CONCLUSION

- a survey protocol is presented in four elements: 1) organisation, 2) methods, 3) counter training and 4) communication.

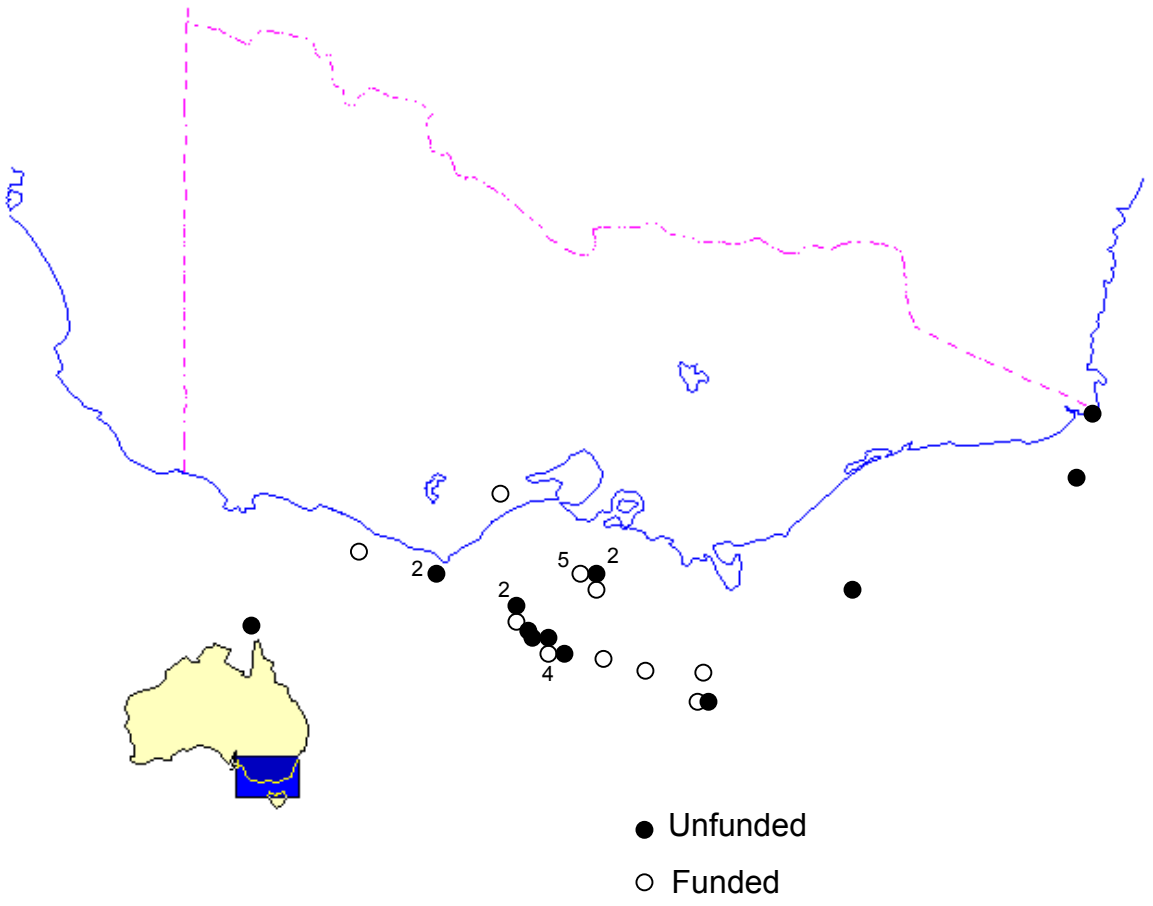


Figure 7.1. The distribution of Hooded Plover talks conducted by the author, 1991 to present. Numbers indicate the number of talks given at sites where more than one presentation has been made.

Chapter 8 – Risks to Hooded Plover Conservation on Land Managed by Parks Victoria

SUMMARY

This chapter determines all the threats which are thought to affect Hooded Plovers. These threats are classified according to their source, and how they affect the plovers. Supporting evidence for each threatening process is presented. Most threats identified influence reproductive success rather than survival of flying birds.

Hooded Plovers face a variety of threats which have been described in the literature, or which have been identified but not yet published. Some threatening processes have merely been suggested causes of mortality, while there is considerable evidence supporting the operation of other threatening processes. There is a need to define the sources of threats, how they operate to impact on Hooded Plovers, and what is known about the threats. This chapter investigates each threatening process.

This chapter does not deal with purely natural sources of mortality, for example, natural predators which prey upon nests, chicks and adults (Schulz 1992, 1995, Weston 1998a). Hooded Plovers are expected to be suitably adapted to cope with these threats. However, this chapter does deal with natural sources of mortality that have been artificially enhanced.

This chapter deals with each potential threat at a time. For each threat, the following structure has been used: 1) *Source*, a description of the origins of the threat, 2) *Potential impacts*, a description of the mechanisms, or links, between the source and its effect on Hooded Plovers, and 3) *Available data*, a section which presents the information available on the threat. This information is summarised at the end of the chapter.

VEHICLES

Source

Vehicles on Victorian beaches fall into one of five categories:

- illegally driven vehicles – it is illegal to drive on Victorian beaches without permission,
- management or research vehicles (driven with permission or permits),
- bicycles,
- horse and carts (sulkies), or;
- sail or kite cars.

Beach driving is illegal in Victoria, but non-management vehicles are regularly driven on beaches in some areas, particularly in western Victoria. Illegal vehicles recorded on Victorian beaches include four-and two- wheel motorbikes and four-wheel drive vehicles. These vehicles originate from a number of sources:

1. A number of local farmers have access tracks from their property through the dunes to the beach.
2. Many vehicle tracks that were discovered in western Victoria had been made overnight, suggesting anglers have been on the beach at night. This is particularly problematic because these tracks were high on the beach, probably because nocturnal high tides are higher than diurnal high tides.
3. Some non-fishers probably drive on the beach for recreation e.g., trail bikes being ridden along Venus Bay (MAW pers. obs.), picnickers and campers on Phillip Island (B. Baird in litt.). This class of beach driver probably requires easy access points to the beach.
4. Some South Australians drive across the border, either directly on the beach, or they may access the beach on the Victorian side. Beach driving is legal in South Australia and many interstate visitors may be unaware that it is illegal in Victoria.

Management vehicles perform a range of tasks including rubbish collection, patrols and search and rescue. Heavy machinery used to open up the mouths of creeks or rivers also fall into this category. The use of off-road bicycles on beaches is becoming common (MAW pers. obs.). Sail cars (actually powered by large kites) frequently occur at Collendina, and are effectively recreational vehicles.

Potential impacts

There are two main impacts of vehicles on beaches:

- Crushing of nests and young, and
- Collisions with flying birds.

Available data

Buick & Paton (1989) estimated 81% of Hooded Plover nests on the Coorong in South Australia were crushed within a normal incubation period. Steve Gilbert (in V. Natt in litt.) suggests that many Coorong nests are still found amongst vehicle wheel ruts along the beach, and he feels that nest success may be greater in areas where four wheel drive access is more difficult. One South Australian nest located during the November 2000 AWSG Biennial National Hooded Plover Count was on a shell bank with a wheel rut less

than 30 cm away (V. Natt in litt.). In western Victoria, illegally driven vehicles crushed 18.2% of nests (Weston & Morrow 2000) and nests have been crushed by vehicles on Phillip Island (B. Baird in litt.). In Tasmania, vehicles have also destroyed nests (Berry in prep.).

Vehicles were also thought to crush up to 30% of chicks on the Coorong (Buick & Paton 1989). Chicks shelter in wheel ruts and behind debris and seaweed and are not easily seen. Chicks can also fall into deep wheel ruts and not be able to get out (V. Natt in litt.). Experience with the beach nesting Piping Plovers *Charadrius melodus* in the USA has also shown that eggs and young are crushed by vehicles, some of them being operated illegally (Melvin *et al.* 1994).

Vehicles may also kill adults through collisions: a dead adult was found in a car park and had apparently been struck by a vehicle (R. Farnes in Weston & Morrow 2000), another has been found dead on a Western Australian beach and was apparently struck by a four wheel drive (Rose 2000). Vehicles operated nocturnally could easily kill adults, particularly when weather conditions are poor (MAW pers. obs.).

Bicycles are generally too slow to represent any risk to chicks or flying birds, but they may crush nests if ridden above the high tide mark. Bicycles also increase the capacity for people to explore remote sections of Hooded Plover habitat. For example, the only people seen in remote sections of Cotters Beach, Wilsons Promontory National Park, were those on bicycles (MAW unpubl. data). Bicycles are a less serious problem to Hooded Plovers compared with the vehicles discussed above.

Horse-drawn carts are considered a threat to Hooded Plovers in Tasmania (P. Park in litt.), and they do occur on Victorian beaches (A. & J. Whitelaw in litt.). They could easily crush nests and chicks, and may be as problematic to nests as vehicles, although they are probably too slow to collide with flying birds.

Sail or Kite cars frequently operate at Collendina (near Point Lonsdale) on the beach and sometimes travel at high speeds. Each car carries one person. They confine their activities to the lower beach, and are only used during the day. When operated at high speeds, they have the potential to crush chicks which are hiding in the intertidal zone.

HUMANS

Source

About 84% of Victorians live in the coastal zone (see Traill & Porter 2001). Australians who live away from the coast often visit the coast for holidays (Yapp 1986). Many areas of Hooded Plover habitat in Victoria are used extensively by humans (e.g., Dowling & Weston

1999). The predominate use of beaches and dunes is by recreationists. Recreationists use Hooded Plover habitats for a wide variety of activities, but mainly for water-based activities (e.g., swimming and surfing) and sun-baking. Most recreation occurs in small groups, but large organised recreation events (e.g., surf carnivals) also occasionally occur. Most recreation occurs during the day, although some anglers and overnight campers also use Hooded Plover habitat at night (B. Dowling pers. comm., MAW pers. obs.).

Potential impacts

Humans can impact on Hooded Plovers by:

- disturbance during breeding. The response of breeding Hooded Plovers to nearby humans has been suggested to cause egg and chick mortality, by causing thermal or energetic stress, or by allowing predators access to eggs or chicks (Schulz 1992, Retallick & Bolitho 1993, Weston 2000a).
- crushing of nests and young (Dowling & Weston 1999),
- unintentional or mischievous collection of eggs and young (Anon. 1999a, D. Ryan in litt.),
- well-intentioned interference with nests (Weston 2000a), and
- attracting scavengers by littering (Schulz & Bamford 1987).

Available data

Many of the disturbances faced by Hooded Plovers are common to other beach-nesting birds, but the Hooded Plover has a long incubation and fledgling period of nearly two months, making it more vulnerable than most (Schulz 1992). There is a strong data set showing that humans disturb Hooded Plovers (for example, see Table 8.1).

Table 8.1 The frequency with which passing humans (unaccompanied by dogs) disrupted incubation and brooding (after Weston 2000a).

Source	Incubating (%)	Brooding (%)
Walkers	21.5	50.0
Joggers	25.0	58.0

Recent information has demonstrated that disturbance decreases reproductive success of Hooded Plovers (Hanisch 1998, Weston 2000a). One major study found that thermal stress to eggs appeared to result from human disturbance, and that this resulted in lower hatching rates through higher rates of egg abandonment (Weston 2000a). Higher rates of egg depredation in disturbed areas has also been reported (Hanisch 1998). Further study is

needed to determine the effect of disturbance on chicks, although the indications are that disturbance may well reduce chick survival (Weston 2000a).

Dowling & Weston (1999) found 30% of nests in Mornington Peninsula National Park were crushed by humans. In western Victoria, 20% of nests were perceived to be at high risk from crushing; 18.3% of breeding units were within 250 m of an access point (Weston & Morrow 2000). On Phillip Island, a child apparently dislodged a nest from a steep nesting site (J. Fallaw pers. comm.). As yet, there is no information on crushing of chicks, but humans have stepped very near crouching chicks (pers. obs).

Mischievous or well-meaning collections of Hooded Plover eggs and chicks have been reported (Schulz 1992, Anon. 1999a, B. Baird, P. Dann., B. Dowling and K. Bartram pers. comms, D. Ryan in litt.). The rate of collection is probably low, because the vast majority of recreationists do not detect eggs or chicks (Weston 2000a). However, such collection occurs even in National and Coastal Parks (Anon. 1999a, B. Dowling pers. comm., D. Ryan in litt.). Well-meaning collections stem from a lack of awareness. This is emphasised by one person who brought a Hooded Plover egg to a ranger and "… could not understand why there would be an egg sitting on the beach when there wasn't any trees around." (D. Ryan in litt.).

Weston (2000a) reports one nest lost to "Other human interference" This nest, at Harmers Haven, was placed on the bank of a creek which also formed a footpath access to the beach. Several weeks into incubation, somebody piled rocks and driftwood around the nest, presumably to keep it safe from being crushed by passing walkers. The nest was abandoned.

Refuse left on beaches has been suggested to attract scavengers such as ravens and gulls (Schulz & Bamford 1987). Ravens are known nest predators of Hooded Plovers, although gulls are successfully driven from areas with nests or chicks (Weston 2000a).

DOGS

Source

The vast majority of dogs are accompanied by humans (Parks Victoria 1998b, Dowling & Weston 1999, Weston 2000a, MAW pers. obs.), although there are some feral dogs in coastal Victoria (Schulz 1992). At Port Campbell National Park, packs of roaming dogs are likely to be pets (Parks Victoria 1997). Dingoes also occur on beaches within the range of Hooded Plovers (A. McIntyre pers. comm.).

Most dogs with humans are on the beach for exercise, but some surfers take dogs to guard the property they leave on the beach while they surf (B. Baird in litt.).

Potential impacts

Dogs impact on Hooded Plovers by:

- disturbance during breeding (Weston 2000a),
- preying upon nests, chicks and breeding adults (Weston 1998a, Weston & Morrow 2000, B. Baird in litt.), and;
- crushing nests (B. Baird in litt.).

Available data

Dogs are highly disturbing to breeding Hooded Plovers (Weston 2000a). Walkers with dogs represented 16.1% of encounters of potential disturbances with nests (and 17% with broods) in central Victoria. Unleashed dogs (with walkers) caused the incubator to leave the nest on 38.4% of encounters, whereas leashed dogs caused the incubator to leave the nest on 21.1% of encounters. Unleashed dogs (with walkers) caused the brooding of chicks to cease on 51.4% of encounters, compared with 33.3% for leashed dogs (Weston 2000a).

Dogs not accompanied by humans represented 0.9% of encounters with nests and caused the incubator to leave the nest on 43.8% of encounters. They represented 2% of encounters with broods (Weston 2000a).

Domestic dogs chase, maul and kill adults (Retallick and Bolitho 1993, Weston & Morrow 2000, B. Baird in litt.) and have been seen mauling (Weston 1998a) and killing chicks (B. Baird in litt.). They also probably prey on nests in Victoria (Dowling & Weston 1999) and are known to prey upon Hooded Plover nests in Tasmania (Hanisch 1998). On Phillip Island, at least 24% of nests over a four year period were lost to dogs (B. Baird in litt.). In western Victoria, 10% of nests were considered at medium risk from dogs – instantaneous sampling revealed 10.0% and 5.3% of breeding units were within 250 m of unleashed and leashed dogs respectively (Weston & Morrow 2000). On Phillip Island, dogs are considered the greatest cause of breeding failure (B. Baird in litt.).

There is a record of a large dog crushing three eggs in a nest on Phillip Island (B. Baird in litt.).

ANIMALS

Source

Large animals that occur on beach and dune areas fall into the following categories:

- Stock occur on beaches due to poor fencing e.g., Shelly Beach, Otway Ranges National Park and at Discovery Bay National Park (Parks Victoria 1998a, MAW pers. obs.). Some stock may be deliberately allowed to graze on the foredunes (B. Baird pers. comm.).
- Private horses, either individually (e.g., at Venus Bay, pers. obs.), as part of Pony Clubs, or as part of training racing horses (e.g., Thirteenth Beach, W. Chapman in litt., Discovery Bay Coastal Park, Parks Victoria 1998a).
- Commercial tourist operators using horses and camels (e.g., in Moyne Shire, Martin 1999).

Potential impacts

The main potential impact is crushing, particularly of nests, but possibly of chicks (Schulz 1992, B. Baird in litt.). Another possibility is that stock may eat eggs for the Calcium they contain. Breeding pairs on Phillip Island are thought to desert the breeding areas during the period when they are used by stock (B. Baird in litt.).

Available data

It has been suggested that stock are responsible for crushing some nests and possibly some young (Schulz 1992, 1993, Weston & Morrow 2000, B. Baird in litt.). Stock have been seen illegally grazing within 20 m of a Hooded Plover nest within a National Park (MAW pers. obs.).

Commercial and private horse riding is permitted in some sections of beach in some National Parks in Victoria (e.g., Parks Victoria 1998b). At Port Campbell National Park, illegal horse riding occurs near Peterborough in areas where Hooded Plovers breed (Parks Victoria 1997). At Thirteenth Beach, ad hoc contact with horse owners has not successfully stopped illegal riding in an area closed to horse riding for Hooded Plover conservation (W. Chapman in litt., MAW pers. obs.).

INTRODUCED PREDATORS.

Source

A number of introduced predators are thought to prey upon Hooded Plovers. These include:

- Foxes *Vulpes vulpes* (Schulz & Bamford 1987, Schulz 1992, Dowling & Weston 1999, Weston 2000a).
- Feral, unowned and roaming domestic cats (Seebeck & Clunie 1997, Urquhart 2000).
- Rats (Berry in prep., B. Baird pers. comm.).

Potential impacts

All these introduced predators can potentially prey upon eggs, chicks and flying birds.

Available data

Foxes are common in Hooded Plover habitat and are well known Hooded Plover nest predators. In Victorian studies, foxes accounted for between 1.8 and 26.8% of Hooded Plover nests (Dowling & Weston 1999, Weston 2000a, Weston & Morrow 2000). They might be responsible for preying upon chicks but there is no direct evidence for this as yet. Foxes are perceived to be the greatest threat to Hooded Plover populations in relatively pristine areas such as Far East Gippsland (A. Murray in litt.) and western Victoria (Weston & Morrow 2000).

Cats are opportunistic predators and will eat a wide variety of foods including birds (Seebeck & Clunie 1997, Urquhart 2000). Cat densities are thought to be highest near human habitation (Seebeck & Clunie 1997). Feral cats occur in coastal National Parks in Victoria (e.g., Otway Ranges and Port Campbell National Parks, DNRE 1996 and Parks Victoria 1997). Dumped kittens have been located within 500 metres of an active breeding territory (MAW pers. obs.). They are suspected predators of Hooded Plover adults at some cage sites at Phillip Island Nature Park (B. Baird pers. comm.). In Tasmania they have been reported preying upon Hooded Plover nests (Hanisch 1998). Although cats may be active at any time, they are usually more active at night (Urquhart 2000), making their activities difficult to monitor.

Rats are known to prey upon Hooded Plover nests (Hanisch 1998). Victorian coastal regions are inhabited by native and introduced rodents. In Tasmania, Berry (in prep.) and Park (in litt.) found Water Rat *Hydromys chyrsogaster* footprints on beaches where Hooded Plovers were breeding, sometimes the tracks were close to nests. Introduced Black rats *Rattus rattus* are known to occur in coastal land managed by Parks Victoria (e.g., in Corner Inlet, NRE

1996b). Rats are notorious predators of ground nesting birds and their eggs and young (see, for example, Marchant & Higgins 1993). Rats have been suspected of taking some Hooded Plover nests in Victoria (MAW pers. obs., B. Baird pers. comm.) and Tasmania (Berry in prep.).

SCAVENGERS

Source

Gull populations have undoubtedly increased since European settlement (Blakers *et al.* 1984), and are very common in Hooded Plover habitat. This is particularly true of the Silver Gull *Larus novaehollandiae*. Other gulls found in Hooded Plover habitats are the Pacific Gull *L. pacificus* and the Kelp Gull *L. dominicanus*.

Three species of ravens occur in Hooded Plover habitats in Victoria: Forest Ravens *Corvus tasmanicus*, Australian Ravens *C. coronoides* and Little Ravens *C. mellori*. Populations of these intelligent and adaptable predators are thought to have increased since European settlement (Blakers *et al*. 1984, Schulz & Bamford 1987, Schulz 1992). Increases in food resources, such as coastal tips and urban rubbish bins, may sustain artificially high populations. Some ravens forage on fruits in dune areas (Weston & Morrow 2000).

Ibis are a potential risk to Hooded Plovers (B. Baird in litt.). They forage on Victorian beaches in the upper section where Hooded Plovers often nest (MAW pers. obs.). Two species of ibis have been noted foraging on Victorian beaches: Australian White Ibis *Threskiornis molucca* and Straw-necked Ibis *T. spinicollis*.

Potential impacts

The potential impact of scavengers is that they take eggs and chicks (Schulz & Bamford 1987, Schulz 1992). However, being generalist foragers, ravens are known to have also killed and hunted flying Hooded Plovers (Weston 2000a, C. Appleby pers. comm.).

Available data

Silver Gulls have been seen consuming Pied Oystercatcher *Haematopus longirostris* eggs in Tasmania (P. Park in litt.). Concern has been expressed that gulls prey upon Hooded Plover eggs and chicks (e.g., Schulz & Bamford 1987, Schulz 1992, Urquhart 2000). However, Weston (2000a) found that Hooded Plovers effectively defended their nests and chicks against gulls. Weston (2000a) also tested the idea that disturbance from humans may leave the eggs and chicks exposed to gulls. Silver Gulls approached to within 30 cm of the unattended nest, much closer than incubating adults would have tolerated (closest approach about 10 m). However, the gulls did not detect the cryptic nest, and no nest loss could be

attributed to gulls (Weston 2000a). Nevertheless, the combination of disturbance and gulls may account for a small number of nest losses.

Ravens have been demonstrated to be important predators of nests (Weston 2000a, Berry in prep.). They have also hunted adult Hooded Plovers, and have killed and eaten juveniles (Weston 2000a, Weston & Morrow 2000, C. Appleby pers. comm.).

There is no evidence that Ibis have taken eggs or chicks. In a comprehensive review of the diet of Australian and Straw-necked Ibis, neither species was recorded eating young birds or eggs, but they do sometimes eat small mammals (Marchant & Higgins 1990). This suggests that it is a possibility that Ibis may occasionally prey upon Hooded Plover chicks.

POLLUTION

Source

Pollution in the form of spills or litter has both onshore and offshore, commercial and private origins.

Potential impacts

Two types of pollution which may be detrimental to Hooded Plovers are:

- Oil spills, which have been recognised as a potential threat to Hooded Plovers (Schulz & Bamford 1987, Schulz 1992) and have occurred in Victoria (e.g., NRE 1996a).
- Fishing line on beaches, which has the potential to snare Hooded Plover adults and chicks (B. Baird in litt., MAW pers. obs.).

Available data

Oil spills, though infrequent and unlikely, have the potential to affect large sections of coastline. Oil-affected Hooded Plovers have been seen during clean-up operations in Tasmania (Holdsworth & Bryant 1995). The effects of oil on marine birds can be devastating. In previous oil spills, the care and rehabilitation of Hooded Plovers (a threatened species) has been neglected at the expense of caring for higher numbers of common species (such as Little Penguin *Eudyptula minor*). In Victoria, the Hooded Plover and the Little Tern *Sterna albifrons* are the most significant beach bird in terms of significant populations of threatened species.

The trap used to catch Hooded Plovers in Victoria (Weston 2000a) used running nooses of fishing line, indicating the potential for ensnarement in discarded line.

HABITAT MODIFICATION

Source

Habitat modification has been suggested to adversely affect breeding beaches. Habitat modification results from a variety of processes and developments:

- erosion control (Park 1994, Weston & Morrow 2000),
- invasive plants other than those used for erosion control (Urquhart 2000),
- extractive processes and industries, such as kelp-harvesting and clearing, sand mining, driftwood collection and private shellfish collecting (Schulz 1992, Parks Victoria 1998b, Weston & Morrow 2000),
- coastal developments (Weston & Morrow 2000), and;
- climate change which may potentially cause sea level rises (Weston & Morrow 2000).

Potential impacts

Habitat modification could result in many areas being abandoned by the birds, and may contribute to lowered reproductive success (e.g., through diminished food supplies available for chicks).

Available data

The main habitat modification currently results from measures to control erosion in dunes. Erosion control in dunes is widespread in Victoria (MAW pers. obs.). Generally, Hooded Plovers will only nest in areas of open sand, and they avoid the steepest of dunes and foredunes (MAW pers. obs.). Erosion control reduces open areas, and often results in steeper dunes and foredunes (Park 1994, P. Heyligers pers. comm.). Such control has the potential to permanently remove Hooded Plover breeding habitat, because steep, heavily vegetated dunes are unsuitable for nesting.

Erosion control can take the form of laying branches over bare sand – a number of Hooded Plover nesting areas have been destroyed by such erosion control on the Bellarine Peninsula (MAW pers. obs.). Some plants used for erosion control, such as Sea Spurge *Euphorbia paralias* (Schulz 1992) and Marram Grass *Ammophila arenaria* (Park 1994) are thought to pose a threat to Hooded Plover habitat (B. Baird in litt., S. Keenan in litt., P. Park in litt.). Some native plants (e.g., Beach Grass *Spinifex sericeus*) are also used for erosion control within the range of Hooded Plovers (P. Heyligers pers. comm.). Erosion control is both deliberate (e.g., covering with brush or planting) and incidental (e.g., colonisation of dunes by introduced plants such as Marram Grass). In many areas, there are proposals to stabilise

dunes in areas where Hooded Plovers are nesting (e.g., between Levy's Point and Port Fairy, Martin 1999) and recommendations to use Marram Grass to stabilise dunes were made until at least the late 1990's (e.g., Kesby & Druett 1997). Marram grass was used to stabilise dunes in National Parks (Parks Victoria 1998b). Other methods of erosion control are also problematic. These include "snow" or brush fences on dunes, and the construction of groynes, breakwaters and beach fences (see Melvin *et al.* 1991).

Dune blowouts are a major part of the breeding habitat of Hooded Plovers in Wilsons Promontory National Park. Analysis of the aerial photographs by Bennett (1994) reveals a decrease in the area of blowouts on the Yanakie Isthmus. In 1941, 1975 ha of bare sand was present, in 1972 1167 ha of bare sand was present and in 1987 the figure had fallen to 977 ha. Bennett (1994) showed that the expansion of Coastal Tea-tree *Leptospermum laevigatum* into the blowouts was responsible for the reduction in area of open sand. The probable reason for the spread of Tea-tree on the isthmus is an increase in grazing pressure by rabbits and Kangaroos due: 1) to their exposure of bare ground and 2) to the restriction of the feeding range of cattle which are known to graze Tea-tree (Bennett 1994). Altered burning regimes probably also contribute to the vegetational change (Bennett 1983, 1994, Judd 1990). It is anticipated that the spread of Tea-tree will continue (Bennett 1994). Currently, there is still substantial blowout areas for nesting in the National Park, but the process represents a long-term threat to the breeding habitat. The extent of this problem elsewhere in Victoria is unknown. Invasion of breeding habitat by native vegetation is also known from Tasmania (P. Park in litt.).

Other invasive introduced plants, apart from those introduced to control erosion and native invasive species, also present problems. For example, African Boxthorn *Lycium ferocissimum* grows on dunes and harbours foxes and rabbits (see Urquhart 2000), and it also probably limits Hooded Plover breeding habitat. It grows extensively in dune areas (see the summary in Urquhart 2000). Potential predators, such as ravens, perch in Boxthorn (MAW pers. obs.) and the plants may provide habitat for potential reptilian predators. One possible but unconfirmed benefit of Boxthorn may be a relatively safe hiding place for chicks. However, no chick has ever been seen using Boxthorn, and on balance the presence of Boxthorn is considered deleterious in the long-term.

Kelp harvesting or clearing has the potential to disrupt Hooded Plover habitat and food resources (Schulz 1992, Parks Victoria 1998b, Weston & Morrow 2000). There is some evidence that nest sites in the wrack are preferred (Berry in prep.) so mechanical destruction of nests during harvesting is a real possibility. Illegal collection of shellfish may diminish food resources (Schulz 1992). Collection of sand would be highly disturbing and may limit food

supplies (Weston & Morrow 2000). Private collection of driftwood and seaweed may risk damage or destruction of nests, which are often close to cover.

Coastal developments can destroy or diminish the habitat values of the area. In particular, developments on dunes (e.g., wind farms) are likely to result in Hooded Plovers abandoning the affected area. Many developments have flow-on effects of increasing disturbance in the general area because access is increased (Weston & Morrow 2000). Developments too close to the dunes or beach may require erosion control works, further affecting habitat.

Predicted climate change is expected to alter the large-scale distribution of flora and fauna (Bennett *et al.* 1991). Associated increases in sea-levels will probably act directly on the habitat of coastal species like the Hooded Plover.

The data available on habitat preference is limited (see Chapter 15). This means it is difficult to determine the tolerance of the species to habitat modification.

SUMMARY OF THE RISKS TO HOODED PLOVERS

Table 8.2 summarises the risks to Hooded Plovers as described in this chapter. Overall, eight sources of threat have been identified, and they operate in nineteen distinct ways on Hooded Plovers. Nine demonstrated and seven potential sources of nest mortality were presented. For chicks, three demonstrated and nine potential sources of mortality were uncovered. For juveniles, one demonstrated and four potential sources of mortality were described. Two sources of mortality to adults were demonstrated, and three potential sources were indicated.

Table 8.2. Summary of the risks (threats) currently facing the Hooded Plover, and the evidence available for the operation of each threatening process. D=demonstrated, P=potential, N=not thought to constitute a risk and ?=unknown.

Source	Mechanisms	Nest mortality	Chick mortality	Juvenile mortality	Adult mortality
Vehicles	crushing	D	P	N	N
Vehicles	collisions	N	N	P	D
Humans	crushing	D	D	N	N
Humans	disturbance	D	P	N	N
Humans	collection	D	D	N	N
Humans	interference	D	N	N	N
Dogs	disturbance	D	P	N	N
Dogs	predation	D	D	P	D
Animals	crushing	P	P	N	N
Animals	predation	P	N	N	N
Introduced Predators	predation	D	P	N	N
Scavengers	predation	D	?	D	P

Source	Mechanisms	Nest mortality	Chick mortality	Juvenile mortality	Adult mortality
Pollution	ingestion (oil)	?	?	P	P
Pollution	entanglement	N	N	P	P
Habitat modification	erosion control	P	P	N	N
Habitat modification	invasive plants	P	P	N	N
Habitat modification	extractive processes and industries	P	P	N	N
Habitat modification	Coastal developments	P	P	N	N
Habitat modification	Climate change	P	P	N	N

Overall, 28 demonstrated mechanisms that influenced the survival of eggs or chicks were identified, compared with only ten mechanisms for birds that could fly. The most frequent mechanisms influencing nests and chicks were crushing, predation and disturbance. For flying birds, only predators, collisions with vehicles and pollution are demonstrated or potential threats.

CONCLUSIONS

- Eight sources of threat are identified. These act in nineteen different ways on Hooded Plovers.
- Most threats lower reproductive success, with relatively few acting on flying birds.

Chapter 9 – Assessment of Risks to Hooded Plover Conservation on Land Managed by Parks Victoria

SUMMARY

This chapter identifies and ranks the risks to Hooded Plovers on land managed by Parks Victoria. This is done by determining which risks operate in which Parks Victoria sites. The degree with which each risk is present at a particular site is also estimated.

At least some threatening processes facing the Hooded Plover are localised (Weston 1993). For example, while illegally driven vehicles are a major cause of nest failure in western Victoria (Weston & Morrow 2000) they did not cause any nest failure at Mornington Peninsula National Park (Dowling & Weston 1999).

Not all threatening processes are likely to impact on Hooded Plover populations to the same extent. For example, the collection of eggs by recreationists is infrequent compared with fox predation of eggs, and so egg collection represents a threat which has less impact on populations of Hooded Plovers (see Schulz 1992).

The variation in occurrence and impact of threats means that managers face complicated decisions about what threat to manage and where to manage them. This chapter lists the threats apparent at each site managed by Parks Victoria in order to provide the distribution of risks. The distribution of threats may vary within a site, but this study summarises the threats to the population of Hooded Plovers across an entire site. For example, if a site is remote except for a single popular beach which holds only a small proportion of the site's Hooded Plovers, then the impact of humans at the site may be considered small. This is because humans would only affect a small part of the population, even though they may affect that part severely.

ASSESSING IMPACTS

Potential risks have been identified in the previous chapter. Here, risks are ranked according to their likely impact on Hooded Plovers. In order to assess the impact of risks, an "Impact Scale" was developed, and is presented in Table 9.1. The table also indicates the levels of breeding failure, territory loss or mortality that can be expected for each score. The criteria are based on apparent sensitivities of populations to different processes (see Chapter 15). For example, breeding failure is common in Hooded Plovers, and they can re-nest and thus compensate for the loss to some extent. However, the death of flying birds is more problematic at the population level because the birds are difficult to produce and have the potential to breed for many years (see Chapter 15).

Table 9.1. An Impact Scale – a scale to indicate the impact of threatening processes (or risks) on Hooded Plovers.

Category	Score	Criteria		
		Percentage of breeding attempts that fail OR	**Percentage of territories lost annually OR**	**Percentage of mortality among flying birds**
Very High	5	21+	2.1+	12+
High	4	16-20	1.6-2.0	9-11
Moderate	3	11-15	1.1-1.5	6-8
Minor	2	6-10	0.6-1.0	3-5
Slight	1	0-5	0.0-0.5	0-2

Impacts are likely to be cumulative (although some may be interactive), so a score is provided for each impact category. This score allows the total impacts at each site to be determined, and also permits a comparison of the impact of different risks across the Parks Victoria estate.

These risks and the estimate of their impact are based on studies, unpublished data, and extensive communication with land managers and others. In many areas, risks are well known and have been surveyed (e.g., Weston & Morrow 2000). Further information may indicate that revision of some aspects of this analysis is required.

RISKS AT EACH SITE

Table 9.2 lists the estimated risks to Hooded Plover conservation at each site, and indicates the impact of each risk on the population at that site. Two risks (oil ingestion and sea-level rises) are excluded from the table because they are not site specific, and will or could act on any or all sites.

Table 9.2 clearly shows the localised nature of some risks (e.g., vehicles), and the widespread nature of other risks (e.g., humans and introduced predators). Tables 9.3 and 9.4 summarise the risk from all sources evident at different Parks Victoria sites.

Table 9.2. The risks to Hooded Plover conservation at each site and the impact of those risks on the population (see table 9.1 for an explanation of the impact score and abbreviations). Blanks indicate that a particular threat is thought to have no impact on the population at that site, and asterisks indicate where a threat is considered to be present but to have a negligible impact.

Source	Vehicles		Humans				Dogs		Animals		Introd-uced Predators	Scavan-gers	Pollution	Habitat modification			
Mechanism	Crush-ing	Colli-sions	Crush-ing	Distur-bance	Collec-tion	Interfer-ence	Distur-bance	Preda-tion	Crush-ing	Preda-tion	Predation	Preda-tion	Entangle-ment	Erosion control	Invasive plants	Extrac-tive process	Coastal develop-ments
Discovery Bay Coastal Park	1	1		1							4	3		3			1
Narrawong Coastal Reserve	3	1		2			2	1			3	2		3			1
Eumeralla (Yambuk) Coastal Reserve	3	1		1			1		1		3	2		3			1
Yambuk F.F.R	2	1	1	1			1		1		3	2		3			
Port Fairy - Warrnambool Coastal Reserve	1	1	2	2			2	1	2		3	3		3			
Port Fairy Maritime Complex H.A				2			1	1			2			2			1
Bay Of Islands Coastal Park			1	2			1	1			2	1					
Peterborough Coastal Reserve			1	2			1	1			2	1		2			
Port Campbell National Park			1	2			1		1		2	1	1				
Otway National Park			1	1			2	1	1		3	1		1			
Elliot River - Addis Bay Coastal Reserve			1	3	*	*	3	1			3	1		1			1

Source	Vehicles		Humans				Dogs		Animals		Introd-uced Predators	Scavan-gers	Pollution	Habitat modification			
Mechanism	Crush-ing	Colli-sions	Crush-ing	Distur-bance	Collec-tion	Interfer-ence	Distur-bance	Preda-tion	Crush-ing	Preda-tion	Predation	Preda-tion	Entangle-ment	Erosion control	Invasive plants	Extrac-tive process	Coastal develop-ments
Angahook - Lorne State Park			1	3	*	*	3	1			3	1		1			1
Wye River Coastal Reserve			1	3	*	*	3	1			3	1		1			1
Lorne - Queenscliff Coastal Reserve	1		2	3			3	1	2		3	3		4	1		2
Lake Connewarre W.R.				1			2	1			3	1					3
Lonsdale Lakes W.R.			1	1			2	1			3	2				1	3
Point Lonsdale Jetty			2	3	*	*	3	1			2	2		5			
Queenscliff Port And Associated Facilities				1	*	*					2	1				2	1
Mud Islands W.R.				1								1					
Mornington Peninsula National Park	1		2	3	*	*	4	1	1		3	2	1		3		
Harold Holt - Point Lonsdale Fisheries Res.											3	1					
Flinders - Somers Coastal Reserve			2	2	*	*	3	1			2	2					

Source	Vehicles		Humans				Dogs		Animals		Introd-uced Predators	Scavan-gers	Pollution	Habitat modification			
Mechanism	Crush-ing	Colli-sions	Crush-ing	Distur-bance	Collec-tion	Interfer-ence	Distur-bance	Preda-tion	Crush-ing	Preda-tion	Predation	Preda-tion	Entangle-ment	Erosion control	Invasive plants	Extrac-tive process	Coastal develop-ments
Flinders Jetty			2	2	*	*	3	1			2	2	1				
Phillip Island Coastal Reserve			2	2	*	*	4	1	1		3	1		1			2
Cowes Jetty			2	3	*	*	2	1			2	1	1	1			
Rhyll Jetty			1	2	*	*	2	1			2	1	1	1			
Newhaven Slipway			1	2	*	*	2	1			2	1	1	1			
Newhaven Jetty			1	2	*	*	2	1			2	1	1	1			
San Remo Jetty			1	2	*	*	2	1			2	1	1	1			
San Remo - Pt Smythe Coastal Reserve			1	2			2	1			4	1		2			3
Bunurong Marine Park			2	3	*	*	3	1			4	1					
Andersons Inlet W.M.C.A				2			1	1			2	1		2			1
Cape Liptrap Coastal Park				1			1				4	1		1			3
Waratah Bay - Shallow Inlet Coastal Reserve			1	2	*	*	2	1	1		3	1		2			2
Shallow Inlet Marine And Coastal Park			1	1			2				3	1		2			1
Wilsons Promontory National Park			1	2							4	1	1		3		3

Source	Vehicles		Humans				Dogs		Animals		Introd-uced Predators	Scavan-gers	Pollution	Habitat modification			
Mechanism	Crush-ing	Colli-sions	Crush-ing	Distur-bance	Collec-tion	Interfer-ence	Distur-bance	Preda-tion	Crush-ing	Preda-tion	Predation	Preda-tion	Entangle-ment	Erosion control	Invasive plants	Extrac-tive process	Coastal develop-ments
Port Franklin - Port Welshpool Coastal Reserve			1	1				1			3	1					1
Nooramunga M&C Park				1			1				2	1	1	2			3
Mcloughlins Beach - Seaspray Coastal Reserve				1			1				3	1	1	2			3
Jack Smith Lake W.R				1			1				3	1	1	1			3
Gippsland Lakes Coastal Park			1	2			2	1			2	1	1	2			2
Rigby Island Reserve	1			2			1				2	1					
Lakes Entrance - Lake Tyers Coastal Reserve			1	2			2	1			2	1		1			2
Ewing Morass W.R				1			2				2	1	1	1			2
Marlo Coastal Reserve			1	2			2				2		1	1			
Cape Conran Coastal Park			1	1			2	1			3	1					1
Croajingolong National Park				2			1				4	1					1
Mallacoota Coastal Reserve			1	3			2	1	1		2	1	1	2			

Table 9.3. The total risk evident at each site managed by Parks Victoria (sum of impact scores). Sites are also ranked by the sum of the impact scores, such that the lower the rank score the higher the risk (i.e., rank 1 = the highest risk). Sites are presented from west to east.

Site	Sum of impact scores	Rank
Discovery Bay Coastal Park	14	8
Narrawong Coastal Reserve	18	4
Eumeralla (Yambuk) Coastal Reserve	16	6
Yambuk F.F.R	15	7
Port Fairy - Warrnambool Coastal Reserve	20	3
Port Fairy Maritime Complex H.A	9	13
Bay of Islands Coastal Park	8	14
Peterborough Coastal Reserve	10	12
Port Campbell National Park	9	13
Otway National Park	11	11
Elliot River - Addis Bay Coastal Reserve	14	8
Angahook - Lorne State Park	14	8
Wye River Coastal Reserve	14	8
Lorne - Queenscliff Coastal Reserve	25	1
Lake Connewarre W.R.	11	11
Lonsdale Lakes W.R.	14	8
Point Lonsdale Jetty	18	4
Queenscliff Port And Associated Facilities	7	15
Mud Islands W.R.	2	17
Mornington Peninsula National Park	21	2
Harold Holt - Point Lonsdale Fisheries Res.	4	16
Flinders - Somers Coastal Reserve	12	10
Flinders Jetty	13	9
Phillip Island Coastal Reserve	17	5
Cowes Jetty	13	9
Rhyll Jetty	11	11
Newhaven Slipway	11	11
Newhaven Jetty	11	11
San Remo Jetty	11	11
San Remo - Pt Smythe Coastal Reserve	16	6
Bunurong Marine Park	14	8
Andersons Inlet W.M.C.A	10	12
Cape Liptrap Coastal Park	11	11
Waratah Bay - Shallow Inlet Coastal Reserve	15	7

Site	Sum of impact scores	Rank
Shallow Inlet Marine And Coastal Park	11	11
Wilsons Promontory National Park	15	7
Port Franklin - Port Welshpool Coastal Reserve	8	14
Nooramunga Marine & Coastal Park	11	11
Mcloughlins Beach - Seaspray Coastal Reserve	12	10
Jack Smith Lake W.R	11	11
Gippsland Lakes Coastal Park	14	8
Rigby Island Reserve	7	15
Lakes Entrance - Lake Tyers Coastal Reserve	12	10
Ewing Morass W.R	10	12
Marlo Coastal Reserve	9	13
Cape Conran Coastal Park	10	12
Croajingolong National Park	9	13
Mallacoota Coastal Reserve	14	8

Table 9.4. The total risk evident at each site managed by Parks Victoria (sum of impact scores), sorted by the sum of impact scores (i.e. by rank). Rank score “1” is the highest risk.

Site	Sum of impact scores	Rank
Lorne - Queenscliff Coastal Reserve	25	1
Mornington Peninsula National Park	21	2
Port Fairy - Warrnambool Coastal Reserve	20	3
Narrawong Coastal Reserve	18	4
Point Lonsdale Jetty	18	4
Phillip Island Coastal Reserve	17	5
Eumeralla (Yambuk) Coastal Reserve	16	6
San Remo - Pt Smythe Coastal Reserve	16	6
Yambuk F.F.R	15	7
Waratah Bay - Shallow Inlet Coastal Reserve	15	7
Wilsons Promontory National Park	15	7
Discovery Bay Coastal Park	14	8
Elliot River - Addis Bay Coastal Reserve	14	8
Angahook - Lorne State Park	14	8
Wye River Coastal Reserve	14	8
Lonsdale Lakes W.R.	14	8
Bunurong Marine Park	14	8
Gippsland Lakes Coastal Park	14	8

Site	Sum of impact scores	Rank
Mallacoota Coastal Reserve	14	8
Flinders Jetty	13	9
Cowes Jetty	13	9
Flinders - Somers Coastal Reserve	12	10
Mcloughlins Beach - Seaspray Coastal Reserve	12	10
Lakes Entrance - Lake Tyers Coastal Reserve	12	10
Otway National Park	11	11
Lake Connewarre W.R.	11	11
Rhyll Jetty	11	11
Newhaven Slipway	11	11
Newhaven Jetty	11	11
San Remo Jetty	11	11
Cape Liptrap Coastal Park	11	11
Shallow Inlet Marine And Coastal Park	11	11
Nooramunga Marine & Coastal Park	11	11
Jack Smith Lake W.R	11	11
Peterborough Coastal Reserve	10	12
Andersons Inlet W.M.C.A	10	12
Ewing Morass W.R	10	12
Cape Conran Coastal Park	10	12
Port Fairy Maritime Complex H.A	9	13
Port Campbell National Park	9	13
Marlo Coastal Reserve	9	13
Croajingolong National Park	9	13
Bay Of Islands Coastal Park	8	14
Port Franklin - Port Welshpool Coastal Reserve	8	14
Queenscliff Port And Associated Facilities	7	15
Rigby Island Reserve	7	15
Harold Holt - Point Lonsdale Fisheries Res.	4	16
Mud Islands W.R.	2	17

RISKS ON ALL LAND MANAGED BY PARKS VICTORIA

The widespread distribution of Hooded Plovers means that impacts of threatening processes are proportional to the distribution and impact of risks. Thus, the impact scores can be summed for each risk to derive the overall impact of each risk to Hooded Plovers on all land managed by Parks Victoria. This analysis is presented in Table 9.5, where risks are

presented in decreasing order of impact. The percentage of sites where the risks occur is used as a measure of distribution of the risks, and this is also presented in Table 9.5.

Table 9.5. The overall impact and distribution of risks across all Parks Victoria land that is actual or potential Hooded Plover habitat. Risks are presented in order of decreasing impact.

Source	Sum of impact scores	Percentage of impact scores	Number of sites where present	Percentage of sites where evident
Humans	129	21.8	47	97.9
Introduced predators	126	21.3	47	97.9
Habitat modification	118	19.9	40	83.3
Dogs	114	19.3	43	89.6
Scavengers	60	10.1	46	95.8
Vehicles	17	2.9	7	14.6
Pollution (entanglement)	16	2.7	16	33.3
Other animals	12	2.1	10	20.8

Overall, four risks have high impacts relative to those of other risks. These are humans, introduced predators, habitat modification and dogs. Combined these represent 82.3% of all impact scores assigned (592). These risks are also widespread, each occurring at least at 83% of sites.

CONCLUSIONS

- Some risks are localised while others are widespread.
- The site-by-site distribution of risks is presented.
- Across the Parks Victoria estate, four risks have high impacts relative to those of other risks. These are humans, introduced predators, habitat modification and dogs.

Chapter 10 – Identification of Management Options for Hooded Plovers on Lands Managed by Parks Victoria

SUMMARY

This chapter identifies the management options for Hooded Plovers on land managed by Parks Victoria. In total, 111 specific management options, which are categorised into seven management types, are identified.

The management options available for Hooded Plovers include:

- those managements already being used on the species,
- managements directed at other species and that are apparently benefiting the Hooded Plover, and;
- managements being used on analogous species, and that are applicable to Hooded Plovers. In particular, there is a wealth of information and experience in managing the Piping Plover *Charadrius melodus* of North America.

This chapter serves only to identify possible management options for the Hooded Plover. Where particular managements are not standard, or not fully documented elsewhere, descriptions of the technique are included in this chapter[1]. Information on the current stage of development and use of the techniques is also included. The next chapter evaluates the usefulness and applicability of these management options. The appearance of an option in this chapter does not imply that it is considered suitable in Parks Victoria managed land, only that it will be considered as a possible management option.

VISITOR MANAGEMENT

Humans

Most of the problems with humans can be solved by education, though in some areas on-ground measures need to be taken. Management options for humans fall into the following categories: educational and awareness options, on-ground managements and planning-phase managements.

Educational and awareness management options that should be considered for humans include:

[1] Images of signage and extension materials are provided in the appendices and on the Compact Disk. The digital images can be enlarged to view these materials in detail.

- Provision of interpretive material to walkers using coastal walks (e.g., the Great South West Walk).
    - **Details:** Such material could be in the form of information in the Park Notes, or could be a separate brochure (see Appendix 5). In Tasmania, a Summer Rangers program has resulted in good awareness among bushwalkers of the problems facing nesting Hooded Plovers (P. Park in litt.).
- Educational material could be sent to recreational groups such as Surf Life Saving Clubs, Surf Rider, Horse Riding and Fishing groups.
    - **Details:** Relevant Brochures are presented in Appendix 5. In the Coorong, the paper *Tattler* is available free to four-wheel drivers and advises of appropriate behaviour around Hooded Plovers. Brochures can date and must be monitored for correctness, as incorrect or contradicting information may jeopardise efforts to manage the species. The aim of such a campaign is to inform frequent beach-users of the problems facing the Hooded Plovers, and the ways they can help alleviate these problems while not diminishing their own enjoyment of the coast.
- Postcards for recreationists.
    - **Details:** Postcards featuring the Hooded Plover are handed to beach-goers at Phillip Island (J. Fallaw pers. comm., B. Baird in litt.) (see Appendix 5). The Breamlea Association has requested funds for the production of postcards (D. Moore in litt.), which will be based on the Phillip Island postcard (W. Chapman in litt.).
- Educational signs.
    - **Details:** These have been placed at beach access points, giving priority to those areas that are popular and support high numbers of Hooded Plovers, or those areas where new access points may bring humans into areas of high breeding densities of Hooded Plovers (see Appendix 6).
    - **Technical Details:** Signs that have been used have been purposefully designed, or are simply laminated posters. Some are standard metal signs, some are metal casts, and some are covered by perspex (B. Baird in litt., MAW pers. obs.). Some signs on Phillip Island are produced so as to minimise the risk of graffiti (J. Fallaw pers. comm.). Signs range from specific Hooded Plover signs to general signs (e.g., “Ground Nesting Birds. Please Keep Out.” Dowling & Weston 1999 and “Please Keep Away. Sensitive Bird Breeding Area”, P. Park in litt.). The production of signs seems particularly popular among funding bodies e.g., Coastaction has funded signs in a

number of areas (D. Cox and D. Moore in litt.) and continues to fund more signs (e.g., in Tasmania, P. Park in litt.). Signs have taken the form of:

1. Attachments to existing fences (e.g., Mornington Peninsula National Park, Breamlea/Blackrock blowout in the Surfcoast Shire),
2. Additions to interpretative signs (e.g., at Eagle's Nest, Bunurong Nature Reserve, and Freycinet National Park, Tas.).
3. Free-standing signs mounted on posts (e.g., at "The Spit" at the mouth of the Barham River, Apollo Bay) or metal frames (e.g., Cloudy Bay, Bruny Island, Tas., and Milligans Beach Conservation Area, Tas.). Cypress and aluminium mounts are being used at Mornington Peninsula (V. Teoh pers. comm.). In Tasmania, signs are placed 300-400 m from nesting areas (P. Park in litt.).

- Posters.
  - **Details:** Posters could be displayed in areas that beach users frequent, such as coffee shops and pubs (A. & J. Whitelaw in litt.). Currently available posters are presented in Appendix 7.
- Camp-ground talks and activity programs could be conducted at times of peak tourist use and peak nesting (late December and January).
  - **Details:** These talks and programs should focus on a code-of-conduct for beach users. They could be given at a number of sites, for example the Narrawong Camp-Ground and the camping area at the mouth of the Fitzroy River. Some "semi-residents" in the Camp-Grounds could be recruited to educate new arrivals. Parks Victoria has recently initiated a "Camp Hosts" program which could serve as the delivery device for this approach (B. Dowling pers. comm.).
- Providing information to neighbours.
  - **Details:** At Mornington Peninsula National Park, Hooded Plover brochures were distributed to letterboxes in Blairgowrie (James 1992). In Tasmania, brochures were distributed to letterboxes in areas where breeding sites were fenced off (P. Park in litt.).

- Talks at meetings of stakeholders.
  - **Details:** It may be possible for Parks Victoria staff to speak at the meetings of some of these groups (e.g., surf and angling club meetings).
- Education in schools.
  - **Details:** In the USA, a Piping Plover education kit including slides and course notes is available for use by teachers in schools. In Victoria, local rangers at Apollo Bay ran a student competition for designing Hooded Plover signs. Talks have been given in Victorian coastal schools (S. Zmitrowicz pers. comm., MAW pers. obs.).
- Media coverage, especially during spring and summer, could influence the behaviour of recreationists.
  - **Details:** Excellent exposure of the issues surrounding Hooded Plovers has been achieved in State and local newspapers (see, for example, Appendix 8). A number of television shows have featured Hooded Plovers and emphasised how beach users can minimise their impact on the species. These include Channel 10's *Totally Wild* and Channel 7's *Harry's Practice*. Radio interviews focussing on Hooded Plovers have been broadcast on a number of stations including ABC, RRR and 3CR.
- Coastal veterinarians should be informed of how to deal with any eggs and chicks that are collected by the well-meaning public.
  - **Details:** Veterinarians should be trained to identify Hooded Plover eggs and chicks, and asked to immediately return the chicks to the site of capture after any required treatment. There is an unconfirmed report of Hooded Plover chicks being brought to a veterinarian on the Mornington Peninsula (B. Dowling pers. comm.).

On-ground management options that should be considered for humans include:

- Permanent fencing – access points.
  - **Details:** To prevent nest trampling or disturbance, formalised (fenced) walking tracks could provide the only access through the dunes to the ocean beaches. The concentration of people using formal tracks may deter the Hooded Plovers from nesting close to access points. This management will also direct people to a central location on the beach, giving plovers raising chicks the opportunity to move away from areas of disturbance. One potential problem with fencing of all kinds is that it may provide perches for avian predators (Weston 1995).

- **Technical Details:** Ringlock (e.g., 30 x 20 mm mesh size) or 3-strand fences have been proven to be effective in channelling people through dune systems and off nesting sites (e.g., Dowling & Weston 1999), they are low maintenance and easily erected. Sand movement may result in the requirement for fence realignment (Urquhart 2000). Coastaction has funded fencing at Mornington Peninsula National Park (D. Cox in litt.).

- Permanent fencing – dune access.
  - **Details:** At Point Lonsdale, an area was permanently fenced by the Bird Observers Club of Australia (BOCA) to protect a pair of Hooded Plovers. The fence fell into disrepair, was abused by beach-goers (e.g., used as an area to leave dogs) and most importantly became overgrown. Consequently, the area was abandoned by Hooded Plovers (Weston 1995). Some fencing of this type is an extension of access point fencing e.g., at Alison Avenue at Rye the access point fencing will extend about 100m each side of the access point (V. Teoh pers. comm.).

- Permanent fencing – breeding areas.
  - **Details:** In Tasmania, one area which included a tern colony has been fenced with ringlock fencing (P. Park in litt.). This fence was erected in combination with generic signs and the distribution of brochures. It excluded most humans and all dogs – only once were human footprints found inside the area (P. Park in litt.).

- Electric fencing – breeding areas.
  - **Details:** No electrical fencing has been used specifically for Hooded Plovers, but pairs have benefited from such fencing placed around Little Tern colonies.
  - **Technical Details:** see Little Tern Taskforce (1997).

- Temporary fencing – dune access.
  - **Details:** One blowout area at Blackrock/Breamlea (Surfcoast Shire) has been fenced using star pickets and wire. Signs were attached but have faded to the extent that they are unreadable. The tide has also washed through the fence and may damage it in future (MAW pers. obs.) – during high tides walkers may be forced inside the fenced area. This fence was constructed to prevent human traffic on a large blowout area used for nesting. In particular football clubs and martial arts clubs exercised on the area. Brush was also laid on the blowout, and the combination of fencing and brush has prevented most human traffic (MAW pers. obs.).

- **Technical Details:** see below.

- Temporary fencing – around nests (the "nest fencing" of Urquhart 2000).
  - **Details:** This type of fencing is also known as "symbolic fencing" and has been used effectively for Piping Plovers (Melvin *et al.* 1991) and Hooded Plovers. This type of fencing has been used for a couple of seasons at the Phillip Island Nature Park, and provides a physical barrier that reinforces Temporary Beach Closures (see Figure 10.1). It has also been used at Inverloch to protect a pair of Hooded Plovers (J. Whitelaw and T. Rolland pers. comm.), has been trialed in Mornington Peninsula National Park (V. Teoh pers. comm.), and has been used in south eastern South Australia to protect nests from being crushed by vehicles (I.D. Stewart pers. comm.). Erection of the fence may be time-consuming, and takes about 40 minutes for one ranger (V. Teoh pers. comm.).
  - **Technical Details:** The nest fence consists of a number of star pickets, metal posts are considered as preferable to wooden stakes which may be used as firewood (P. Park in litt.). Poly-posts have been used in Victoria to make fence erection quicker (J. Fallaw and V. Teoh pers. comms). Up to 100 m of rope (e.g., nylon) is attached to the pickets with wire. Apart from rope, plastic tape has also be used (P. Park in litt.). Depending on the area the nest is either partially or fully enclosed in a ring with the fence approximately 15 to 20 metres away from the actual nest. The nest fence has been used with temporary beach closure signs or other signs on the rope fence to educate the public. The fences do attract attention, but the fence does minimise trampling by people.

- Informal tracks from private property should be minimised and closed if possible (Urquhart 2000).

- Details: **This has been achieved through fencing (Dowling & Weston 1999) and other methods (see Urquhart 2000).** Temporary Partial Closure of Site (the "Temporary Beach Closure" of Dowling & Weston 1999, Urquhart 2000 and Weston 2000a).
  - **Details:** Temporary beach closures are currently being used at both Mornington Peninsula National Park and Phillip Island Nature Park, and serve two purposes: 1) they educate the public about the plight of the Hooded Plover, and 2) they prompt people to stay out of the nesting area, thus reducing the risk of crushing and disturbance (Dowling & Weston 1999, Weston 2000a). At Mornington Peninsula National Park, over 30 Temporary Beach Closures were used in the 2000/2001

season (V. Teoh pers. comm.). One minor problem with signs on the beach is that some beach-goers use them to dry their gear (J. Fallaw and V. Teoh pers. comms).

- **Technical Details:** For details see Dowling & Weston (1999). The signs are relatively inexpensive (corflute attached to one or two wooden stakes), and require little maintenance. They should be moved whenever a nesting or brood-rearing site is not in use to ensure the public sees the beach closure as: 1) purposeful and 2) aimed at maximising coexistence between recreationists and birds.

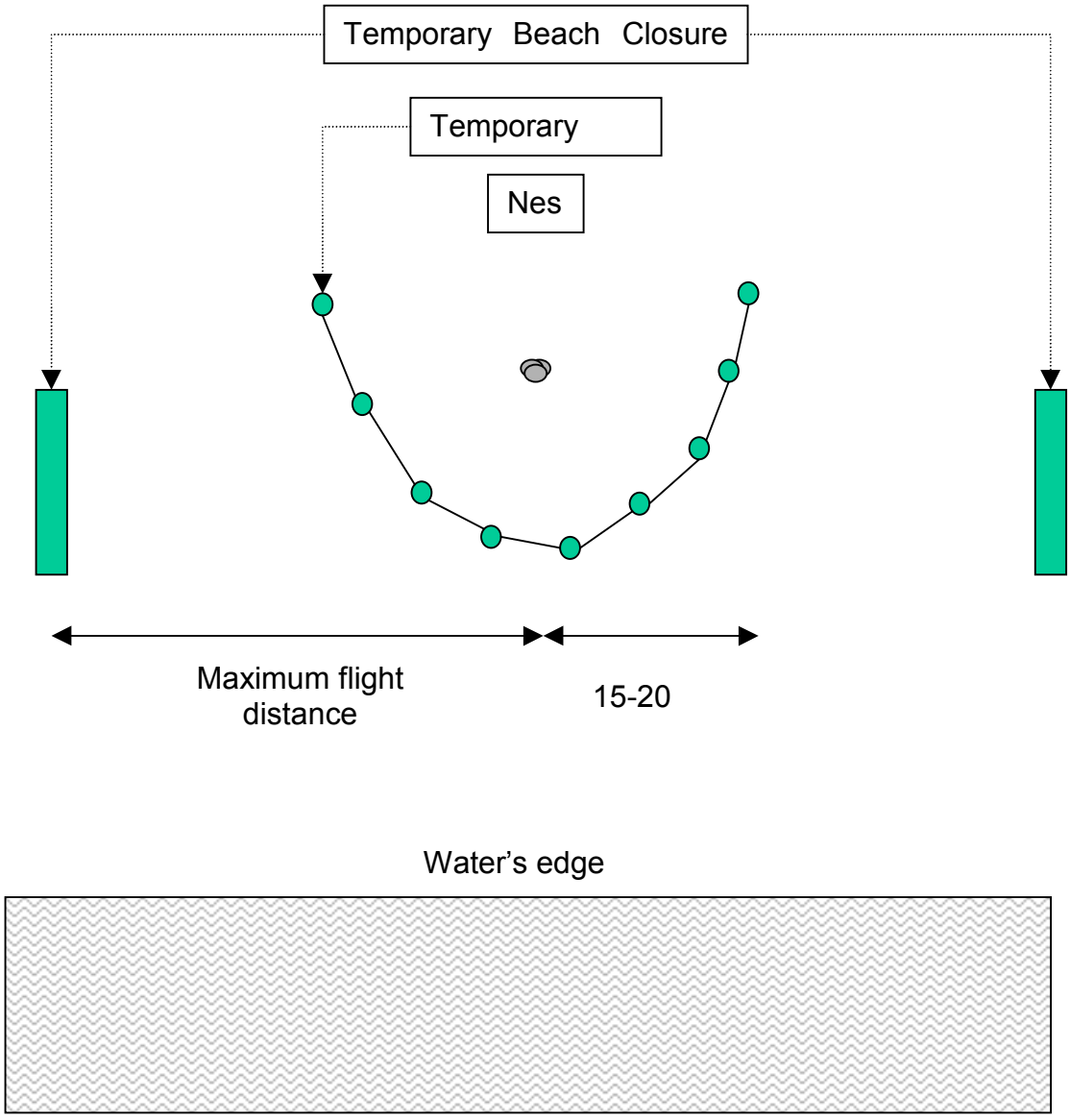


Figure 10.1. Diagram of the combined Temporary Beach Closure and nest fencing as used on Phillip Island and Mornington Peninsula (not to scale). This tequnique is used at high visitation nest sites. At Phillip Island, additional small signs on the temporary fence proved problematic because people approached the inner area to read them (J. Fallaw pers. Comm.).

- Seasonal site closures.
  - **Details:** These have been recommended at Corner Inlet and Nooramunga Marine and Coastal Parks for important bird sites (NRE 1996b). These could be implemented by using signs, advertisements and a community awareness program (NRE 1996b).
- Temperature-relative temporary site closures.
  - **Details:** Weston (2000a) suggested that temporary beach closures on very hot and very cold days could reduce thermal stress to eggs and chicks and increase survival.
- Site-specific Wardening (the "Plover Watch" of Dowling & Weston 1999).
  - **Details:** Wardens not only protect the plovers, but also distribute educational material and chat with recreationists about the birds (Dowling & Weston 1999). Some Hooded Plovers have benefited from wardening of Little Tern colonies (e.g., at the Glenelg River mouth, D. Ryan in litt.; east Gippsland, P. Kambouris pers. comm.). If volunteers are used, they need to be suitably trained and supported – all wardens are destined to encounter less cooperative members of the public. At Mornington Peninsula National Park, volunteers have worn "Plover Watch Volunteer" badges. In 2001, volunteers have been provided with hats reading "Friends of the Hooded Plover – 10 years and counting – Mornington Peninsula National Park" These hats will help identify volunteer wardens.
- Beach-specific Wardening.
  - **Details:** The Far South Coast Birdwatchers and the Eurobodalla Natural History Society, in conjunction with the New South Wales Hooded Plover Recovery Team, have instigated an "Adopt a Beach" program (Jones 2000). This volunteer program has only run for the 2000/2001 breeding season, but preliminary indications are that the beaches were visited regularly, and that at least some successful fledging occurred from beaches included in this program. In Western Australia, an "adopt a beach or wetland" program seeks to monitor habitat and inform managers of when Hooded Plovers are breeding and what threats are present at the adopted sites (Raines 2001).
- Total temporary beach closure.
  - **Details:** This politically difficult option has not been used in Victoria on Hooded Plovers. However, about 110 km of the northern end of the Coorong (SA) is closed to vehicles from 24th October to 24th December each year specifically to protect the Hooded Plover (South Australian Government 1993, Anon. 1992, Anon. undated, V.

Natt in litt., I.D. Stewart pers. comm.). A small number of commercial vehicles ("Cocklers" and professional fishers) use the area under permit (V. Natt in litt., I.D. Stewart pers. comm.). A media campaign sought to raise awareness of the closure (Hockley 2000). In North America, seasonal closures of popular beaches are reinforced by wardens who explain the closures to the public (Melvin *et al.* 1991).

- Total permanent beach closure.
  - **Details:** Directing people away from particular beaches was proposed by Schulz (1992). Some beaches where Hooded Plovers breed, such as at Point Nepean, are not open to the public for safety reasons.
- Shading nests on busy beaches on hot days.
  - **Details:** This was proposed by Weston (2000a). Such an approach would involve shade placed on top of a nest cage, because predators would readily detect the structure (Weston 2000a). This proposal stems from the evidence that overheating of eggs due to disturbance reduces hatching success (Weston 2000a).
- Encouraging dune nesting.
  - **Details:** This could be achieved by sympathetic dune management (see below) or planned clearing of overgrown dunes. It would also help alleviate the effect of disturbance on hatching success (Weston 2000a) and nest crushing would also be reduced (after Dowling & Weston 1999).
- Provision of chick shelters (Weston 2000a).
  - **Details:** Shelters could be provided at all levels of the habitat (but safely above the high tide mark) and may 1) reduce the time spent by chicks responding to disturbance, and 2) minimise predation of chicks (Weston 2000a).
  - **Technical Details:** Several designs of chick shelters are available; one of these and a proposed design is shown in Figure 10.2. Half or broken pipes have been effective for Little Terns and Hooded Plovers in east Gippsland (P. Kambouris pers. comm.).
- The use of "passage windows" for recreationists through territories.
  - **Details:** This would minimise the time Hooded Plovers spent responding to disturbance, and so would minimise the risk of thermal stress or predation (Weston 2000a).
  - **Technical Details:** such passage windows would need to be supervised by trained wardens.

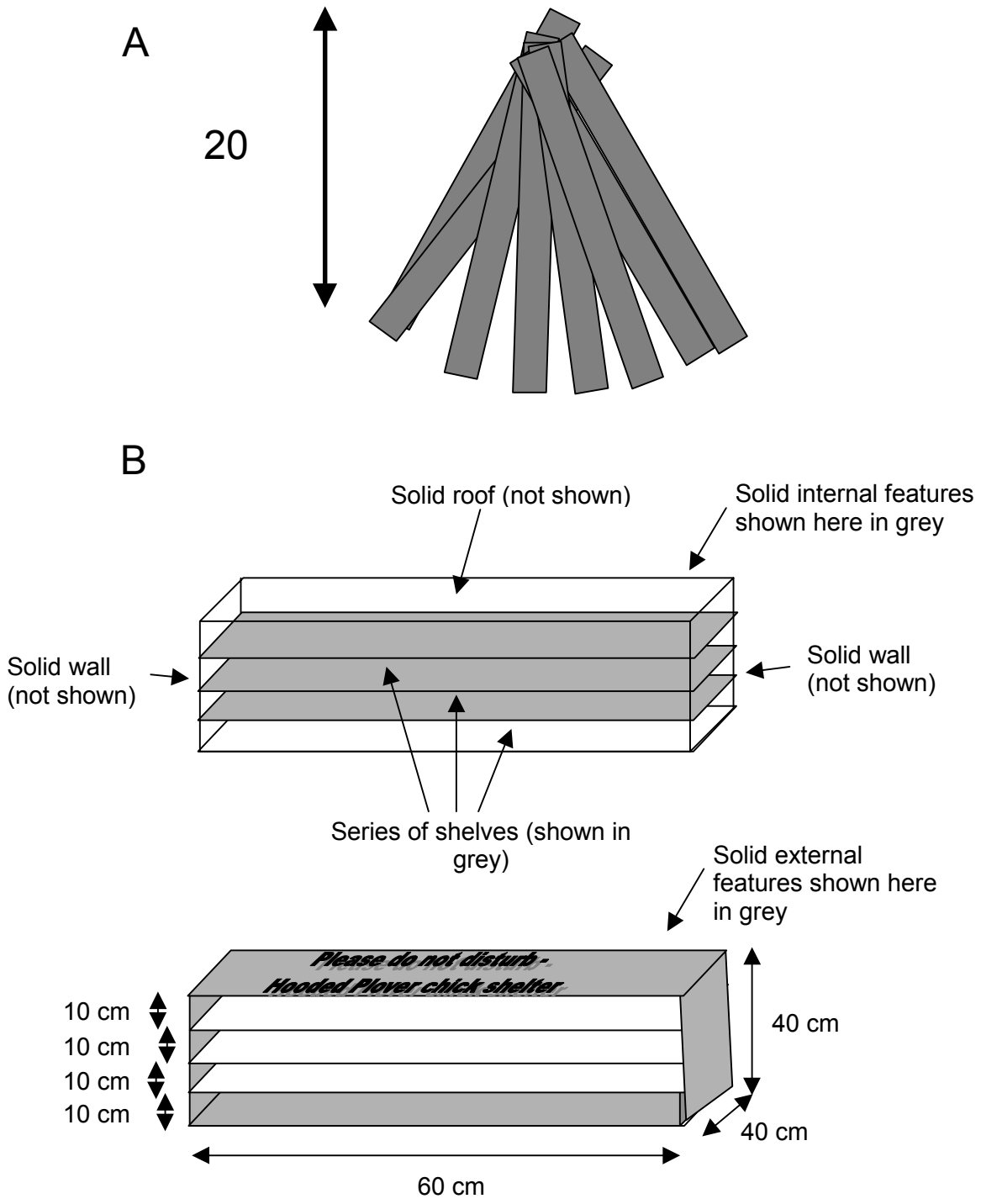


Figure 10.2. Potenital chick shelter designs: A: a traditional tee-pee design and B: a proposed "box with shelves" design. Both are constructed from wood.

Planning-phase management options that should be considered for humans include:

- Any proposed new access points should be considered carefully in terms of their potential impact on Hooded Plover populations at the planning stage.

- The planning of new developments must account for effects on Hooded Plovers (*Flora and Fauna Guarantee Act 1988*, see Schulz 1992). In the case of the Hooded Plover this is not only the direct impact of any development, but also flow-on effects in terms of increased numbers of humans on beaches. To understand the implications of any proposed developments for Hooded Plovers, Parks Victoria could monitor any proposed developments, and seek advice on the potential impacts of developments. Incorporation of Hooded Plover management and conservation issues into planning proposals could also help minimise the impact of any developments on Hooded Plovers. This is particularly important given that the recreational use of beaches is likely to increase into the future.
- Parks currently temporarily reserved under the National Parks Act (e.g., Schedule 4 Parks, such as Corner Inlet, Nooramunga and Shallow Inlet Marine and Coastal Parks) have 'grey' areas of management due to land status issues. This has potential to affect the management of humans and dogs with respect to Hooded Plover management. Permanent reservation of these areas would eliminate any confusion (J. Stevenson in litt.).

Domestic dogs

Although the vast majority of dogs are accompanied by humans (Dowling & Weston 1999, MAW pers. obs.), they are treated separately here because different managements are options. Studies have shown that compliance with dog laws in Victoria is very low (Dowling & Weston 1999, MAW unpubl. data). However, efforts at dog control sustained over several years has increased compliance on Mornington Peninsula and on Phillip Island (Dowling & Weston 1999, B. Baird in litt.). Management of dogs has proven to be one of the most contentious management issues for Hooded Plovers at both Mornington Peninsula National Park and at Phillip Island Nature Reserve.

Management options that could be considered for dogs include education and awareness of dog owners (e.g., Parks Victoria 1997), bans and regulations and planning-phase managements (Dowling & Weston 1999).

Management options that should be considered for dogs include:

- Educational signs.
    - **Details:** These should be placed at beach access points, giving priority to those areas that are popular with dog walkers and support high numbers of Hooded Plovers, or those areas where new access points may bring dogs into areas of high breeding densities of Hooded Plovers. Some areas are not currently signposted at

every access point (A. & J. Whitelaw in litt.), thus creating confusion about regulations.

- **Technical Details:** see above.

- Educational signs at boat-launching ramps.

  - **Details:** Where people travel by boat to Hooded Plover habitat, the educational signs could be placed at boat launching facilities.

  - **Technical Details:** see above.

- Educational signs should be placed on the beach at the boundaries of different dog management zones.

  - **Details:** Many dog walkers move along substantial sections of coast and it can be difficult to know what the prevailing regulations are from the perspective of walking along the beach. These signs should preferably be in large fonts so walkers do not have to walk up the beach to read them.

- Educational material.

  - **Details:** This could be sent to recreational groups which may have dogs accompanying them to the coast (e.g., Surf Life Saving Clubs, and Surf Rider, Horse Riding and Fishing groups). It may be possible for Parks Victoria staff to speak at the meetings of some of these groups. The aim of such a campaign is to inform frequent beach-users of the problems their dogs pose to Hooded Plovers, and the ways they can help alleviate these problems. Such a campaign has substantially reduced the numbers of surfers leaving their dogs unattended as they surf at Mornington Peninsula National Park (B. Dowling pers. comm.).

- Educating neighbouring dog owners.

  - **Details:** Educating park neighbours that own dogs has been recommended in an attempt to reduce the number of roaming domestic dogs (Parks Victoria 1997).

- A Hooded Plover-specific poster could be produced for display in the waiting rooms of coastal veterinarians.

  - **Details:** The poster could deal with the appropriate management of dogs and cats in coastal areas. Such a poster is being prepared for display in a veterinary practice in Merimbula, New South Wales (B. Jones pers. comm.).

- Camp-ground talks and activity programs.
  - **Details:** These could be conducted at times of peak tourist use and peak nesting (late December and January). These could include the problem of dogs. Some "semi-residents" in the Camp-Grounds could be recruited to educate new arrivals.
- Bans.
  - **Details:** Dogs have been banned from some Hooded Plover breeding beaches at Phillip Island and Mornington Peninsula National Park (Schulz 1992, Dowling & Weston 2000a). Weston (2000a) suggested that limiting recreational activity in breeding territories to walking without dogs would reduce disturbance to breeding Hooded Plovers. Experience has shown that one of the benefits of restricting dogs from a few beaches with breeding Little Terns can be to enhance the tourist values of these sites (Schulz 1992). Beaches that are promoted for their wildlife values provide opportunities for new tourism enterprises, personal satisfaction and biodiversity conservation.
- Seasonal bans.
  - **Details:** Seasonal bans are in place on many Victorian beaches (e.g., Point Lonsdale). It has been argued that such regulations merely confuse dog owners and that complete year-round bans are preferable (B. Baird in litt.).
- Leash-only regulations.
  - **Details:** These regulations are common on many Victorian beaches, with the main driving force behind these regulations presumably being public safety and comfort. Weston (2000a) suggested that a simple modification of human and dog behaviour (i.e., leashing), could almost halve the disturbance response frequencies of incubating Hooded Plovers. In terms of the frequency of response during incubation, walkers with leashed dogs are no more disturbing compared with walkers without dogs. However, compliance with dog leashing laws is extremely low in Australia (see Dowling & Weston 1999, B. Baird pers. comm., pers. obs.). For example, after seven years of intense education, awareness campaigns and enforcement of leashing laws in Mornington Peninsula National Park, compliance peaked with only 22.4% of dogs leashed (see Dowling & Weston 1999). Currently, it appears that wherever dogs are permitted on Australian beaches, most of them will be off the leash regardless of the prevailing regulations or management efforts. It is therefore considered undesirable to recommend that only leashed dogs could pass through Hooded Plover territories, because of the inevitable occurrence of unleashed dogs, which are highly disturbing

and sometimes predatory to Hooded Plovers. Additional regulations in leash-only zones could be that dogs are to remain below the high tide mark (after Parks Victoria 1998a) and that leashes should be no longer than 3 m. This would help prevent the infrequent occurrence of leashed dogs trampling or eating nests or chicks.

- Enforcement of regulations (Dowling & Weston 1999).
  - **Details:** On Phillip Island, illegal dogs are reported to Parks Victoria so rangers can remove them. Most people leave the beach willingly once the regulations are explained. Enforcement also occurs at Mornington Peninsula National Park.
- Collection of roaming dogs from areas surrounding Hooded Plover habitat (Dowling & Weston 1999).
  - **Details:** At Mornington Peninsula National Park, rangers from local councils performed this task.

Planning phase managements that are options include:

- Any proposed new access points should be considered carefully in terms of their potential impact on Hooded Plover populations at the planning stage – one of these potential impacts is dogs on beaches.
- The planning of new developments must account for effects on Hooded Plovers (*Flora and Fauna Guarantee Act 1988*, see Schulz 1992).

PREDATOR MANAGEMENT

Foxes

At the current time, it is not feasible to eliminate foxes in Victoria. Thus, it has been proposed that the resources available for fox control should be allocated in ways that address threatened species conservation (Mansergh & Marks 1993). A range of approaches to fox control are currently under consideration. Three main approaches can be used to control fox predation:

- Population reduction.
  - **Details:** Baiting foxes is perhaps one of the most commonly used managements for Hooded Plovers at the current time. Other methods include shooting, trapping, and den destruction and fumigation (Urquhart 2000). Fox-baiting was one of the management techniques used to increase reproductive success in Hooded Plovers at Mornington Peninsula National Park (Dowling & Weston 1999). In the short term, fox-

baiting showed promising results in terms of increasing hatching success (Weston & Morrow 2000). Fox-baiting combined with a beach closure on the Coorong, SA, is thought to have increased the number of Hooded Plovers, eggs and chicks located during surveys (Hockley 2000, I.D. Stewart and V. Natt pers. comms). Fox-control can be targeted in different ways. On Phillip Island, a "Dob in a Fox" campaign encourages residents to report Foxes which are then targeted for control (B. Baird in litt.). Mornington Peninsula National Park advertises the use of poison and this results in the public reporting some fox sightings (V. Teoh pers. comm.). The ultimate aim is to eliminate the fox from the Phillip Island, but fox-control is also concentrated around breeding Hooded Plovers (B. Baird in litt.), as it is in Discovery Bay Coastal Park (Weston & Morrow 2000).

- **Technical Details:** *Baiting:* Several problems with current fox baiting regimes were identified during the course of preparing this report. These include the problem of dependence on fox baiting by adjacent landholders (A. & J. Whitelaw in litt.). Foxes in coastal Australia have mean home ranges of 135 ha and some make forays well beyond their normal range (Meek & Saunders 2000). The narrow nature of much of Parks Victoria coastal land means that fox control need to occur on neighbouring properties. Additionally, it has been suggested that fox-baiting should occur at regular intervals throughout the year, and not in short periods as is the current situation in many areas (A. Murray pers. comm.). It has been suggested that such a program could increase the intensity of fox-baiting before the Hooded Plover breeding season (P. Kambouris pers. comm.). The limited geographical scope of fox-baiting along the coast may be a further problem (A. Murray pers. comm.). *Other methods:* A trial using poisonous gas is underway on Phillip Island and Discovery Bay Coastal Park (Parks Victoria 1998a, S. Burgess pers. comm.). This trial is using M-44 ejectors and cyanide gas, which will be replaced with 1080 pellets if the trial is effective and the technique implemented (J. Fallaw pers. comm.).

  Fox populations are very resilient to conventional methods of control. Rapid reinvasion of areas occurs after control measures are applied. This suggests that control is rarely or never achieved. To reduce this rapid reinfestation and produce long-term population reduction, it has been suggested that control work should generally be carried out in early spring during the Fox's reproductive phase (but note that peak Fox breeding times may differ regionally). By targeting the breeding season, the breeding population and their potential or realised offspring can be removed (Urquhart 2000). Early spring roughly coincides with the period before the main Hooded Plover breeding season, and it has been suggested that Fox control should

occur before the breeding season begins (NRE 1996b). Recovery of the fox population would therefore be dependent on immigrant animals dispersing into the control area. The larger the area controlled, the longer the time it takes for foxes to reach the core area to be protected (Urquhart 2000). It may be useful to differentiate between three types of fox control:

1. fox control on the mainland (e.g., Weston & Morrow 2000), where re-colonisation is likely to occur rapidly after population reduction.
2. fox control on islands (e.g., Atkin 1998) where re-colonisation after population reduction will probably be slow, or may not occur. On islands, total eradication may be feasible (Natural Resources and Environment 1996b).
3. control on semi-isolated sections of the mainland, such as on peninsulas (e.g., Wilsons Promontory or the Coorong) is intermediate to the first two types of control. Anecdotal evidence suggests that fox-baiting on these areas may be more effective (I.D. Stewart pers. comm, V. Natt in litt.).

- Training.
  - **Details:** Foxes are intelligent animals that can be readily trained to avoid undesirable stimuli. A number of overseas studies, typically those dealing with native foxes, have provided foxes with artificial eggs that provide a negative stimulus by way of taste, or they make the fox ill (e.g., McIvor 1991, Cross 1992). The fox then avoids eating eggs. By not killing the fox, the animal remains on its territory and prevents a large flux of other foxes from moving through the area. In Australia, where foxes are introduced, an important question to be asked before this technique is used would be whether a dietary shift would occur that might impact on other significant populations of native animals. The effectiveness of this technique is unknown, but seems worthy of study. It has been used as part of work on Little Terns in Gippsland (P. Kambouris pers. comm.).
- Exclusion – cages.
  - **Details:** Cages over nests are called “nest cages” in Australia, but are sometimes called “predator exclosures”[2] in the international literature (e.g, Mabee & Estelle 2000). Cages over nests has been used for Piping and other plovers (Rimmer & Deblinger 1990, Melvin *et al.* 1994, Vaske *et al.* 1994, Mabee & Estelle 2000) and is being trialed by the Phillip Island Nature Park on Hooded Plovers (Dann and Baird

1997, B. Baird in litt.). The effectiveness of the cages is being examined, and the results will probably be published thus allowing easy access to details of the technique. However, several additional seasons data collection are required (B. Baird in litt.). A recent paper on nest cages in North America found that the cages did not increase nest success of three species of plover, and that previously reported positive results were artefacts of inappropriate experimental design or analysis (Mabee & Estelle 2000).

On Phillip Island, the cage trial has continued for five years and has involved 26 cages; the egg hatching rate has increased from 24% with no cages to 61% with cages (Urquhart 2000). Caging is labour-intensive as nests have to be located before a cage is fitted, and then monitored. It would not be practical to use cages on all breeding units, but they might be useful in areas where fox or other predation is heavy, or where humans and dogs impact on nests. The issue of whether cages attract curious people or predators requires investigation. Nests on slopes have moved in nest cages resulting in the nest being very close to the side of the cage, and thus exposed to predators that can reach into a cage (MAW pers. obs.). Another issue to be considered is the frequency of human interference with cages. An apparent increase in adult mortality associated with cages means that their use needs to be carefully evaluated in terms of their contribution and risks to population dynamics.

Young Hooded Plovers leave the nest soon after hatching and so cages alone do not confer protection to chicks. Initial results indicated that although hatching success had increased, fledging success had not. However, volunteer wardening, signs, predator control, and enforcement of dog regulations, in combination with nest cages proved to be important techniques in contributing significantly to overall breeding success (P Dann pers. comm*.).* The addition of these techniques to nest caging has further increased breeding success to seven flying young from 14 nests in 1998 (P. Dann pers comm.).

- Exclusion – temporary fences.
  - **Details:** Foxes are agile animals capable of passing through, digging under, jumping over, or even climbing various types of fence. Hooded Plovers in eastern Victoria have successfully bred inside areas of beach that have been fenced to protect Little Terns from feral predators and human interference (e.g., Murray & Reside 1995). Feral predator control operations were also undertaken at these sites (Schulz 1992,

[2] The term "predator exclosure" is applied both to cages, and to fences around nests (for example, see Melvin *et al.* 1991 and Mabee & Estelle 2000).

Reside 1998). Wire fences around Piping Plover nests have proved effective at increasing nesting success (Melvin *et al.* 1991).

- **Technical Details:** Wire netting (ring lock) with mesh size not exceeding 88 mm will prevent most foxes passing through the fences. The netting should be 1.2 – 1.9 m high and should be buried to a depth of at least 450 mm. Adding electrified outrigger wires to netting fences could help to discourage foxes from climbing (Urquhart 2000). Some of these fences around Piping Plover nests have black twine or monofilament line stretched across the top to exclude avian predators (Melvin *et al.* 1991).

- Chick shelters (Weston 2000a).

  - **Details:** Tee-pee style chick shelters have proved useful for Little Tern chicks (Murray & Reside 1995). Recent experience has suggested that half pipes and calverts are apparently more successful and resilient (P. Kambouris pers. comm.). Providing cover for chicks is thought to be a desirable management on Phillip Island (B. Baird in litt.).

Feral dogs

Feral dogs are potential predators, and some control programs have occurred over small stretches of coast in Victoria (Schulz 1992). Elsewhere, control programs have been recommended (Parks Victoria 1997). Control programs parallel those for foxes, but care will be needed to ensure that no domestic dogs that are legally present are harmed.

Educating park neighbours that own dogs has been recommended as a strategy to address roaming domestic dogs (Parks Victoria 1997).

Feral cats

Predation by feral and unowned cats can be reduced by control programs (Seebeck & Clunie 1997). Control programs have occurred at Phillip Island (J. Fallaw pers. comm., B. Baird in litt.) and at Port Campbell National Park (Parks Victoria 1997). An “ad hoc” control program based on observed occurrences is conducted in Discovery Bay Coastal Park (Parks Victoria 1998a). At Phillip Island, cat control is focussed around nesting Hooded Plovers (B. Baird in litt.). Cats have not been declared vermin because of the perceived difficulty of distinguishing between Feral and owned cats (Seebeck & Clunie 1997). Management options include:

- Population reduction.

  - **Details:** Population reduction can be achieved through 1) trapping (Urquhart 2000), which allows roaming domestic cats to be separated from feral and unowned cats.

This technique has not been assessed for efficacy (Seebeck & Clunie 1997), and 2) shooting, which has been used in Victoria, although it has not been assessed for efficacy (see Seebeck & Clunie 1997, B. Baird in litt.). Poisoning programs specifically aimed at cats have not been carried out in Victoria (Seebeck & Clunie 1997). Baits are buried to minimise threats to non-target species, and buried baits are not taken by cats (Seebeck & Clunie 1997).

- **Technical Details:** On Phillip Island traps are baited with Pilchards, and electronic bird calls to attract cats to traps are currently being trialed (B. Baird in litt.). In South Australia, Tuna baits or baits using Tuna oil are being assessed (V. Natt in litt.).

Domestic cats

Like the management of dogs, cat management is likely to be controversial. Responsible cat ownership can limit the number of pets taking wildlife (Seebeck & Clunie 1997). This can be achieved by education and regulation.

There are many good reasons to prevent domestic cats from roaming although many owners do not support restrictions (see Seebeck & Clunie 1997). Education of pet owners can be achieved by:

- Brochures.
  - **Details:** Brochures on appropriate cat management have been produced and conducted by the then DCE (now DNRE) (see Seebeck & Clunie 1997). Educating park neighbours that own cats has been recommended (Parks Victoria 1997), and postcards have been placed in letterboxes on Phillip Island (B. Baird in litt.).
- Resource Kits.
  - **Details:** Resource Kits on appropriate cat management have been produced and by the then DCE (now DNRE). Schools and local governments were specifically targeted (see Seebeck & Clunie 1997).
- Workshops.
  - **Details:** Regional workshops on appropriate cat management have been conducted by the then DCE (now DNRE). Schools and local governments were specifically targeted (see Seebeck & Clunie 1997).

- Posters.
    - **Details:** A Hooded Plover-specific poster could be produced for display in the waiting rooms of coastal veterinarians. The poster could deal with the appropriate management of cats and dogs in coastal areas (see above).

Regulations that could be used to manage cats include:

- Curfews (Seebeck & Clunie 1997).
    - **Details:** A nocturnal ban on roaming cats has been used in the Shire of Sherbrooke.
- Keeping cats primarily indoors or within enclosures (Seebeck & Clunie 1997).
- Desexing.
    - **Details:** This limits numbers and prevents genetic drift into feral and unowned populations (Seebeck & Clunie 1997).

Rats

Control of rodents in Australia has focussed on poisoning. However, this is not selective and also affects native rats, and possibly the higher-order predators of the sick or dead rats. Control on islands may eradicate rats from those areas (NRE 1996b). Coastal towns may also support rat populations (after Hanisch 1998).

Management options include:

- Discouraging recreationists (including fishers and campers) from leaving food scraps (or bait) on the beach.
    - **Details:** Rubbish should be placed in bins that are inaccessible to rats. In some instances, the provision of bins can lead to more littering (B. Dowling pers. comm.), and so rates of littering may need to be monitored. Additionally, a policy of “take your own rubbish home” should be encouraged (e.g., Harvey 1989). Codes of conduct for beach campers are also useful (e.g., Anon. 1994).

Ravens

Unlike most other predators of Hooded Plovers, ravens are native. Ravens are highly intelligent birds, and management of them is difficult. Management of ravens usually involves labour intensive lethal and non-lethal techniques, though the effectiveness of such measures has not been adequately demonstrated (Weston & Morrow 2000). It has been suggested that ravens can be effectively controlled on a short term or seasonal scale (e.g., at Marlo, P. Kambouris pers. comm.).

Management options include:

- Discouraging recreationists (including fishers) from leaving food scraps (or bait) on the beach.
    - **Details:** Such a measure could be incorporated into the educational signs and mail-out material. Rubbish should be placed in bins that are inaccessible to ravens. Additionally, a policy of "take your own rubbish home" should be encouraged (e.g., Harvey 1989).
- Staff should not approach Hooded Plover nests or young when ravens are nearby.
    - **Details:** The movement of a Hooded Plover from the nest may allow the raven to locate, and later prey upon, the nest.
- Chick shelters.
    - **Details:** see above.
- Population reduction.
    - **Details:** Airports have trialed lethal techniques for the control of ravens with limited success (MAW pers. obs.).

Gulls

Management options include:

- Discouraging recreationists (including fishers) from leaving food scraps (or bait) on the beach.
    - **Details:** Rubbish should be placed in bins that are inaccessible to gulls. Additionally, a policy of "take your own rubbish home" should be encouraged. Such information could be incorporated into other educational signs and mail-out material.
- Staff should not approach Hooded Plover nests or young when gulls are nearby.
    - **Details:** see above.
- Chick shelters could reduce gull predation.
    - **Details:** see above.
- Population reduction.
    - **Details:** Some airports in the USA have successfully reduced gull populations in the short term over a limited area (Dolbeer *et al.* 1993).

VEHICLE MANAGEMENT

Illegal vehicles

The following management options could be considered:

- A mail out.
    - **Details:** This could be sent to local landowners whose land backs onto the coast, local fishing and four-wheel driving clubs. It should explain that beach driving is illegal in Victoria, and describe legal options for off-road experiences. The letters should also explain the threat beach driving poses to nesting shorebirds, and the penalties that apply. Such a letter has been mailed out to landowners near Portland (K. Schramm pers. comm.). If required, direct and personable consultation with landowners should occur. The cooperation of landowners with other dune and beach management issues is highly desirable.
- Signs at gates (Weston & Morrow 2000).
    - **Details:** Where gates are fitted (see below), signs could be erected explaining that Hooded Plovers are threatened and are vulnerable to crushing and disturbance by humans, dogs and vehicles.
- Any public access point where vehicles could potentially get onto the beach need to be identified then gated (Weston & Morrow 2000).
    - **Details:** At Port Campbell National Park and Discovery Bay Coastal Park, bollards, fencing and planting have been used to prevent vehicle access (Urquhart 2000). These gates should be kept locked and should be positioned so vehicles cannot drive around them (where possible). By holding the key to the gates, Parks Victoria staff can also brief any authorised beach drivers in techniques to prevent damage or destruction of Hooded Plover nests and broods (i.e. by driving slowly below the high tide line).
- Close private access tracks (Weston & Morrow 2000).
    - **Details:** It may be useful to seek the co-operation of adjacent landholders to prevent access to dunes or the beach through their property (Parks Victoria 1998a).
- Maintaining signs prohibiting driving on beaches, on the Victorian side of the South Australian border (facing west) (Parks Victoria 1998a).
    - **Details:** These signs could be placed on the beach and on the highway.

- Enforcement.
    - **Details:** Enforcement is a necessary part of an integrated management approach. If the other measures do not produce complete compliance with beach-driving laws, then enforcement could be considered. This may be the only way of preventing habitual offenders. Active patrols of problem areas may be necessary, including after-hours, and where possible should be timed to occur just prior to the peak of the breeding season (before October).

Legal (management) vehicles

- Parks Victoria and DNRE staff should only drive clearly marked vehicles on the beach, and should preferably be in uniform. Vehicle activity should be restricted to that required for specific or essential management or research purposes.
    - **Details:** The vehicles of contract staff should display magnetic Parks Victoria or DNRE logos, provided and administered by the appropriate agency. If other vehicles are encountered on the beach, staff should be encouraged to record the details of number plates.
- Driving below the high tide mark at all times (Buick & Paton 1989, Stove & Paton 1989).
    - **Details:** The FFG Action Statement indicates that management vehicles in Victoria should remain below the high tide mark (Schulz 1992). One exception to this is the use of heavy machinery to open creek or river mouths (dynamite is sometimes used). Such operations could proceed after a thorough check for nests or chicks.

Legal vehicles (bicycles, horse carts and sail carts)

Management options include bans and education.

- Bans.
    - **Details:** Legally driven vehicles could be subject to the same regulations as other vehicles.

Drivers should be encouraged to remain below the high tide mark and stay out of the dunes in areas of Hooded Plover habitat. This can be achieved by:

- Signs.
    - **Details:** These could focus on access points to areas where legal vehicle use is high e.g., Collendina, near Point Lonsdale (MAW pers. obs.). Other educational materials

may be less effective because most legal vehicle operators are unlikely to belong to a stakeholder group such as a club or association.

OTHER ANIMAL MANAGEMENT

Stock

Management options include the exclusion of livestock from the dunes and beach by:

- Fence maintenance (Weston & Morrow 2000).
  - **Details:** Encouraging farmers adjacent to the coast to maintain the integrity of their fences will help manage stock. Fences on dunes are vulnerable to the movement of sand. High standards of fence maintenance could be encouraged during ranger visits.
- Additional fencing.
  - **Details:** This has been underway on Phillip Island (B. Baird in litt.).
- Discouraging farmers from allowing grazing in the dunes and foredunes.
  - **Details:** This could be encouraged by ranger visits and patrols.

Horses and camels

The following management options are available:

- All commercial horse and camel riding on Parks Victoria land could be licensed and regulated.
  - **Details:** Permits could include conditions that riding is only to occur below the high-tide mark (thus only during non-high tide periods, see DNRE 1996 and Parks Victoria 1998a), and that riders must pass quickly and quietly past any Hooded Plovers, their nests or young. Additionally, meal stops should be made in areas without Hooded Plovers.
- Brochures.
  - **Details:** Such material could be provided to private riders, outlining a code of conduct which are the permit conditions given above. There is an opportunity to educate young riders at the riding schools.
- Any new proposed commercial or private horse/camel riding access to beaches could be assessed in terms of its impact on Hooded Plovers.

- Bans.
    - **Details:** Commercial horse riding tours have been prohibited from using a beach at Cape Otway, Victoria, because of concern regarding the crushing of Hooded Plover nests. The operators admitted that it was impossible for them to remain below the high tide mark during the tours.
- Signs.
    - **Details:** Signs advising of appropriate behaviour around Hooded Plovers could be placed in areas where horse riding is permitted (e.g., Parks Victoria 1998b), and in carparks used extensively by horse floats (A. & J. Whitelaw in litt.).
- Enforcement and fines.
    - **Details:** These measures could be directed at sites where horses are prohibited and where riding occurs frequently (e.g., near Peterborough, Port Campbell National Park, Parks Victoria 1997).

HABITAT MANAGEMENT

Erosion control

Management options include:

- Not undertaking any erosion control in dunes without conducting an impact assessment on Hooded Plovers.
    - **Details:** Such assessments need to fully account for the use of the area by the birds during the breeding season.
- Not using invasive species.
    - **Details:** Where erosion control is not considered detrimental to Hooded Plover breeding habitat (e.g., immediately next to a walking track), techniques such as laying brush should be used. The planting of non-endemic grasses should not occur.
- The exporting or importing of non-endemic dune-stabilising grasses from the coast should be rejected at the planning phase.
- Discourage activities that promote erosion.
    - **Details:** Such activities include walking in dunes, driving through dunes (Parks Victoria 1998a) and dune-boarding or “sand-surfing”(Anon. undated, MAW pers. obs.).

- Manual removal (see Urquhart 2000).
  - **Details:** This has been used for removal of Sea Spurge in Mornington Peninsula National Park (B. Dowling pers. comm.). The removal was performed by volunteers (B. Dowling and V. Teoh pers. comms). Any physical removal must be preceded with an assessment of the use of the site by Hooded Plovers, and if necessary work should be conducted during the non-breeding season.
- Chemical control.
  - **Details:** Chemical control of Sea Spurge is underway in Mornington Peninsula National Park (V. Teoh pers. comm.).
- Burning.
  - **Details:** see Urquhart (2000). Burning may be an option for control of Marram Grass (J. Burke pers. comm.).

Other invasive plants – introduced

Management options include:

- Progressive or staged control programs where invasive plants (e.g., Boxthorn hedges) are removed and replaced with non-invasive species.
  - **Details:** see Urquhart (2000).
- Manual removal by hand, tractor, front-end loader or chainsaw followed by burning or mulching.
  - **Details:** This may be the most effective technique for control. Dead Boxthorn remain spiky for many years and continue to provide a harbour for pest animals such as rabbits and foxes. After the manual removal of the plants, the area should be ploughed deeply to bring the roots up for raking and burning. Alternatively, to prevent regrowth from pieces of broken roots and cut stumps, all exposed surfaces should be chemically treated with appropriate herbicides (Urquhart 2000). Any physical removal must be preceded with an assessment of the use of the site by Hooded Plovers, and if necessary work should be conducted during the non-breeding season.
- Chemical control.
  - **Details:** Appropriate procedures vary with the target species. The best information available is for Boxthorn (Urquhart 2000). Boxthorn does not respond to chemical spaying on its own. Chemicals are most effective when Boxthorn is cut and then

painted. It is best to use a product containing one of the following active constituents or combinations of active constituents: 2,4-D Amine, Glyphosate Isopropylamine, or Glysophate Mono Ammonium (Urquhart 2000).

Other invasive plants – non-indigenous

- Native Australian plants which are non-indigenous in some areas (e.g., Coast Tea-tree and Coast Wattle in Otway Ranges and Port Campbell National Parks, DNRE 1996 and Parks Victoria 1997) may also represent a potential problem for Hooded Plovers if they colonise dunes or the upper beach.
    - **Details:** Control methods are as for the introduced plants above.

Other invasive plants – indigenous

Further management options include:

- Adjusting grazing pressure to halt colonisation of the dunes.
- Adjusting burning regimes.

Kelp harvesting/clearing and other extractive industries.

Management options include:

- Examining all proposals in terms of their potential impact on Hooded Plovers or habitat.
- Seasonal ban.
    - **Details:** Any Kelp Harvesting, if considered to meet the above requirement (and thus the Flora and Fauna Guarantee Act) should be conducted outside the breeding season (i.e. April to July).
- Prohibit the collection of driftwood or seaweed from the beach.
    - **Details:** Such a prohibition is used at Mornington Peninsula National Park (Parks Victoria 1998b).

Oil spills

Management options include:

- Emergency response plan.
    - **Details:** Developing an oil spill response plan, that can be incorporated into more general plans, to ensure Hooded Plovers are effectively rehabilitated after an oil spill,

has been recommended by Weston & Morrow (2000). The plan should include contact details of people qualified to catch, wash and rehabilitate Hooded Plovers.

- Staff training.
  - **Details:** DNRE staff are trained in contingency plans for oil spills, including the care of injured wildlife (Schulz 1992). Parks Victoria staff could be similarly trained. Importantly, this training would not teach staff how to catch oil-affected Hooded Plovers that are still flying. Expert bird-banders would have to be used to catch such birds.

Rubbish

The main problem with rubbish is that discarded fishing line has the potential to entangle Hooded Plovers. Management options include:

- Rubbish disposal facilities.
  - **Details:** These could be provided at popular beaches so discarded fishing line can be safely thrown away. Additionally, a policy of "take your own rubbish home" should be encouraged.

Education of anglers could be facilitated by:

- Signs encouraging litter collection.
  - **Details:** The general public should be encouraged to collect fishing line and dispose of it appropriately (B. Baird in litt.) – if lines are broken anglers often cannot collect the line but must wait until it washes ashore. Signs at popular fishing spots could encourage anglers to collect fishing line and be responsible in its disposal. Some currently available signs encourage the collection of fishing line.
- Media coverage.
  - **Details:** Presentations on fishing shows could encourage anglers and the general public to collect fishing line and be responsible for its disposal.

Sea-level rises

Flooding of nests is a source of nest loss and the frequency of flooding may increase with rises in sea level (Weston & Morrow 2000). Only one realistic management option exists for coping with sea-level rises:

- Nest relocation.

  - **Details:** It has been suggested that nests could be moved higher on beaches in order to reduce the probability of flooding, and the Victorian Wader Studies Group (VWSG) is apparently investigating this technique in Corner Inlet (funded by Coastaction). Moving nests may also be desirable when they are located in an area where the risk of trampling is high. Hooded Plover nests on slopes do move up to about one metre during an incubation period, but always downhill (MAW unpubl. data). This suggests that the species has behavioural flexibility which would allow nests to be slowly moved. The tendency of nests to move downhill has also meant that some nest cages have to be adjusted from time to time. Little Tern nests have been elevated above flood levels using car tyres and sandbags (P. Kambouris pers. comm.). Drawbacks with moving nests include attracting predators to the site and excessively disturbing the parents.

HABITAT CREATION

Hooded Plovers have bred on islets that have been made from dredge spoil (Schulz 1992, Reside 1998) e.g., in the Gippsland Lakes and formerly at Sand Island, Queenscliff. Such habitat can only be practically created inside inlets or embayments, and these habitats are not the primary habitat of Hooded Plovers in eastern Australia. The dispersed nature of the population, the relatively small proportion of birds using inlet areas for breeding, and the high expense associated with creating and maintaining habitat means that it is not a suitable management technique.

POPULATION AUGMENTATION

The only practical means of artificially augmenting Hooded Plover populations is captive breeding followed by release. No captive breeding of Hooded Plovers has occurred, however the Adelaide Zoo has a number of birds on display which were hatched from eggs collected from the field (D. Baker-Gabb pers. comm.).

Healesville Sanctuary (Zoological Board of Victoria) proposed captive breeding of the species in the early 1990's, but the proposal was not supported on the basis that it would not contribute substantially to Hooded Plover conservation (K. Lowe pers. comm.). The sanctuary currently has no plans to proceed with captive breeding (I. Smales in litt.).

There are a number of problems with captive breeding and release. Such an approach does not address the threatening processes that cause low reproductive success or loss of habitat, and so captive breeding and release does not in itself solve the long-term threats to the species.

OVERVIEW

This chapter identifies 111 specific management options that could be used to manage the Hooded Plover. The management options can be sorted into one of seven categories based on functionality (bracketed figures refer to the number of specific managements): Visitor Management (46), Predator Management (23), Vehicle Management (10), Other Animal Management (9), Habitat Management (21), Habitat Creation (1) and Population Augmentation (1).

In terms of underlying techniques, 30.6% (34) of specific management options involved education and public awareness, 13.5% (15) involved control of plants or animals, 12.6% (14) involved regulation, 9.9% (11) involved manipulation, 9.0% (10) involved fencing, 9.9% (11) involved planning, 6.3% (7) involved predator exclusion, 3.6% (4) involved rubbish disposal facilities, and 2.7% (3) involved staff protocols near nests or broods.

Table 10.1 summarises the management options available, and indicates whether they have been used on Hooded Plovers before. The management actions are categorised, and described according to whether they are implemented by Parks Victoria staff or Parks Victoria volunteers, and whether they should occur on or off park. Table 10.2 shows which management types are applicable to which threats.

Table 10.1. Specific management options available for Hooded Plovers. Management options are described in terms of their Management category, Target category, Target and Management type. Information is also provided on where the options are intended to be implemented (on or off Parks Victoria managed land), whether they have been used before on Hooded Plovers, and whether they involve Parks Victoria staff or volunteers. Y=Yes, N=No, asterisks indicate the appropriate option.

Manage-ment Category	Target Category	Target	Manage-ment Type	Delivery	PV land	Surroun-ding land	Used?	Volunteers ?	PV staff?
Visitor management	Humans	Walkers	Education/ Public Awareness	Brochures	*	*	Y	N	Y
Visitor management	Humans	Recreational Groups	Education/ Public Awareness	Brochures		*	N		
Visitor management	Humans	People on beaches	Education/ Public Awareness	Postcards	*		Y	Y	Y
Visitor management	Humans	People on beaches	Education/ Public Awareness	Signs at access points	*		Y	N	Y
Visitor management	Humans	Neighbours	Education/ Public Awareness	Poster		*	N		
Visitor management	Humans	Coastal campers	Education/ Public Awareness	Campground talks	*	*	N		

Manage-ment Category	Target Category	Target	Manage-ment Type	Delivery	PV land	Surroun-ding land	Used?	Volunteers ?	PV staff?
Visitor management	Humans	Neighbours	Education/ Public Awareness	Brochure mailout		*	Y	Y	Y
Visitor management	Humans	Stake-holders	Education/ Public Awareness	Presenta-tions		*	N		
Visitor management	Humans	Schools	Education/ Public Awareness	Presenta-tions		*	Y	N	Y
Visitor management	Humans	Holiday-makers	Education/ Public Awareness	Media coverage		*	Y	N	Y
Visitor management	Humans	Veterinarians	Education/ Public Awareness	Poster		*	Y	N	Y
Visitor management	Humans	People on beaches	Fencing	Permanent – access points	*		Y	Y	Y
Visitor management	Humans	People on beaches	Fencing	Permanent – dune access	*		Y	N	Y
Visitor management	Humans	People on beaches	Fencing	Permanent – breeding area	*		Y	N	Y
Visitor management	Humans	People on beaches, predators	Fencing	Electric fencing – breeding area	*		Y	N	Y
Visitor management	Humans	People on beaches	Fencing	Temporary – dune access.	*		Y	Y	Y
Visitor management	Humans	People on beaches	Fencing	Temporary – around nests	*		Y	Y	Y
Visitor management	Humans	Coastal residents	Fencing	Permanent – informal track closure	*	*	Y	N	Y
Visitor management	Humans	People on beaches	Exclusion	Temporary Partial Closure of Site	*		Y	Y	Y
Visitor management	Humans	People on beaches	Exclusion	Seasonal site closures	*		Y	N	Y
Visitor management	Humans	People on beaches	Exclusion	Temperature -relative temporary site closures	*		N		
Visitor management	Humans	People on beaches	Guarding	Site - specific Wardening	*		Y	Y	Y
Visitor management	Humans	People on beaches	Guarding	Beach-specific Wardening.	*		Y	Y	Y

Manage-ment Category	Target Category	Target	Manage-ment Type	Delivery	PV land	Surroun-ding land	Used?	Volunteers ?	PV staff?
Visitor management	Humans	People on beaches	Exclusion	Total temporary beach closure.	*		N		
Visitor management	Humans	People on beaches	Exclusion	Total permanent beach closure	*		Y	Y	N
Visitor management	Humans	Effect of people on beaches	Manipulation	Shading nests	*		N		
Visitor management	Humans	Effect of people on beaches	Manipulation	Encouraging dune nesting	*		N		
Visitor management	Humans	Effect of people on beaches	Manipulation	Chick shelters	*		N		
Visitor management	Humans	People on beaches	Manipulation	Passage windows	*		N		
Visitor management	Humans	People on beaches	Planning	Assess new access points	*	*	N		
Visitor management	Humans	People on beaches	Planning	Assess new developments	*	*	Y	N	Y
Visitor management	Humans	People on beaches	Planning	Clarify land status	*	*	Y	N	Y
Visitor management	Dogs	Dog walkers	Education/ Public Awareness	Signs at access points	*		Y	N	Y
Visitor management	Dogs	Dog walkers	Education/ Public Awareness	Signs at departure points	*	*	N		
Visitor management	Dogs	Dog walkers	Education/ Public Awareness	Signs at boundaries of dog zones	*	*	N		
Visitor management	Dogs	Recreational Groups that often have dogs	Education/ Public Awareness	Brochures/ Talks		*	Y		
Visitor management	Dogs	Park neighbours with dogs	Education/ Public Awareness	Brochures		*	Y	Y	Y
Visitor management	Dogs	Dog owners visiting Veterinarians	Education/ Public Awareness	Poster		*	Y	Y	Y
Visitor management	Dogs	Coastal campers with dogs	Education/ Public Awareness	Campground talks	*	*	N		
Visitor management	Dogs	Beaches	Regulation	Bans	*		Y	N	Y

Manage-ment Category	Target Category	Target	Manage-ment Type	Delivery	PV land	Surroun-ding land	Used?	Volunteers ?	PV staff?
Visitor management	Dogs	Beaches	Regulation	Seasonal bans	*		Y	N	Y
Visitor management	Dogs	Beaches	Regulation	Leash only	*		Y	N	Y
Visitor management	Dogs	Dogs on restricted beaches	Regulation	Enforcement	*		Y	N	Y
Visitor management	Dogs	Roaming dogs	Control	Collection		*	Y	N	N
Visitor management	Dogs	Dog walkers	Planning	Assess new access points	*	*	N		
Visitor management	Dogs	Dog walkers	Planning	Assess new develop-ments	*	*	Y	N	Y
Predator management	Introduced predators	Foxes	Control	Population reduction	*	*	Y	Y	Y
Predator management	Introduced predators	Foxes	Control	Training	*		N		
Predator management	Introduced predators	Foxes	Manipulation	Nest cages	*		Y	Y	Y
Predator management	Introduced predators	Foxes	Fencing	Temporary - around nests	*		Y	Y	Y
Predator management	Introduced predators	Foxes	Manipulation	Chick shelters	*		N		
Predator management	Introduced predators	Feral dogs	Control	Population reduction	*	*	Y	N	Y
Predator management	Introduced predators	Feral cats	Control	Population reduction	*	*	Y	N	Y
Predator management	Introduced predators	Cat owners	Education/ Public Awareness	Brochures		*	Y	N	Y
Predator management	Introduced predators	Cat owners	Education/ Public Awareness	Resource kits		*	Y	N	Y
Predator management	Introduced predators	Cat owners	Education/ Public Awareness	Workshops		*	Y	N	Y
Predator management	Introduced predators	Cat owners visiting veterinarians	Education/ Public Awareness	Poster		*	N		
Predator management	Introduced predators	Domestic cats	Regulation	Curfews		*	Y	N	Y
Predator management	Introduced predators	Domestic cats	Regulation	Cat enclosures		*	Y	N	N
Predator management	Introduced predators	Domestic cats	Regulation	Desexing		*	Y	N	N
Predator management	Introduced/ native predators	Rats	Rubbish disposal facilities	Bins	*		N		

Manage-ment Category	Target Category	Target	Manage-ment Type	Delivery	PV land	Surroun-ding land	Used?	Volunteers ?	PV staff?
Predator management	Native predators	Ravens	Rubbish disposal facilities	Bins	*		N		
Predator management	Native predators	Ravens	Staff protocol	Staff behaviour	*		N		
Predator management	Native predators	Ravens	Manipulation	Chick shelters	*		N		
Predator management	Native predators	Ravens	Control	Population reduction	*	*	N		
Predator management	Native predators	Gulls	Rubbish disposal facilities	Bins	*		N		
Predator management	Native predators	Gulls	Staff protocol	Staff behaviour	*		N		
Predator management	Native predators	Gulls	Manipulation	Chick shelters	*		N		
Predator management	Native predators	Gulls	Control	Population reduction	*	*	N		
Vehicle management	Illegal vehicles	Potential offenders	Education/ Public Awareness	Brochures		*	Y	Y	N
Vehicle management	Illegal vehicles	Potential illegal drivers	Education/ Public Awareness	Signs at access points	*		Y	N	Y
Vehicle management	Illegal vehicles	Access points	Exclusion	Gates	*		Y	N	Y
Vehicle management	Illegal vehicles	Adjacent landowners	Exclusion	Prevent access		*	N		
Vehicle management	Illegal vehicles	South Australian drivers	Education/ Public Awareness	Signs on SA border	*		Y	N	Y
Vehicle management	Illegal vehicles	illegal drivers	Regulation	Enforcement	*		Y	N	Y
Vehicle management	Legal vehicles	Public	Education/ Public Awareness	Clearly mark management vehicles	*	*	Y	N	Y
Vehicle management	Legal vehicles	legal drivers	Staff protocol	Drive below high-tide mark	*	*	Y	N	Y
Vehicle management	Legal vehicles	Legal drivers	Regulation	Bans	*		N		
Vehicle management	Legal vehicles	Legal drivers	Education/ Public Awareness	Signs	*	*	N		
Other animal management	Stock	Adjacent landowners	Fencing	Ranger visits		*	N		
Other animal management	Stock	Areas where stock wander	Fencing	Additional fencing	*		Y	Y	Y

Manage-ment Category	Target Category	Target	Manage-ment Type	Delivery	PV land	Surroun-ding land	Used?	Volunteers ?	PV staff?
Other animal management	Stock	Illegal grazing	Education/ Public Awareness	Ranger visits		*	N		
Other animal management	Horse and camel	Commercial operators	Regulation	License	*		N		
Other animal management	Horse and camel	Private owners and pony clubs	Education/ Public Awareness	Brochures		*	N		
Other animal management	Horse and camel	Commercial and private riders	Planning	Assess new access points	*	*	N		
Other animal management	Horse and camel	Commercial and private riders	Regulation	Bans	*		Y	N	Y
Other animal management	Horse and camel	Commercial and private riders	Education/ Public Awareness	Signs at access points	*		Y	Y	N
Other animal management	Horse and camel	Illegal riders	Regulation	Enforcement	*		Y	N	Y
Habitat management	Erosion control	Any site proposed for erosion control	Planning	Assessment of impacts	*		N		
Habitat management	Erosion control	All sites	Planning	Use non-invasive techniques	*		Y	Y	Y
Habitat management	Erosion control	All sites	Planning	Not exporting introduced invasive species	*		Y	N	Y
Habitat management	Erosion control	All sites	Education/ Public Awareness	Reduce artificial erosion	*		Y	N	Y
Habitat management	Erosion control	Affected sites	Control	Manual removal	*		Y	Y	Y
Habitat management	Erosion control	Affected sites	Control	Chemical control	*		Y	Y	Y
Habitat management	Erosion control	Affected sites	Control	Burning	*		Y	N	Y
Habitat management	Invasive plants	Affected sites	Control	succession with natives	*		Y	N	Y
Habitat management	Invasive plants	Affected sites	Control	Manual removal	*		Y	Y	Y
Habitat management	Invasive plants	Affected sites	Control	Chemical control	*		Y	Y	Y
Habitat management	Invasive plants	Affected sites	Control	Burning	*		Y	N	Y
Habitat management	Invasive plants	Affected sites	Control	Adjust grazing pressure	*		Y	N	Y

Manage-ment Category	Target Category	Target	Manage-ment Type	Delivery	PV land	Surroun-ding land	Used?	Volunteers ?	PV staff?
Habitat management	Extractive industries	Any proposed site	Planning	assess proposals	*		Y	N	Y
Habitat management	Extractive industries	Any site where commercial extraction approved	Regulation	Seasonal bans	*		N		
Habitat management	Extractive industries	Any private extraction	Regulation	prohibit	*		Y	N	Y
Habitat management	Oil Spill	Coastal PV staff	Planning	prepare emergency plan	*		Y	Y	Y
Habitat management	Oil Spill	Coastal PV staff	Education/ Public Awareness	Staff Training	*		Y	Y	Y
Habitat management	Rubbish	Anglers and people on beach	Rubbish disposal facilities	Bins	*		Y	N	Y
Habitat management	Rubbish	Anglers and people on beach	Education/ Public Awareness	Signs at fishing spots	*		Y	N	Y
Habitat management	Rubbish	Anglers and people on beach	Education/ Public Awareness	Media coverage	*		N		
Habitat management	Sea-level rises	Reduce flooding	Manipulation	Nest relocation	*		Y	Y	N
Habitat creation	Habitat loss	Estuaries and inlets	Manipulation	Dredge islands	*	*	N		
Population Management	Population augmentati on	Increase population	Manipulation	Captive breeding and release		*	N	N	N

CONCLUSIONS

- This chapter identified 111 specific management options, in seven categories, that could be used to manage the Hooded Plover.
- Each management option is described, and where published details of an option are unavailable, then as much information as is available is presented. The use of each management for Hooded Plovers is described.
- A table summarises and describes the management options.

Chapter 11 – Use of Management Options for Hooded Plovers on Lands Managed by Parks Victoria

SUMMARY

This short chapter documents the managements that benefit Hooded Plovers, and which are already in use on Parks Victoria sites. Apart from vehicle management which is implemented to some extent in every coastal park or reserve, 68 relevant management efforts are currently being implemented on Parks Victoria land, and at least one management option is being implemented at 52.1% of Parks Victoria sites.

Parks Victoria is the first management authority that has demonstrably and effectively managed Hooded Plovers (see Dowling & Weston 1999). Only two state authorities have documented management techniques in use within their jurisdictions (Urquhart 2000, Baker-Gabb & Weston 2001).

This chapter documents the current use of different management options on Parks Victoria land. The main sources of information are the results of a statewide conference of managers (Urquhart 2000) and through discussions with relevant land managers and other appropriate persons. Table 11.1 presents the managements being actively used at each Parks Victoria site. The table excludes the protocols already in use at every coastal park and reserve for management vehicles. It also excludes measures to prevent access of illegal vehicles which are also evident to some extent at every coastal park and reserve.

Overall, 68 relevant management options are currently being implemented on Parks Victoria land, and at least one management option is being implemented at 52.1% of Parks Victoria sites. The maximum number of management options at any one site is seven (Mornington Peninsula National Park).

CONCLUSIONS

- Overall, 68 relevant management efforts are currently being implemented on Parks Victoria land, and at least one management option is being implemented at 52.1% of Parks Victoria sites.
- The maximum number of management options at any one site is seven (Mornington Peninsula National Park)

Table 11.1. The management options currently in use at each Parks Victoria site. The options listed are those that are active, and the presence of an active management option does not imply that the option is implemented or targeted to the extent where no further effort is needed. For illegal vehicles, only active measures such as patrols or mailouts are included. For the purposes of this table, management vehicles are excluded from the "legal vehicles" category.

Park Name	Visitor management		Predator management		Vehicle management		Other animal management		Habitat management				Total
	Humans	Dogs	Introduced predators	Native predators	Illegal vehicles	Legal vehicles	Stock	Horse and camel	Erosion control	Invasive plants	Extractive industries	Rubbish	
Discovery Bay Coastal Park	*	*	*		*								4
Narrawong Coastal Reserve			*		*								2
Eumeralla (Yambuk) Coastal Reserve			*		*								2
Yambuk F.F.R			*		*								2
Port Fairy - Warrnambool Coastal Reserve			*										1
Port Fairy Maritime Complex H.A													0
Bay of Islands Coastal Park	*	*	*										3
Peterborough Coastal Reserve	*		*										2
Port Campbell National Park	*	*	*		*			*					5
Otway National Park	*	*	*										3
Elliot River - Addis Bay Coastal Reserve													0
Angahook - Lorne State Park													0
Wye River Coastal Reserve													0
Lorne - Queenscliff Coastal Reserve	*		*										2
Lake Connewarre W.R.													0
Lonsdale Lakes W.R.													0
Point Lonsdale Jetty		*											1

Park Name	Visitor management		Predator management		Vehicle management		Other animal management		Habitat management				Total
	Humans	Dogs	Introduced predators	Native predators	Illegal vehicles	Legal vehicles	Stock	Horse and camel	Erosion control	Invasive plants	Extractive industries	Rubbish	
Queenscliff Port And Associated Facilities	*	*											2
Mud Islands W.R.	*	*											2
Mornington Peninsula National Park	*	*	*					*		*	*	*	7
Harold Holt - Point Lonsdale Fisheries Res.	*	*	*										3
Flinders - Somers Coastal Reserve													0
Flinders Jetty													0
Phillip Island Coastal Reserve													0
Cowes Jetty													0
Rhyll Jetty													0
Newhaven Slipway													0
Newhaven Jetty													0
San Remo Jetty													0
San Remo - Pt Smythe Coastal Reserve	*	*											2
Bunurong Marine Park	*	*											2
Andersons Inlet W.M.C.A													0
Cape Liptrap Coastal Park													0
Waratah Bay - Shallow Inlet Coastal Reserve													0
Shallow Inlet Marine & Coastal Park													0
Wilsons Promontory National Park	*	*	*		*	*							3

Park Name	Visitor management		Predator management		Vehicle management		Other animal management		Habitat management				Total
	Humans	Dogs	Introduced predators	Native predators	Illegal vehicles	Legal vehicles	Stock	Horse and camel	Erosion control	Invasive plants	Extractive industries	Rubbish	
Port Franklin - Port Welshpool Coastal Reserve													0
Nooramunga Marine & Coastal Park			*										1
Mcloughlins Beach - Seaspray Coastal Reserve			*										1
Jack Smith Lake W.R													0
Gippsland Lakes Coastal Park	*	*	*										3
Rigby Island	*	*	*	*									4
Lakes Entrance - Lake Tyers Coastal Reserve													0
Ewing Morass W.R													0
Marlo Coastal Reserve	*	*	*	*									4
Cape Conran Coastal Park	*	*	*										3
Croajingolong National Park	*	*	*	*									4
Mallacoota Coastal Reserve													0

Chapter 12 – Evaluation of Management Techniques for Hooded Plovers on Lands Managed by Parks Victoria

SUMMARY

This chapter evaluates the management techniques available for Hooded Plovers. Evaluation criteria are developed and each technique is ranked according to 1) site-specificity, 2) threat-specificity, 3) cost, 4) effectiveness and 5) disruption associated with implementation. The effectiveness of 69.4% (77) of management techniques is unknown because they have not been tested. In total, 29.7% (33) have been shown to be effective, and 0.9% (1) has been shown to be ineffective.

This chapter evaluates different management techniques for Hooded Plovers. The management techniques evaluated here are described in detail in Chapter 10.

EVALUATION CRITERIA

The evaluation of each management technique has a number of components.

Site-specificity

Some management techniques influence a single pair, while others influence a number of pairs or birds within a region.

Some management techniques require that nests or broods are located (e.g., nest cages and chick shelters) while less site-specific managements do not require the location of the breeding attempt. This represents a fundamental difference among management techniques. Those techniques that require the location of the breeding attempt require substantial amounts of frequent monitoring (e.g., daily, weekly or monthly), and they include all the manipulative management techniques. These techniques require rapid implementation, and tend to act more directly to alleviate threats. Thus, these techniques lend themselves well to quantitative studies of their effectiveness.

Techniques that do not require the site of the breeding attempt before implementation tend to be techniques acting over a greater area or number of pairs (e.g., public awareness) and they tend to indirectly address threats (e.g., by altering human behaviour). These techniques do not lend themselves well to examinations of their effectiveness, because they often influence a threatening process (e.g., human behaviour) rather than acting directly on

reproductive success. These two broad types of management techniques are shown in diagrammatic form in Figure 12.1.

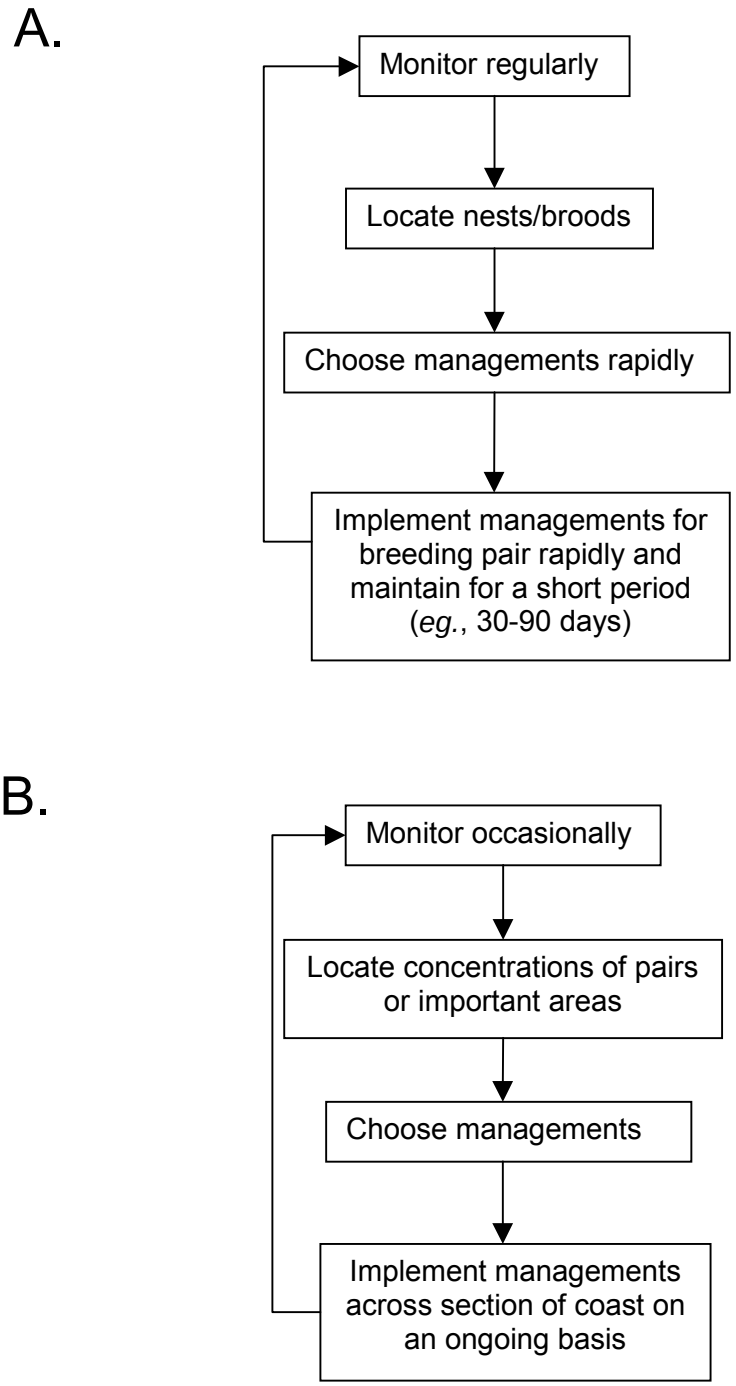


Figure 12.1. Diagramatic representation of the two kinds of management techniques: A. pair-specific management (high site-specificity) and B. non-pair-specific management (low site-specificity).

Some management techniques can be used in both the ways outlined above. For example, fox-control can be used across a broad area, or can focus on an active breeding territory. It

should also be noted that some management techniques that require the nest or brood to be located do have flow on benefits to other territories. For example, Temporary Beach Closures not only protect a particular territory but also increase awareness of the plight of the species, and appropriate human behaviour in a territory. This in turn may benefit other territories (see Dowling & Weston 1999).

Threat-specificity

Some management techniques address more than one threat. For example, brochures can advise of appropriate recreational behaviour and at the same time warn against collecting eggs and chicks. Thus, some management techniques may be particularly cost efficient. Other management techniques, such as fox-baiting, address a single threat.

Cost

Different management techniques have different costs. Here, costs are divided into two categories:

1. Initial costs, which are costs involved in first implementing a management technique. For example, the costs in fencing off the dune, or in placing signs for a Temporary Beach Closure are initial costs, and;
2. Maintenance costs, which are those involved in ongoing support of a management technique. For example, the costs involved in checking and repairing a fence, or in checking signs and enforcing Temporary Beach Closures.

For management techniques that are highly site-specific, there will also be costs associated with frequent monitoring. Even if volunteers are used, they need to be trained and supervised, and so there are additional costs associated with monitoring. Here, the monitoring costs are excluded but the summary indicates whether the technique requires frequent monitoring.

Effectiveness

Here, “effectiveness” refers to how well a management technique alleviates a threat or increases breeding success. All techniques listed in the previous chapter have the potential to be effective, but not all of them have been evaluated for effectiveness.

Very few specific management techniques have been evaluated for effectiveness. The following techniques have been quantitatively evaluated for effectiveness:

- Short-term intense fox-baiting on nest success (Weston & Morrow 2000). Some follow-up work to this study was conducted by Ric Ressom in the 2000/2001 breeding season (K. Schramm pers. comm.), and a report has been produced (Ressom 2001[3]).
- Nest cages on nest success (Baird & Dann 1999), and;
- Temporary Beach Closures on incubation constancy (Weston in prep.).

There are two major studies (one published and one ongoing) that have examined the effectiveness of a suite of management techniques on Hooded Plover breeding success. These are:

- Mornington Peninsula National Park (Dowling & Weston 1999), and;
- Phillip Island Nature Reserve (Baird & Dann 1999, B. Baird in litt.).

These studies are difficult to interpret at the level of individual management techniques, because some techniques may work while others do not, or it may be the combination of techniques that is effective. In both these studies, the techniques have been refined and some techniques deemed not to be effective have been abandoned. Thus, for the purposes of this report each technique in the suite of managements is deemed to have contributed to the outcome.

There is also substantial anecdotal information available about the effectiveness of different management techniques. For example, at Inverloch's main beach a pair bred unsuccessfully for several breeding seasons until a temporary fence and wardening was implemented, and the pair then fledged young (J. Whitelaw and T. Rolland pers. comm.).

Disruption associated with implementation

The implementation of some management actions may cause disruption to breeding Hooded Plovers. Disruption of this kind is equivalent to disturbance, but there may be an added risk of abandonments of nest or young if the disturbance is caused by the management technique (e.g., the fence or nest cage) rather than by the people implementing the management technique. This is because the management technique remains in place for a lengthy period compared with the period required to implement the management.

Here, it is assumed that the implementation of managements are performed in a sensitive manner, as outlined in Figure 12.2. Additionally, it is assumed that management techniques

are implemented by staff trained in how to avoid crushing of nests and young and prevention of excessive disturbance to Hooded Plovers. Even with these precautions there is a slight risk of nest or brood abandonment with some management techniques.

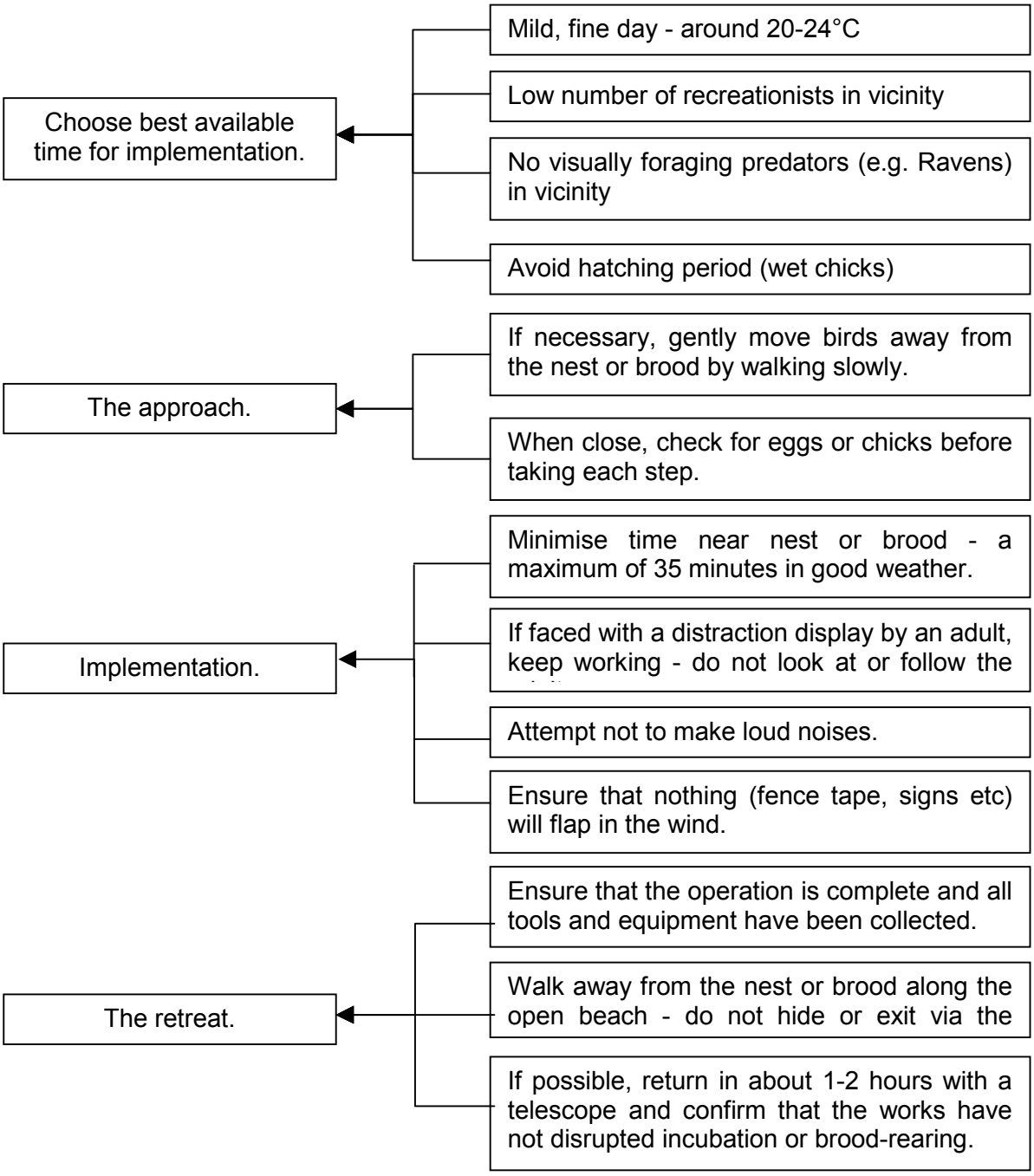


Figure 12.2. Guidelines for implementing intrusive managements (e.g., nest cages, nest fences) in order to minimise disruption and minimise risk of abandonment. These guidelines may not always be practical, and some managements may need to be implemented urgently.

[3] This report was received only days before the current report was printed, and so was not fully incorporated.

The guidelines presented in Figure 12.2 could be developed into a more comprehensive manual on field procedures for Hooded Plover managers.

EVALUATION

Table 12.1 presents each management technique given in Chapter 11 and provides information on site and threat specificity, an estimate of costs and what is known about effectiveness.

Table 12.1. Evaluation of the effectiveness of management techniques. Title abbreviations are: No. bird = number of birds that benefit per management attempt, IC = Initial cost, MC = Maintenance cost, D1 = requirement for nest or brood detection, TS = Threat-specificity (number of applications), D2 = potential for disruption of birds, and Effect. = effectiveness. Abbreviations in the table are: L=low ($1-$500), M=medium ($500-$1000), H=high (>$1000), Y=yes, N=no, SMP=suite of Mornington Peninsula managements, SPI=suite of Phillip Island managements.

Category	Subject	Target	Type	Delivery	No. bird	IC	MC	D1	TS	D2	Effect	Evid-ence
Visitor manage-ment	Humans	Walkers	Education/ Public Awareness	Brochures	Many	M	L	N	7	N	Effective	SMP, SPI
Visitor manage-ment	Humans	Recrea-tional Groups	Education/ Public Awareness	Brochures	Many	M	L	N	7	N	Unknown	
Visitor manage-ment	Humans	People on beaches	Education/ Public Awareness	Postcards	Many	M	L	N	1	N	Effective	SMP, SPI
Visitor manage-ment	Humans	People on beaches	Education/ Public Awareness	Signs at access points	Many	M	L	N	4	N	Effective	SMP, SPI
Visitor manage-ment	Humans	Neigh-bours	Education/ Public Awareness	Poster	Many	M	None	N	4	N	Unknown	
Visitor manage-ment	Humans	Coastal campers	Education/ Public Awareness	Camp-ground talks	Many	L	None	N	2	N	Unknown	
Visitor manage-ment	Humans	Neigh-bours	Education/ Public Awareness	Brochure mailout	Many	M	None	N	1	N	Effective	SMP, SPI
Visitor manage-ment	Humans	Stake-holders	Education/ Public Awareness	Presenta-tions	Many	L	None	N	2	N	Unknown	
Visitor manage-ment	Humans	Schools	Education/ Public Awareness	Presenta-tions	Many	L	None	N	2	N	Effective	SMP, SPI
Visitor manage-ment	Humans	Holiday-makers	Education/ Public Awareness	Media coverage	Many	L	None	N	2	N	Effective	SMP, SPI
Visitor manage-ment	Humans	Veterin-arians	Education/ Public Awareness	Poster	Many	M	None	N	4	N	Unknown	
Visitor manag.	Humans	People on beach	Fencing	Permanent access pts	0-2 pair	H	M	N	1	N	Effective	SMP, SPI

Category	Subject	Target	Type	Delivery	No. bird	IC	MC	D1	TS	D2	Effect	Evid-ence
Visitor manage-ment	Humans	People on beaches	Fencing	Permanent – dune access	1 pair	H	M	N	1	N	Effective	SMP, SPI
Visitor manage-ment	Humans	People on beaches	Fencing	Permanent – breeding area	1 pair	H	M	N	1	N	Effective	Tas.
Visitor manage-ment	Humans	People on beaches, predators	Fencing	Electric fencing – breeding area	1 pair	H	H	Y	1	Y	Effective	Gippsla nd
Visitor manage-ment	Humans	People on beaches	Fencing	Temporary – dune access.	1 pair	M	M	N	1	N	Effective	SMP, SPI
Visitor manage-ment	Humans	People on beaches	Fencing	Temporary – around nests	1 pair	M	M	Y	1	Y	Effective	SPI, Inverloc h
Visitor manage-ment	Humans	Coastal residents	Fencing	Permanent – informal track closure	0-1 pair	H	M	N	1	N	Effective	SMP, SPI
Visitor manage-ment	Humans	People on beaches	Exclusion	Temporary Partial Closure of Site	1 pair	L	L	Y	1	Y	Effective	SMP, specific study
Visitor manage-ment	Humans	People on beaches	Exclusion	Seasonal site closures	Many	M	M	N	1	N	Effective	SMP, SPI
Visitor manage-ment	Humans	People on beaches	Exclusion	Temperatur e-relative temporary site closures	1 pair	H	None	Y	1	Y	Unknown	
Visitor manage-ment	Humans	People on beaches	Guarding	Site-specific Wardening	1 pair	L	None	Y	1	N	Effective	SMP
Visitor manage-ment	Humans	People on beaches	Guarding	Beach-specific Wardening.	Many	L	L	N	1	N	Effective	SMP, SPI
Visitor manage-ment	Humans	People on beaches	Exclusion	Total temporary beach closure.	Many	M	M	N	1	N	Unknown	
Visitor manage-ment	Humans	People on beaches	Exclusion	Total permanent beach closure	Many	H	M	N	1	N	Effective	SMP
Visitor manage-ment	Humans	Effect of people on beaches	Manipulation	Shading nests	1 pair	M	M	Y	1	Y	Unknown	
Visitor manage-ment	Humans	Effect of people on beaches	Manipulation	Encourag-ing dune nesting	Many	H	H	N	1	N	Unknown	

Category	Subject	Target	Type	Delivery	No. bird	IC	MC	D1	TS	D2	Effect	Evid-ence
Visitor manage-ment	Humans	Effect of people on beaches	Manipulation	Chick shelters	1 pair	M	L	Y	4	Y	Unknown	
Visitor manage-ment	Humans	People on beaches	Manipulation	Passage windows	1 pair	M	H	Y	1	Y	Unknown	
Visitor manage-ment	Humans	People on beaches	Planning	Assess new access pts	Many	L	N/A	N	3	N	Unknown	
Visitor manage-ment	Humans	People on beaches	Planning	Assess new develop-ments	Many	L	N/A	N	2	N	Unknown	
Visitor manage-ment	Humans	People on beaches	Planning	Clarify land status	Many	L	N/A	N	2	N	Unknown	
Visitor manage-ment	Dogs	Dog walkers	Education/ Public Awareness	Signs at access points	Many	M	L	N	4	N	Effective	SMP, SPI
Visitor manage-ment	Dogs	Dog walkers	Education/ Public Awareness	Signs at departure points	Many	M	L	N	1	N	Unknown	
Visitor manage-ment	Dogs	Dog walkers	Education/ Public Awareness	Signs at boundaries of dog zones	Many	M	L	N	1	N	Unknown	
Visitor manage-ment	Dogs	Recrea-tional groups that often have dogs	Education/ Public Awareness	Brochures	Many	M	L	N	7	N	Unknown	
Visitor manage-ment	Dogs	Park neigh-bours with dogs	Education/ Public Awareness	Brochures	Many	M	L	N	7	N	Effective	SPI
Visitor manage-ment	Dogs	Dog owners visiting Vets	Education/ Public Awareness	Poster	Many	M	None	N	4	N	Unknown	
Visitor manage-ment	Dogs	Coastal campers with dogs	Education/ Public Awareness	Camp-ground talks	Many	L	None	N	2	N	Unknown	
Visitor manage-ment	Dogs	Beaches	Regulation	Bans	Many	H	M	N	3	N	Effective	SMP, SPI
Visitor manage-ment	Dogs	Beaches	Regulation	Seasonal bans	Many	H	H	N	2	N	Effective	SMP, SPI
Visitor manage-ment	Dogs	Beaches	Regulation	Leash only	Many	H	H	N	1	N	Ineffect.	SMP, specific study

Category	Subject	Target	Type	Delivery	No. bird	IC	MC	D1	TS	D2	Effect	Evid-ence
Visitor manag.	Dogs	Dogs on restricted beaches	Regulation	Enforce-ment	Many	M	H	N	3	N	Effective	SMP, SPI
Visitor manage-ment	Dogs	Roaming dogs	Control	Collection	Many	Non e	None	N	1	N	Effective	SMP
Visitor manage-ment	Dogs	Dog walkers	Planning	Assess new access pts	Many	L	N/A	N	3	N	Unknown	
Visitor manage-ment	Dogs	Dog walkers	Planning	Assess new develop-ments	Many	L	N/A	N	2	N	Unknown	
Predator manage-ment	Introduced predators	Foxes	Control	Population reduction	Many	M	M	N	5	N	Effective	specific study
Predator manage-ment	Introduced predators	Foxes	Control	Training	Many	M	M	N	1	N	Unknown	
Predator manage-ment	Introduced predators	Foxes	Manipulation	Nest cages	1 pair	M	M	Y	1	Y	Effective	SPI
Predator manage-ment	Introduced predators	Foxes	Fencing	Temporary – around nests	1 pair	M	M	Y	1	Y	Effective	specific study
Predator manage-ment	Introduced predators	Foxes	Manipulation	Chick shelters	1 pair	M	L	Y	4	Y	Unknown	
Predator manage-ment	Introduced predators	Feral dogs	Control	Population reduction	Many	M	L	N	5	N	Unknown	
Predator manage-ment	Introduced predators	Feral cats	Control	Population reduction	Many	M	M	N	5	N	Effective	SPI
Predator manage-ment	Introduced predators	Cat owners	Education/ Public Awareness	Brochures	Many	M	L	N	7	N	Unknown	
Predator manage-ment	Introduced predators	Cat owners	Education/ Public Awareness	Resource kits	Many	M	L	N	1	N	Unknown	
Predator manage-ment	Introduced predators	Cat owners	Education/ Public Awareness	Workshops	Many	M	None	N	1	N	Unknown	
Predator manage-ment	Introduced predators	Cat owners visiting veterinar-ians	Education/ Public Awareness	Poster	Many	M	None	N	4	N	Unknown	
Predator manage-ment	Introduced predators	Domestic cats	Regulation	Curfews	Many	L	L	N	1	N	Unknown	

Category	Subject	Target	Type	Delivery	No. bird	IC	MC	D1	TS	D2	Effect	Evid-ence
Predator manag.	Introduced predators	Domestic cats	Regulation	Cat enclosures	Many	None	None	N	1	N	Unknown	
Predator manage-ment	Introduced predators	Domestic cats	Regulation	Desexing	Many	None	None	N	1	N	Unknown	
Predator manage-ment	Introduced/ native predators	Rats	Rubbish disposal facilities	Bins	Many	M	M	N	4	N	Unknown	
Predator manage-ment	Native predators	Ravens	Rubbish disposal facilities	Bins	Many	M	M	N	4	N	Unknown	
Predator manage-ment	Native predators	Ravens	Staff protocol	Staff behaviour	Many	L	L	N	2	N	Unknown	
Predator manage-ment	Native predators	Ravens	Manipulation	Chick shelters	1 pair	M	L	Y	4	Y	Unknown	
Predator manage-ment	Native predators	Ravens	Control	Population reduction	Many	H	H	N	5	N	Unknown	
Predator manage-ment	Native predators	Gulls	Rubbish disposal facilities	Bins	Many	M	M	N	4	N	Unknown	
Predator manage-ment	Native predators	Gulls	Staff protocol	Staff behaviour	Many	L	L	N	2	N	Unknown	
Predator manage-ment	Native predators	Gulls	Manipulation	Chick shelters	1 pair	M	L	Y	4	Y	Unknown	
Predator manage-ment	Native predators	Gulls	Control	Population reduction	Many	H	H	Y	5	N	Unknown	
Vehicle manage-ment	Illegal vehicles	Potential offenders	Education/ Public Awareness	Brochures	Many	M	L	N	7	N	Unknown	
Vehicle manage-ment	Illegal vehicles	Potential illegal drivers	Education/ Public Awareness	Signs at access points	Many	M	L	N	4	N	Unknown	
Vehicle manage-ment	Illegal vehicles	Access points	Exclusion	Gates	Many	H	L	N	1	N	Unknown	
Vehicle manage-ment	Illegal vehicles	Adjacent landowners	Exclusion	Prevent access	Many	M	L	N	1	N	Unknown	
Vehicle manage-ment	Illegal vehicles	South Australian drivers	Education/ Public Awareness	Signs on SA border	Many	M	L	N	1	N	Unknown	
Vehicle manage-ment	Illegal vehicles	illegal drivers	Regulation	Enforcement	Many	M	M	N	3	N	Unknown	

Category	Subject	Target	Type	Delivery	No. bird	IC	MC	D1	TS	D2	Effect	Evid-ence
Vehicle manage-ment	Legal vehicles	Public	Education/ Public Awareness	Clearly mark managem't vehicles	Many	L	L	N	1	N	Unknown	
Vehicle manage-ment	Legal vehicles	legal drivers	Staff protocol	Drive below high-tide mark	Many	L	L	N	1	N	Unknown	
Vehicle manage-ment	Legal vehicles	Legal drivers	Regulation	Bans	Many	H	M	N	3	N	Unknown	
Vehicle manage-ment	Legal vehicles	Legal drivers	Education/ Public Awareness	Signs	Many	M	L	N	1	N	Unknown	
Other animal manage-ment	Stock	Adjacent landown-ers	Fencing	Ranger visits	Many	L	L	N	2	N	Unknown	
Other animal manage-ment	Stock	Areas where stock wander	Fencing	Additional fencing	0-1 pair	H	M	N	1	N	Effective	SPI
Other animal manage-ment	Stock	Illegal grazing	Education/ Public Awareness	Ranger visits	Many	L	L	N	2	N	Unknown	
Other animal manage-ment	Horse and camel	Commer-cial operators	Regulation	License	Many	M	L	N	1	N	Unknown	
Other animal manage-ment	Horse and camel	Private owners and pony clubs	Education/ Public Awareness	Brochures	Many	M	L	N	7	N	Unknown	
Other animal manage-ment	Horse and camel	Commer-cial and private riders	Planning	Assess new access points	Many	L	N/A	N	3	N	Unknown	
Other animal manage-ment	Horse and camel	Commer-cial and private riders	Regulation	Bans	Many	H	M	N	3	N	Effective	SMP
Other animal manage-ment	Horse and camel	Commer-cial and private riders	Education/ Public Awareness	Signs at access points	Many	M	L	N	4	N	Effective	SMP, SPI
Other animal manage-ment	Horse and camel	Illegal riders	Regulation	Enforce-ment	Many	M	M	N	3	N	Effective	SPI
Habitat manage-ment	Erosion control	Any site prop. For erosion control	Planning	Assess-ment of impacts	Many	L	None	Y	1	N	Unknown	

Category	Subject	Target	Type	Delivery	No. bird	IC	MC	D1	TS	D2	Effect	Evid-ence
Habitat manage-ment	Erosion control	All sites	Planning	Use non-invasive techniques	Many	L	None	N	1	N	Unknown	
Habitat manage-ment	Erosion control	All sites	Planning	Not exporting introduced invasive sp	Many	L	L	N	1	N	Unknown	
Habitat manage-ment	Erosion control	All sites	Education/ Public Awareness	Reduce artificial erosion	Many	L	L	N	1	N	Unknown	
Habitat manage-ment	Erosion control	Affected sites	Control	Manual removal	Many	H	M	N	2	N	Unknown	
Habitat manage-ment	Erosion control	Affected sites	Control	Chemical control	Many	M	M	N	2	N	Unknown	
Habitat manage-ment	Erosion control	Affected sites	Control	Burning	Many	M	M	N	2	N	Unknown	
Habitat manage-ment	Invasive plants	Affected sites	Control	Succession with natives	Many	M	M	N	1	N	Unknown	
Habitat manage-ment	Invasive plants	Affected sites	Control	Manual removal	Many	H	M	N	2	N	Unknown	
Habitat manage-ment	Invasive plants	Affected sites	Control	Chemical control	Many	M	M	N	2	N	Unknown	
Habitat manage-ment	Invasive plants	Affected sites	Control	Burning	Many	M	M	N	2	N	Unknown	
Habitat manage-ment	Invasive plants	Affected sites	Control	Adjust grazing pressure	Many	H	H	N	1	N	Unknown	
Habitat manage-ment	Extractive industries	Any proposed site	Planning	assess proposals	Many	L	N/A	N	1	N	Unknown	
Habitat manage-ment	Extractive industries	Any site where commer-cial extraction approved	Regulation	Seasonal bans	Many	L	L	N	2	N	Unknown	
Habitat manage-ment	Extractive industries	Any private extraction	Regulation	prohibit	Many	L	L	N	1	N	Effective	SMP
Habitat manage-ment	Oil Spill	Coastal PV staff	Planning	Prepare emergency plan	Many	L	L	N	1	N	Unknown	
Habitat manage-ment	Oil Spill	Coastal PV staff	Education/ Public Awareness	Staff Training	Many	L	L	N	1	N	Unknown	

Category	Subject	Target	Type	Delivery	No. bird	IC	MC	D1	TS	D2	Effect	Evid-ence
Habitat manage-ment	Rubbish	Anglers and people on beach	Rubbish disposal facilities	Bins	Many	M	M	N	4	N	Unknown	
Habitat manage-ment	Rubbish	Anglers & people on beach	Education/ Public Awareness	Signs at fishing spots	Many	M	L	N	1	N	Unknown	
Habitat manage-ment	Rubbish	Anglers & people on beach	Education/ Public Awareness	Media coverage	Many	L	None	N	2	N	Unknown	
Habitat manage-ment	Sea-level rises	Reduce flooding	Manipulation	Nest relocation	1 pair	H	L	Y	1	Y	Unknown	
Habitat creation	Habitat loss	Estuaries and inlets	Manipulation	Dredge islands	1-2 pair	H	H	N	1	N	Unknown	
Popula-tion Manage-ment	Population augmenta-tion	Increase popula-tion	Manipulation	Captive breeding and release	Many	H	H	N	1	Y	Unknown	

OVERVIEW

Of the 111 management options, the effectiveness of 69.4% (77) is unknown because they have not been tested. In total, 29.7% (33) have been shown to be effective, and 0.9% (1) has been shown to be ineffective. A summary of effective management for up to two pairs is shown in Table 12.2, and a summary of management techniques that benefit many birds are shown in Table 12.3. A summary of threat-specificity for each technique is provided in Table 12.4. Overall, 14.4% (16) techniques required regular monitoring, and 12.6% (14) had the potential to cause disruption.

Table 12.2. Twelve management techniques known to be effective for up to two pairs per application, sorted by initial and maintenance costs.

Subject	Target	Type	Delivery	Initial cost	Maintenance cost	Requires nest/brood detection
Humans	People on beaches, predators	Fencing	Electric fencing – breeding area	H	H	Y
Humans	Coastal residents	Fencing	Permanent – informal track closure	H	M	N
Stock	Areas where stock wander	Fencing	Additional fencing	H	M	N
Humans	People on beaches	Fencing	Permanent – access points	H	M	N
Humans	People on beaches	Fencing	Permanent – dune access.	H	M	N
Humans	People on beaches	Fencing	Permanent – breeding area	H	M	N

Subject	Target	Type	Delivery	Initial cost	Maintenance cost	Requires nest/brood detection
Humans	People on beaches	Fencing	Temporary – dune access.	M	M	N
Humans	People on beaches	Fencing	Temporary – around nests	M	M	Y
Introduced predators	Foxes	Manipulation	Nest cages	M	M	Y
Introduced predators	Foxes	Fencing	Temporary - around nests	M	M	Y
Humans	People on beaches	Exclusion	Temporary Partial Closure of Site	L	L	Y
Humans	People on beaches	Guarding	Site-specific Wardening	L	None	Y

Table 12.3. Twenty-one management techniques known to be effective for many pairs per application, sorted by initial and maintenance costs.

Subject	Target	Type	Delivery	Initial cost	Maintenance cost	Requires nest/brood detection
Dogs	Dogs on restricted beaches	Regulation	Enforcement	M	H	N
Humans	People on beaches	Exclusion	Seasonal site closures	M	M	N
Introduced predators	Foxes	Control	Population reduction	M	M	N
Introduced predators	Feral cats	Control	Population reduction	M	M	N
Horse and camel	Illegal riders	Regulation	Enforcement	M	M	N
Humans	Walkers	Education/ Public Awareness	Brochures	M	L	N
Humans	People on beaches	Education/ Public Awareness	Postcards	M	L	N
Humans	People on beaches	Education/ Public Awareness	Signs at access points	M	L	N
Dogs	Dog walkers	Education/ Public Awareness	Signs at access points	M	L	N
Dogs	Park neighbours that own dogs	Education/ Public Awareness	Brochures	M	L	N
Horse and camel	Commercial and private riders	Education/ Public Awareness	Signs at access points	M	L	N
Humans	Neighbours	Education/ Public Awareness	Brochure mailout	M	None	N

Subject	Target	Type	Delivery	Initial cost	Maintenance cost	Requires nest/brood detection
Humans	People on beaches	Guarding	Beach-specific Wardening.	L	L	N
Extractive industries	Any private extraction	Regulation	Prohibit	L	L	N
Humans	Schools	Education/ Public Awareness	Presentations	L	None	N
Humans	Holiday-makers	Education/ Public Awareness	Media coverage	L	None	N
Dogs	Roaming dogs	Control	Collection	None	None	N

Table 12.4. Summary of the threat-specificity of each management type. Those managements not shown are considered to only be applicable to a single risk. The table is presented in decreasing order of the number of specific threats a management addresses.

Management	Number of applications (risks addressed)
Brochures	7
Population reduction	5
Bins	4
Chick shelters	4
Poster	4
Signs at access points	4
Assess new access points	3
Bans	3
Enforcement	3
Assess new developments	2
Burning	2
Campground talks	2
Chemical control	2
Clarify land status	2
Manual removal	2
Media coverage	2
Presentations	2
Ranger visits	2
Seasonal bans	2
Staff behaviour	2

CONCLUSIONS

- Management techniques are categorised according to site-specificity and threat-specificity, cost, the requirement for frequent monitoring, effectiveness and potential for disruption to breeding birds.
- The effectiveness of 69.4% (77) of management techniques is unknown because they have not been tested. In total, 29.7% (33) have been shown to be effective, and 0.9% (1) has been shown to be ineffective.
- Twenty one management techniques would benefit many pairs of Hooded Plovers, and 20 management techniques are applicable to more than one risk.

Chapter 13 – Management Options for Hooded Plovers on Lands Managed by Parks Victoria

SUMMARY

This chapter presents the management options that are suitable for each Parks Victoria site. An estimate of the effectiveness, and the implication of each management option at the population level is provided. The data are summarised to provide an overview of suitable managements across the Parks Victoria estate.

Management options for Hooded Plovers are those options that:

- address a risk to Hooded Plovers,
- are effective (demonstrated or probable), and;
- are practical to implement and maintain.

In order to simplify the management options available, twelve main threat categories addressed by five main management approaches have been used in this chapter. Planning-phase managements (those involving oil spills, coastal developments and climate change) are excluded because the impact and the implication of the management options is impossible to determine. Habitat creation and population augmentation have been omitted as they are not practical or effective (see Chapter 11).

An additional option at each site is to do nothing. This is an important option because it allows available resources to be targeted where they are most needed. This “do nothing” option therefore represents the fifteenth main management option.

DEFINITIONS

In this report, an “impact” is the degree of effect that a risk has on Hooded Plovers. For example, the impact of foxes on Hooded Plovers may be high if many nests are eaten by foxes. The impact score is provided and defined in Table 9.1.

In this report, “implication” is the outcome at the population level within a site. This is often different to “impacts”, because the influence of impacts at the population level are mediated by a variety of factors. For example, although many nests may be eaten by foxes, it may not reduce reproductive success to the extent that populations decline. Under such a scenario, foxes would have a high impact but there would be no population implication of their activities.

IMPLICATIONS OF MANAGEMENT

Every management option has implications for Hooded Plovers, although the implications vary depending on the impact of the risks being addressed, the effectiveness of the management option and the sensitivity of populations. Here the implications of each management option are given at the level of the population in each site. It is evident that changes in Hooded Plover populations generally occur slowly, presumably because adults are long-lived (Weston 1993, 2000a). Table 13.1 presents the classification scheme used here for implications (i.e. population trends). The rates of population change are based on observed rates of change in Victorian Hooded Plovers.

Table 13.1. The classification of expected population trends (implications). The rate of decline or increase refers to the annual percentage change in the number of breeding adults.

Population Trend	Rate of decline or increase	Symbol
Rapid Decline	5+%	↓↓
Slow Decline	1-5%	↓
Stable	0%	↔
Slow Increase	1-5%	↑
Rapid Increase	5+%	↑↑

It is apparent that Hooded Plovers are adapted to high rates of reproductive failure (Weston 2000a). Therefore, it is not necessary to eliminate all risks at a site before a population recovery will occur. This has been demonstrated at Mornington Peninsula National Park, where threats have been reduced but not eliminated, and reproductive success and population size has increased (Dowling & Weston 1999, B. Dowling pers. comm.).

MANAGEMENT OPTIONS AND IMPLICATIONS OF EACH OPTION FOR EACH SITE

Table 13.3 presents the management options and implications of each option at sites managed by Parks Victoria. Some management options are already in place, and the implications of these options are treated the same as for options which are not currently being undertaken. The notation used in Table 13.3 is described in Figure 13.1. In the example in Figure 13.1, the risk being addressed by the management option has a very high impact (impact score 5 [Table 9.1]), but the management option reduces the impact so it is moderate (impact score 3). Thus, the management has alleviated impact by two points. A zero (“0”) impact score with management indicates that the impact has been neutralised (i.e. no impact remains).

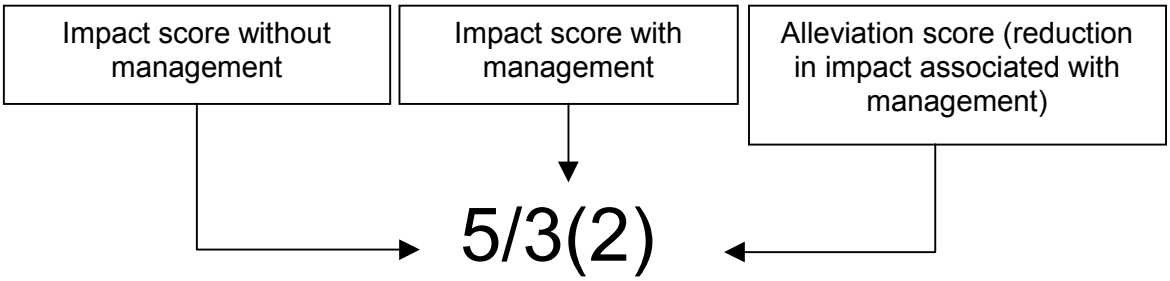


Figure 13.1. The notation used in Table 13.3 to describe impacts and the alleviation of them by management options.

Figure 13.2 shows the full entry in each cell of Table 13.3. The first section of the entry describes the impact and alleviation of the impact by a particular management option. The second section describes the population trend (implication) that would result if this management option were applied in isolation (after Table 13.1). Thus, for the example shown in Figure 13.2, the impact and alleviation of the impact is read as for the explanation provided above (for Figure 13.1), and if the management option is applied in isolation, the population at the site is expected to decline rapidly (after Table 13.1).

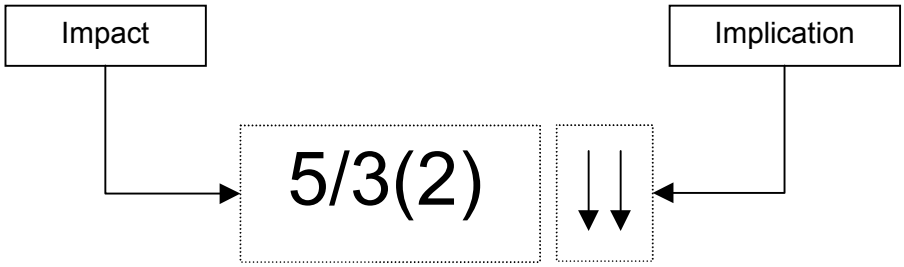


Figure 13.2. The notation used in Table 13.3 describing the impacts and implications of each management option.

Some management options have benefits beyond alleviation of impacts at a particular site. For example, visitor management at sites that are heavily used by recreationists can increase awareness beyond that site. At these sites, visitor management can be thought of as Flagship management. These sites are indicated by an “F” following the implications arrows (sites with high visitation and a high-flux of visitors).

Table 13.2 summarises the symbols and scales used in Table 13.3.

Table 13.2. A quick reference key to Table 13.3.

Symbol or score	Meaning
5	Very High Impact
4	High Impact
3	Moderate Impact
2	Minor Impact
1	Slight Impact
0	No Impact
↓↓	Rapid Population Decline
↓	Slow Population Decline
↔	Population Stable
↑	Slow Population Increase
↑↑	Rapid Population Increase
F	“Flagship”

Table 13.3 presents the management options and implications of each option at each site managed by Parks Victoria. Planning-phase managements (those involving oil spills, coastal developments and climate change) are excluded because the alleviation of impact and the implication of the management options is impossible to determine. Thus, overall impact scores may differ slightly from those in Chapter 9.

Management options were identified for every Parks Victoria site. From two to eight options were identified per site (mean 5.3). Six sites (12.5%) were considered to be suitable for flagship management efforts.

INTERPRETING TABLE 13.3 – EXAMPLES

In recognition that Table 13.3 is complicated to interpret, two worked examples are provided:

- Cape Liptrap Coastal Park.
  - **Risks:** Five sources of risk are evident at this park (humans, dogs, introduced predators and erosion control). Introduced predators are thought to have the highest impact in the absence of any management.
  - **Management Options:** Managing introduced predators has the highest alleviation score, and if this was the only management activity undertaken, it is expected to result in a stable population.
  - **Population Implications:** In the absence of management, populations at the park are expected to slowly decline. Managing introduced predators alone is expected to stabilise the population, while each of the other management options would result in

a slowly declining population if applied in isolation. If all management options are used, then it is expected to result in a population that is slowly increasing.

- Wilsons Promontory National Park.
  - **Risks:** The greatest risks at the park in the absence of management are introduced predators, invasive plants and humans. Other risks include rubbish and native predators. If no management actions were to be carried out, the population at the park is expected to slowly decline.
  - **Management Options:** Five management options (one for each risk) are considered appropriate for this park. The most effective management action is considered to be the control of introduced predators, which has the highest alleviation score. The least effective management action is the control of native predators, which is unlikely to have any significant benefit to Hooded Plovers in the park. The management of humans in the park may have flow-on benefits to other areas, and so can be considered a Flagship management.
  - **Population Implications:** In the absence of management, populations at the park are expected to slowly decline. The management options are not expected to result in anything other than slow population decline if they are used in isolation. In other words, there is not a single management option that will turn around the slow population decline. However, if all options are implemented, then it is expected that the risks will be alleviated to such an extent that the population will slowly increase.

MANAGEMENT OPTIONS AND IMPLICATIONS ACROSS LANDS MANAGED BY PARKS VICTORIA

The analysis presented in this chapter also allows the generation of a summary of the management options across Parks Victoria managed land. Table 13.4 shows the percentage of sites where each management option would be appropriate. However, some management options will not alleviate the impacts of risks to the same extent as other management options. The percentage of sites where the most effective management options (here defined as those with alleviation scores of at least 2) are appropriate is also shown.

It is also possible to examine the overall benefit of different management options by summing impact and alleviation scores across all sites (Table 13.5). The implications of each management option are shown for the population as a whole i.e. the population trend expected if only that management option was implemented at every appropriate Parks Victoria site (see Table 13.1 for the symbols used).

Table 13.3. Management options and implications of each option for each site. Blanks indicate that there are no management options considered suitable. The entries in the table give the estimated impacts (Figure 13.1) and the estimated implications (Table 13.1) of each management option when applied in isolation. Thus, wherever an entry is evident in the table, it indicates a suitable management option.

Site	Visitor management		Predator management		Vehicle management		Other animal management		Habitat management				Overall	Population trends	
	Humans	Dogs	Introd-uced predators	Native predators	Illegal vehicles	Legal vehicles	Stock	Horse and camel	Erosion control	Invasive plants	Extractive industries	Rubbish		No manage-ments	All manage-ments
Discovery Bay Coastal Park	1/0(1)↓F		4/1(3)↔	3/3(0)↓	2/1(1)↓				3/3(0)↓				13/7(6)	↓	↔
Narrawong Coastal Reserve	2/0(3)↓	3/1(2)↓	3/1(2)↓	2/2(0)↓	4/0(5)↓				3/3(0)↓				17/7(10)	↓	↔
Eumeralla (Yambuk) Coastal Reserve	1/0(1)↓	1/0(1)↓	3/1(2)↔	2/2(0)↓	4/0(5)↔		1/0(1)↓		3/3(0)↓				15/6(9)	↓	↔
Yambuk F.F.R	2/1(1)↓	1/0(1)↓	3/1(2)↔	2/2(0)↓	3/0(4)↔		1/0(1)↓		3/3(0)↓				15/7(8)	↓	↔
Port Fairy - Warrnambool Coastal Reserve	4/1(3)↓	3/1(2)↓	3/1(2)↓	3/3(0)↓	2/1(1)↓			2/1(1)↓	3/3(0)↓				20/11(9)	↓↓	↓
Port Fairy Maritime Complex H.A	2/1(1)↓	2/1(1)↓	2/1(1)↓						2/2(0)↓				8/5(3)	↓	↑
Bay of Islands Coastal Park	3/1(2)↓	2/1(1)↓	2/1(1)↓	1/1(0)↓									8/4(4)	↓	↑
Peterborough Coastal Reserve	3/1(2)↓	2/1(1)↓	2/1(1)↓	1/1(0)↓					2/2(0)↓				10/6(4)	↓	↔
Port Campbell National Park	3/1(2)↓F	1/0(0)↓	2/1(1)↓	1/1(0)↓				1/0(1)↓				1/0(1)↓	9/4(5)	↓	↑
Otway National Park	2/1(2)↓F	3/1(2)↓	3/1(2)↓	1/1(0)↓				1/0(1)↓	1/1(0)↓				10/5(5)	↓	↑
Elliot River - Addis Bay Coastal Reserve	4/2(2)↓	4/1(3)↓	3/1(2)↓	1/1(0)↓					1/1(0)↓				13/6(7)	↓	↔
Angahook - Lorne State Park	4/2(2)↓	4/1(3)↓	3/1(2)↓	1/1(0)↓					1/1(0)↓				13/6(7)	↓	↔
Wye River Coastal Reserve	4/2(2)↓	4/1(3)↓	3/1(2)↓	1/1(0)↓					1/1(0)↓				13/6(7)	↓	↔
Lorne - Queenscliff Coastal Reserve	5/2(3)↓	4/1(3)↓	3/1(2)↓	2/2(0)↓	1/0(1)↓			2/0(2)↓	4/1(3)↓	1/0(1)↓			22/7(16)	↓↓	↔
Lake Connewarre W.R.	1/0(1)↓	3/1(2)↓	3/1(2)↓	1/1(0)↓									8/3(5)	↓	↑
Lonsdale Lakes W.R.	2/1(1)↓	3/1(2)↓	3/1(2)↓	2/2(0)↓							1/0(1)↓		11/5(6)	↓	↑
Point Lonsdale Jetty	5/2(3)↓	4/1(3)↓	2/1(1)↓	2/2(0)↓					5/2(3)↓				18/8(10)	↓	↓
Queenscliff Port And Associated Facilities	1/0(1)↓		2/1(1)↓	1/1(0)↓							2/1(1)↓		6/3(3)	↔	↑
Mud Islands W.R.	1/1(1)↓			1/1(0)↓									2/1(1)	↑	↑↑
Mornington Peninsula National Park	5/1(4)↓F	5/2(3)↓	3/1(2)↓	2/2(0)↓	1/0(1)↓			1/0(1)↓		3/1(2)↓		1/0(1)↓	21/7(14)	↓↓	↔
Harold Holt - Point Lonsdale Fisheries Res.			3/0(3)↔	1/1(0)↓									4/1(3)	↑	↑↑
Flinders - Somers Coastal Reserve	4/2(2)↓	4/1(3)↓	2/1(1)↓	2/2(0)↓									12/6(6)	↓	↔
Flinders Jetty	4/2(2)↓	4/1(3)↓	2/1(1)↓	2/2(0)↓								1/0(1)↓	13/6(7)	↓	↔
Phillip Island Coastal Reserve	4/2(2)↓	5/1(4)↓	3/1(2)↓	1/1(0)↓				1/0(1)↓	1/1(0)↓				15/6(9)	↓	↔
Cowes Jetty	5/3(2)↓	3/1(2)↓	2/1(1)↓	1/1(0)↓					1/1(0)↓			1/0(1)↓	13/7(6)	↓	↔

Site	Visitor management		Predator management		Vehicle management		Other animal management		Habitat management				Overall	Population trends	
	Humans	Dogs	Introd-uced predators	Native predators	Illegal vehicles	Legal vehicles	Stock	Horse and camel	Erosion control	Invasive plants	Extractive industries	Rubbish		No manage-ments	All manage-ments
Rhyll Jetty	5/3(2)↓	3/1(2)↓	2/1(1)↓	1/1(0)↓					1/1(0)↓			1/0(1)↓	11/5(6)	↓	↑
Newhaven Slipway	5/3(2)↓	3/1(2)↓	2/1(1)↓	1/1(0)↓					1/1(0)↓			1/0(1)↓	11/5(6)	↓	↑
Newhaven Jetty	5/3(2)↓	3/1(2)↓	2/1(1)↓	1/1(0)↓					1/1(0)↓			1/0(1)↓	11/5(6)	↓	↑
San Remo Jetty	5/3(2)↓	3/1(2)↓	2/1(1)↓	1/1(0)↓					1/1(0)↓			1/0(1)↓	11/5(6)	↓	↑
San Remo - Pt Smythe Coastal Reserve	3/1(2)↓	3/1(2)↓	4/1(3)↓	1/1(0)↓					2/1(1)↓				13/5(8)	↓	↑
Bunurong Marine Park	5/2(3)↓	4/1(3)↓	4/1(3)↓	1/1(0)↓									14/5(9)	↓	↑
Andersons Inlet W.M.C.A	2/1(1)↓	2/1(1)↓	2/1(1)↓	1/1(0)↓					2/1(1)↓				9/5(4)	↓	↑
Cape Liptrap Coastal Park	1/0(1)↓	1/0(1)↓	4/1(3)↔	1/1(0)↓					2/1(1)↓				8/2(6)	↓	↑
Waratah Bay - Shallow Inlet Coastal Reserve	3/1(1)↓	3/2(1)↓	3/1(2)↓	1/1(0)↓				1/0(1)↓	2/2(0)↓				13/7(6)	↓	↔
Shallow Inlet Marine & Coastal Park	2/1(1)↓	2/1(1)↓	3/1(2)↓	1/1(0)↓					2/1(1)↓				10/5(5)	↓	↑
Wilsons Promontory National Park	3/1(2)↓F		4/1(3)↓	1/1(0)↓						3/2(1)↓		1/0(1)↓	12/5(7)	↓	↑
Port Franklin - Port Welshpool Coastal Reserve	2/1(1)↓	1/0(1)↓	3/1(2)↓	1/1(0)↓									7/3(4)	↔	↑
Nooramunga Marine & Coastal Park	1/1(0)↓	1/0(1)↓	2/0(2)↓	1/1(0)↓					2/2(0)↓			1/0(1)↓	8/4(4)	↓	↑
Mcloughlins Beach - Seaspray Coastal Reserve	1/1(0)↓	1/1(0)↓	3/1(2)↓	1/1(0)↓					2/2(0)↓			1/0(1)↓	9/6(3)	↓	↔
Jack Smith Lake W.R	1/1(0)↓	1/1(0)↓	3/1(2)↓	1/1(0)↓					1/1(0)↓			1/0(1)↓	8/5(3)	↓	↑
Gippsland Lakes Coastal Park	3/2(1)↓	3/1(2)↓	2/1(1)↓	1/1(0)↓					2/2(0)↓			1/0(1)↓	12/7(5)	↓	↔
Rigby Island Reserve	3/1(2) ↓	1/1(0) ↓	2/0(2) ↓	1/1(0) ↓									7/3(4)	↓	↑
Lakes Entrance - Lake Tyers Coastal Reserve	3/1(2)↓	3/1(2)↓	2/1(1)↓	1/1(0)↓					1/1(0)↓				10/5(5)	↓	↑
Ewing Morass W.R	1/1(0)↓	2/1(1)↓	2/1(1)↓	1/1(0)↓					1/1(0)↓			1/0(1)↓	8/5(3)	↓	↑
Marlo Coastal Reserve	3/1(2)↓	2/1(1)↓	2/1(1)↓						1/1(0)↓			1/0(1)↓	9/4(5)	↓	↑
Cape Conran Coastal Park	2/1(1)↓	3/1(2)↓	3/1(2)↓	1/1(0)↓									9/4(5)	↓	↑
Croajingolong National Park	2/0(1)↓F	1/0(1)↓	4/1(3)↓	1/1(0)↓									8/3(5)	↓	↑
Mallacoota Coastal Reserve	4/2(2)↓	3/1(2)↓	2/1(1)↓	1/1(0)↓				1/0(1)↓	2/2(0)↓			1/0(1)↓	14/7(7)	↓	↔

Table 13.4. The applicability and effectiveness of different management options across the Parks Victoria estate.

Type	Source	Sites where applicable	Percentage of sites	Sites where alleviation scores ≥2	Percentage of sites
Visitor management	Humans	47	97.9	22	44.9
	Dogs	43	89.6	25	51.0
Predator management	Introduced predators	47	97.9	28	57.1
	Native predators	46	95.8	0	0.0
Vehicle management	Illegal vehicles	7	14.6	3	6.1
	Legal vehicles	0	0.0	0	0.0
Other animal management	Stock	2	4.2	0	0.0
	Horse and camel	8	16.7	1	2.0
Habitat management	Erosion control	32	66.7	2	4.1
	Invasive plants	3	6.3	1	2.0
	Extractive industries	2	4.2	0	0.0
	Rubbish	16	33.3	0	0.0

Table 13.5. Management options and implications of each option across Parks Victoria managed land (see Table 13.1 for explanation of the symbols).

Management options	Overall score	Alleviation as a percentage of pre-management impact
Humans	129/57(72) ↓	55.8
Dogs	114/38(76) ↓	66.7
Introduced predators	126/44(82) ↓	65.1
Native predators	60/58(2) ↓	3.3
Illegal vehicles	17/2(15) ↓	88.2
Other animals	12/1(11) ↓	91.7
Habitat management	86/54(32) ↓	37.2

Table 13.5 provides an index of the benefit of each management option across Parks Victoria managed land. It also indicates the degree to which impacts are alleviated by particular management options, if they were applied in every suitable site. The alleviation for management options aimed at Humans, dogs, introduced predators, illegal vehicles, and other animals is excellent. However, little alleviation of impact is likely from management options aimed at habitat management or native predators. New management techniques may suitably decrease the impact of these risks on Hooded Plovers.

The implications of all or no managements across the state is summarised in Table 13.6 (derived from Table 13.3). If no managements were implemented, decline would be evident

at 91.7% of sites, if all managements were implemented then population stability or increase would be evident at 95.8% of sites.

Table 13.6. The population trend predicted at Parks Victoria sites under no management regime compared with under a regime where all managements are implemented. Percentage = percentage of sites (n=48).

Population trend	No managements		All managements	
	Number of sites	Percentage	Number of sites	Percentage
↓↓	3	6.3	0	0.0
↓	41	85.4	2	4.2
↔	2	4.2	18	37.5
↑	2	4.2	26	54.2
↑↑	0	0.0	2	4.2

The management options provided in this report mostly enable either population increases at some sites, or population stability at some sites. Thus, these management options should allow Parks Victoria to either stabilise or increase populations at the State level. The following section discusses what "population goals" are available to Parks Victoria.

AIMS OF MANAGEMENT AT THE POPULATION LEVEL

Population trends at the State levels are difficult to ascertain, although there appears to have been a slow decline at least since 1980 (after Weston 1993). This suggests that without management, such a decline is expected to continue. Population stability (or halting declines) is the minimum management goal, but a period of population increase is preferable in order to aid in recolonising former habitat, reduce any early stages of population fragmentation, and produce a robust population capable of persisting in the face of any widespread intense threat (e.g., an oil spill). If populations decline to very low levels, they may require intensive and expensive management such as captive breeding and cross-fostering (see Sutherland 1998b).

A period of population increase is consistent with the notion of a "recovery". Modern Recovery Plans require an appropriate target population size to be nominated. For Victoria, the appropriate population size will be at least the population size evident in the early 1980's count (about 500 birds). The few historical records available indicate that local populations were once much higher. For Victoria, a reasonable target population would be 650 birds (*c.*570 birds on Parks Victoria land assuming the distribution across land tenures remains constant). Once achieved, management could then focus on maintaining population stability. Ryan *et al.* (1993) have modelled the cost of achieving recovery for Piping Plovers, under different scenarios of delayed management. They determined that a 1% increase in

productivity could take a population heading for extinction towards recovery. A one and five year delay in achieving the 1% increase results in a 13 and 67 year delay in recovery respectively.

Once recovery has been achieved, it is likely that coexistence of Hooded Plovers with humans on beaches will increasingly depend on management (see Haig 1992). The development of efficient and effective management techniques that balance the requirements of recreationists with those of the birds is essential for the long-term future of Hooded Plovers. Generational change in attitudes to recreation, and to the management of recreation on Australian beaches may hold the key to successful coexistence between plovers and humans (Weston 2000a).

CONCLUSIONS

- Management options and their implications are presented for each site. Like the site-by-site variation in risks, suitable management options vary from one site to the next.
- Predator and visitor management are the most broadly applicable options, and the options focussing on the management of humans, dogs and introduced predators are expected to confer the greatest benefit to Hooded Plover populations.
- Current management options for habitat and native predators are not highly effective.
- The managements presented could be used to stabilise existing populations, or increase them to pre-1980 levels. The merits of these two approaches are discussed.

Chapter 14 – Sources of Information for the Management of Hooded Plovers.

SUMMARY

This chapter reviews published and unpublished information on the Hooded Plover. The number of publications on the species is increasing rapidly, and many of the major studies have an emphasis on management. These studies have been conducted by a small number of mostly Victorian researchers and managers. A number of unpublished manuscripts also deal with management.

In a review of the state of knowledge of the world's wading birds, Piersma *et al.* (1997) considered that the Hooded Plover was reasonably well known but that it required some more research. There has been a great deal of study on Hooded Plovers, but the most significant research has been performed since the last comprehensive review of the species' biology (presented in Marchant & Higgins 1993). Although Garnett & Crowley (2000) incorporated a considerable amount of recently published and unpublished information on the species, there is a need for a comprehensive and critical review of the information available on the species. Such a review will be used to identify information gaps and will form the basis for the identification of research needs (Chapters 15 and 16).

SOURCES OF INFORMATION

Published information

There are six main sources of published information: papers in reviewed journals, the so-called "grey" literature, reports, books, theses and newspapers.

Articles in journals are generally peer reviewed, however some bulletins are best considered "semi-reviewed" (e.g., *Stilt*) and some are merely edited (e.g., *VWSG Bull.*). The majority of useful information on Hooded Plovers comes from these journal articles. These are presented, along with other published sources of information, in Appendix 9.

The "grey literature" refers to information presented in newsletters. There are a multitude of ornithological newsletters, with many regional bird-watching groups publishing their own newsletter. One (the newsletter of BELLBOCA [Bellarine Bird Observers Club]) is called "The Hoodie"! These newsletters contain a wealth of information, and so have been included in the compilation of available information. Readers are warned that the high frequency of these publications means that additions to the list of literature will accumulate rapidly. Additionally, it is possible that some newsletters, or some articles in them, have been overlooked.

Reports on the Hooded Plover have been prepared by a variety of State agencies (e.g., Parks Victoria) and non-government organisations (e.g., Birds Australia). Although there is not a always a formal review process, in practice these reports are treated critically at the draft phase. Thus, they can be considered to be reliable sources of information. The species is also mentioned in more general reports such as Environmental Impact Studies (e.g., Lane *et al.* 1997) and Local Government (e.g., Martin 1999) and National Park Management Plans (e.g., Parks Victoria 1998a). Here, such reports are only cited where they contribute new and useful information.

Theses are always assessed by the Universities hosting the students, and can therefore be considered reviewed and reliable. Consequently, these are listed in Appendix 9.

There is no book that focuses entirely on the Hooded Plover. However, there are a multitude of books on Australian birds, and on shorebirds, that have sections dealing with the species. The vast majority of these books cite primary sources of information, and so themselves are secondary sources of information (e.g., Hayman *et al.* 1986, Pringle 1987). Some books do represent primary information, particularly early books (e.g., Gould 1865, Belcher 1900, North 1913-14). In this review, books have been used where relevant, but they are not presented in a separate table. Major reviews (e.g., Marchant & Higgins 1993) are particularly useful, and have contributed significantly to this account.

Newspapers have run a number of articles on Hooded Plovers. Some local newspapers have been used to increase awareness of management practices. Other articles tend to focus on land-use debates that involve issues relevant to the Hooded Plover. A full search of all relevant newspapers is beyond the scope of this study. However, a number of newspaper articles, including most from recent times, are presented in Appendix 8. Newspapers generally reflect information that is available through other channels, and the majority of contributors to these newspaper articles have contributed information elsewhere in this report.

Unpublished information

There are four main sources of unpublished information: personal communications, letters/emails, solicited information from appropriate persons, and publications that are in preparation or in press.

This report drew upon correspondence and communication with all of the major researchers and managers involved with Hooded Plovers in Victoria over the past ten years. Correspondence (mail, email and notes of personal communications) have been stored by the author at his house and cover the period from 1991 to the present day.

Information has also been solicited from a large group of people including land managers, scientists and funding agencies (see Acknowledgments).

Publications in preparation or in press represent a difficulty. Not all papers reach a point where they are submitted for publication, and some papers are likely to be rejected. These publications are presented in Appendix 10.

A number of databases exist on Hooded Plovers. Most researchers maintain databases, and these can often be analysed in a variety of ways to generate useful questions about plover management. These databases are maintained privately or as part of funded programs. Currently, there are plans to analyse and publish results from all databases. In addition to Hooded Plover-specific databases, a number of general databases contain useful information. These include the Atlas of Victorian Wildlife (DNRE), the Atlas of Australian Birds (Birds Australia), and the Nest Record Scheme (Birds Australia). These databases were used when the account in Marchant & Higgins (1993) was prepared (MAW pers. obs.).

AVAILABLE INFORMATION

The information available on Hooded Plovers is presented here in detail, both as a way of documenting the sources used in the review, and also to assist Parks Victoria research partners with their work.

Published information

This study located 143 publications dealing in some substantial way with Hooded Plovers. Of these, 65.7% (94) were in journals, 16.8% (24) were in newsletters, 6.7% (11) were abstracts, 5.6% (8) were reports, 3.5% (5) were university theses, and 0.7% (1) were in magazines. Thus, 82.5% appeared in reviewed or semi-reviewed formats.

Of the 143 publications, 16.8% (24) contained a request for assistance or information, 4.9% (7) reviewed existing information, and 0.7% (1) were popular articles. Although 72.0% (103) of publications contained original observations or data, only 22.4% (32) of publications were classified as major studies (those with replication and analysis).

Overall, 131 publications were specific to one state. Of these, 48.1% (63) referred to Victoria, 18.3% (24) referred to Western Australia, 12.2% (16) referred to South Australia, 12.9% (17) referred to Tasmania, and 8.4% (11) referred to New South Wales. Thus, 81.7% of state-specific publications deal with the eastern population of Hooded Plovers.

Of the 143 publications, 7.0% (10) deal with either banding or sexing techniques. Breeding biology is discussed in 17.5% (25) of publications, social biology or behaviour in 7.7% (11) of publications, habitat in 6.3% (9) of publications, foraging ecology in 4.9% (7) of publications,

and taxonomy in 2.1% (3) of publications. Threatening processes or mortality are discussed in 15.4% (22) of publications, declining populations and range contraction in 4.2% (6) of publications. Management of Hooded Plovers is mentioned in 17.5% (25) of publications. These percentages do not necessarily add to 100% because one publication may deal with several subject areas.

Without doubt, major studies are the greatest contributor to knowledge about the Hooded Plover. Of these publications (32), 34.4% (11) dealt with breeding biology, 31.3% (10) dealt with threatening processes, 31.3% (10) dealt with management, 18.8% (6) dealt with foraging ecology, 15.6% (5) dealt with social biology or behaviour, 12.5% (4) dealt with sexing or banding techniques, 12.5% (4) dealt with habitat, and 6.3% (2) dealt with decline or range contraction. These percentages do not necessarily add to 100% because one publication may deal with several subject areas.

The major studies dealing with management are: Baird & Collins (1996), Baird & Dann (1999), Buick & Paton (1989), Dann & Baird (1997), Dowling (1997, 1999), Dowling & Weston (1999), Weston (2000a,b) and Weston & Morrow (2000). All but one of these (Buick & Paton 1989) are based on Victorian birds. These studies originate from four research groups: 1) a South Australian Research group, 2) the Phillip Island Nature Reserve team particularly B. Baird, J. Fallaw and P. Dann, 3) a Mornington Peninsula National Park group spearheaded by Parks Victoria (notably by B. Dowling), and 4) the work of M.A. Weston through the AWSG, the Threatened Bird Network and the University of Melbourne. Another major research group which will probably contribute significantly to future publications on management will be the University of Tasmania.

Management plans constituted 2.2% (3) of the publications. The plans were: Schulz (1992), Baker-Gabb & Weston (2001), and Weston & Morrow (2000). Two of these plans refer to Victorian populations.

The number of publications available on Hooded Plovers has been growing during the course of this century, and it is projected that over 100 articles will be published on the species this decade (Figure 14.1). Major studies are also being published more frequently, with the last five year period (1996-2000) being responsible for 66.7% of the major studies available on the species (Figure 14.2). This suggests that a number of major publications will emerge soon, and are in preparation (see below). If the subject mix of publications remains the same, and the current publication rates of major studies are maintained, then it is expected that an average of 1.7 publications per year will be major studies dealing with management issues.

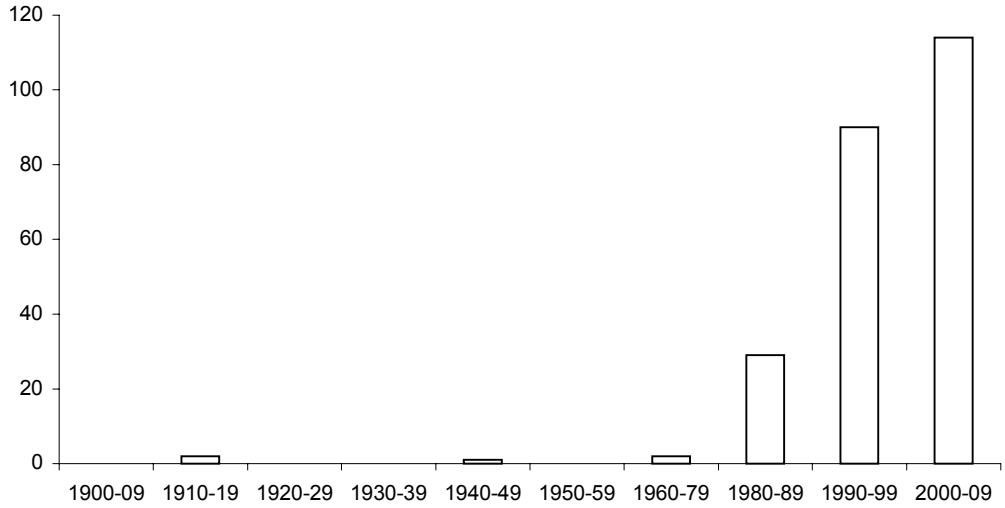


Figure 14.1. The growth in publications on Hooded Plovers. The figure for 2000-2009 is a projection based on publications in 2000 and early 2001.

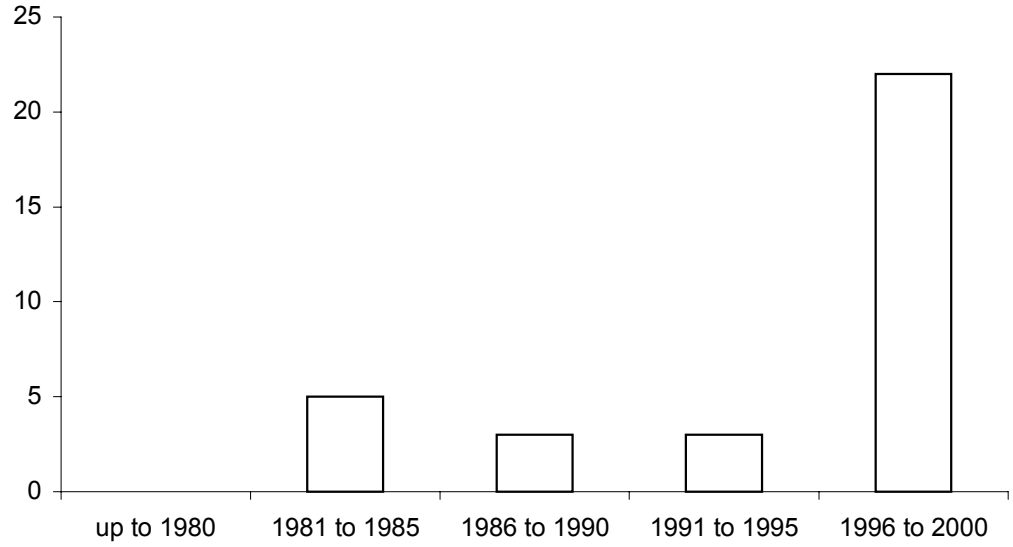


Figure 14.2. The growth in major published studies in Hooded Plovers.

As mentioned above, books tend to represent secondary sources of information on the Hooded Plover. The most comprehensive review of the species, including data from museums and Birds Australia's Nest Record Scheme (NRS) is in Marchant & Higgins (1993).

The available newspaper articles are presented in Appendix 8. Thirty articles were located, and these fell into one of two broad categories. They were either providing advice to the public about how they could minimise their impact on Hooded Plovers (63.3%, 19 articles), or they reported debates about the Hooded Plover as a consideration in planning or

development proposals (36.7%, 11 articles). These articles contribute little original information, but they are valuable in two ways. Firstly, they demonstrate an excellent way of increasing public awareness about issues relevant to coexistence between Hooded Plovers and recreationists (e.g., Anon. 1999a). Secondly, they provide the best published description of local management efforts such as volunteer wardening (e.g., Maud 1994) or fencing off nest sites (e.g., Anon. 2000b, 2001b).

Unpublished information

This chapter has already demonstrated that the publications on Hooded Plovers are in a growth phase, suggesting that there is considerable unpublished information available. This study attempted to access as much unpublished information on the species as possible. This was done in three ways. Firstly, publications being prepared or those cited as "in preparation" were accessed where possible. A list of these manuscripts is given in Appendix 10. Secondly, the excellent network of Hooded Plover researchers, managers and funding agencies were contacted and asked to contribute any information available. This was mostly done by e-mail and phone. Thirdly, records of correspondence from 1991 to present have been maintained by the author, and these were also drawn upon when relevant.

Appendix 10 identifies 18 publications that are in preparation, but it is almost certainly not complete. Of these manuscripts, all are intended to be published in journals, except one is a thesis, one is intended for publication in a magazine and one in a newsletter. The subject matter of these manuscripts is particularly interesting, with 27.8% (5) dealing with management issues. There is also an emphasis on Parks Victoria land and studies, with four manuscripts based on Parks Victoria sites, and three dealing with management techniques currently used by Parks Victoria.

There are long term plans to produce a book on Hooded Plovers (by MAW), and some artwork has already been commissioned (see Figures 1.1 and 15.1). At the current time, the book is intended to be published privately.

CONCLUSIONS

- The main sources of information on the Hooded Plover are publications and unpublished data, which is either held in databases or is in the process of being prepared for publication. There is a growth in major published studies, indicating that more information on managing and conserving Hooded Plovers will become available.
- There is a great deal of published information on Hooded Plovers, but only a small proportion of information is highly relevant to conservation and management of the species.

Chapter 15 – A Review of Information Available for the Management of Hooded Plovers.

SUMMARY

A review of the available information suggests that from a conservation and management point of view, two subjects are critical: 1) the low reproductive success which appears to be driving population declines and 2) the loss of, or reduction in the quality of breeding habitat. The information available on these subjects is presented.

This review is presented in two parts. Firstly, the available information is examined to identify those aspects of the species biology or life cycle that are problematic from a conservation point of view. This strategic overview focuses on the areas where management could benefit the conservation of the species. This section has been aided substantially by the strategic approach taken by Weston (2000a).

The second part of this review is to summarise the available information on those subjects identified as important by the strategic review. This part is presented in some detail.

A STRATEGIC OVERVIEW OF AVAILABLE INFORMATION ON HOODED PLOVERS – A CONSERVATION AND MANAGEMENT PERSPECTIVE

Weston (2000a) has confirmed the previous unsubstantiated claims (e.g., Schulz & Bamford 1987, Schulz 1992) that the main conservation problems facing Hooded Plovers centre on depressed reproductive success.

The most comprehensive and complete overview of the life cycle of Hooded Plovers is that of Weston (2000a) – a study conducted in Victoria including sections of coast managed by Parks Victoria. This major study determined survival rates in all major phases of the life cycle, and the results are presented in Figure 15.1. Weston (2000a) demonstrated that the main phases of mortality were both during the egg (nesting) and chick (brood-rearing) phases. Weston (2000a) also states that at the apparent survival rates, adults are not expected to live long enough to replace themselves. A review of threatening processes (Chapter 8) also revealed that most threats are thought to act to reduce reproductive success rather than the survival of flying birds.

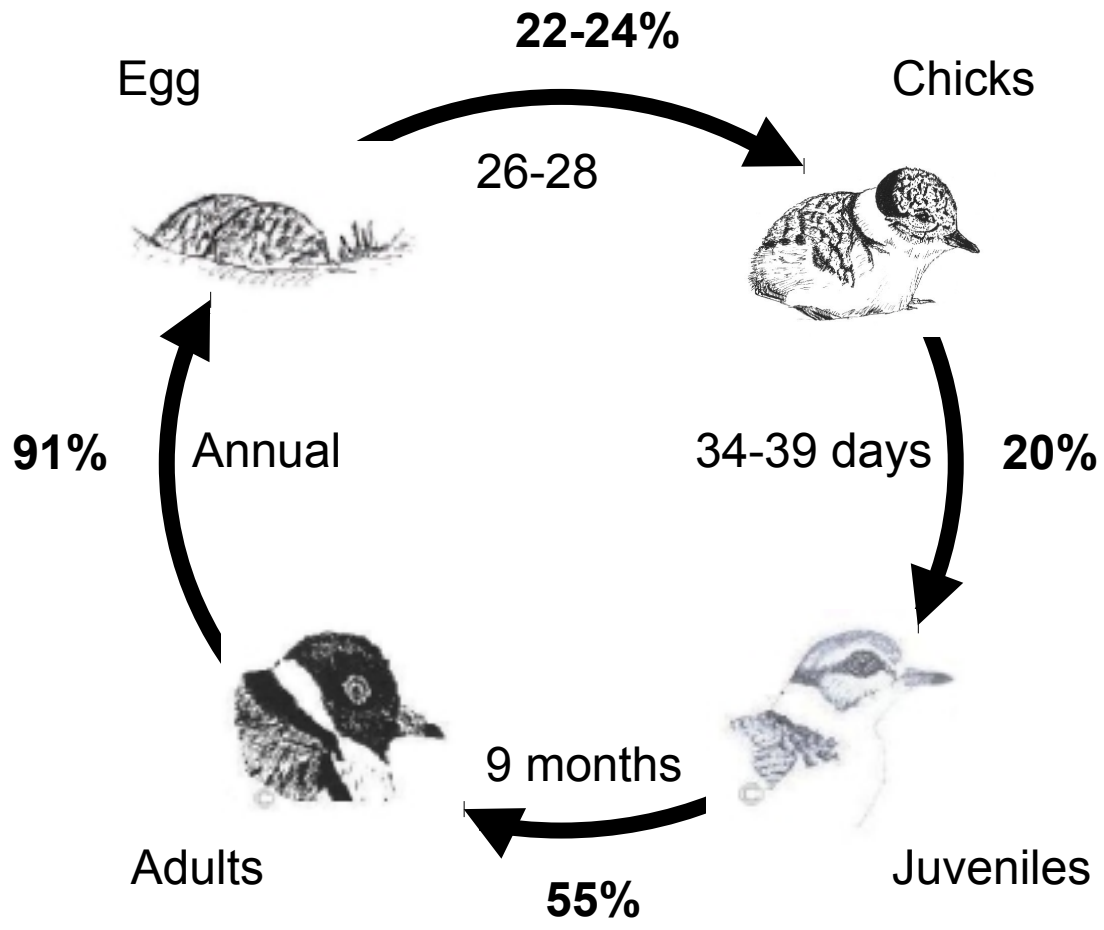


Figure 15.1. Diagrammatic representation of the life cycle of Hooded Plovers. The duration of each period and the percentage survival (for central Victoria) is shown for each phase of the life cycle (after Weston 2000a).

Management and conservation efforts for this species should therefore focus on the nesting and brood-rearing phases, because:

- these are the major sources of mortality, thus they appear to be the main factors in population decline, and;
- management during these phases of the breeding cycle is more practical because eggs and chicks are spatially localised, unlike juveniles.

In addition to the high-mortality phases of the life cycle, a number of longer term processes have been identified as being potentially deleterious to breeding habitat, particularly in eastern Australia (Schulz 1992, Park 1994, Weston 2000a). Breeding habitat of any species

is a critical resource. The processes acting on breeding habitat are potentially long-term or permanent, and so habitat is considered here to be another area important to conservation and management of the species.

In conclusion, the available information suggests that management and conservation of the Hooded Plover should focus on reproductive success and breeding habitat. These resolve into three specific areas:

- Survival of eggs,
- Survival of chicks; and,
- Breeding habitat.

The remainder of this chapter will focus on these three areas. In particular it will review the known processes resulting in low reproductive success and present what is known about breeding habitat.

NESTING (EGG) PHASE

Basic biology

Hooded Plovers lay two or three eggs, and occasionally lay one or four eggs (Weston *et al.* 1998). Their nests are usually simple structures on the beach or in nearby dune areas (Marchant & Higgins 1993). Nests are known to move, always downhill, up to about four metres (Weston 2000a, J. Fallaw pers. comm.). Nests have moved in nest cages resulting in the nest being very close to the side of the cage, and thus exposed to predators that can reach into a cage (MAW pers. obs.).

Hooded Plovers do not begin incubating in earnest until the clutch is complete (Weston 2000a). This species is said to have an unusually long incubation period (*c*. 26-28 days, Weston 2000a) thus exposing the eggs to a high risk of failure (Lane 1987). In fact, the incubation period is no longer than other related species, however it is long in relation to egg size (Weston 2000a). Infertile eggs are incubated much longer than a normal incubation period, up to 59 days (Hanisch 1998, Weston 2000a).

The breeding season is lengthy, and in Victoria nests have been found from August to February (Weston 2000a). There is a peak in the number of nests between about October and December (Dowling & Weston 1999, Weston 2000a). However, there are inter-annual variations in the start of the breeding season (Weston 2000a); on Phillip Island in 2000 the first nest was discovered in November (J. Fallaw pers. comm.). Pairs rapidly re-nest a number of times each breeding season, following loss of eggs or chicks (Weston 2000a).

Occasionally, pairs will re-nest after fledging young (Weston 2000a). Pairs may nest in all major habitat types (beach, foredune, dune) in one season (Weston 2000a).

Mortality, survival and threatening processes

Table 15.1 shows the nest fates recorded in major studies of Hooded Plover nesting success. These studies all used the regular diurnal checking method to determine nest fates, although Weston (2000a) observed raven predation from an observation hide. This methodology may bias the results because some forms of nest fate may be readily detectable while others are not.

Table 15.1. Nest fates from different studies. These data are sourced from Dowling & Weston (1999), Hanisch (1998), Weston (2000a), Weston & Morrow (2000), Berry (in prep.). The proportion of nests is shown unless indicated otherwise.

Fate	Cause	Study area					
		Mornington Peninsula NP	Central Victoria excluding Mornington Peninsula NP	Western Victoria	South Eastern Tasmania; Disturbed [a]	South Eastern Tasmania; Undisturbed [a]	Mt William NP, North Eastern Tasmania
n (nests)		171	124	14	16	9	54
Successful	Hatched	39.8	21.8	21.4	14.6	29.6	31.5
Failed	Fox	1.8	5.6	28.6			
	Raven		4.8				11.1
	Unknown predator				60.0	39.0	51.9
	Crushed by motorbike or vehicle			28.6			1.9
	Crushed by humans	30.1	1.0				
	Eggs rolled-out		1.6	14.3			
	Flooded	1.8	2.4		8.0	34.0	3.7
	Abandoned	1.8	4.8	7.1	7.0		
	Non-viable				13.0		
	Human interference		1.0				
	Unknown	24.0	57.3				

[a]Figures represent proportion of eggs.

A number of sources report only the percentage of successful nests rather than the detailed nest fates. Thus, all available success rates of nests are shown in Table 15.2.

Table 15.2. Success rates of Hooded Plover nests. The number of nests and the percentage of nests that hatched are shown (unless indicated otherwise).

State	Location	n (nests)	Percentage Hatching	Source
Vic.	Phillip Island	52[a]	26.9	B. Baird in litt.
Vic.	Mornington Peninsula NP	171	39.8	Dowling & Weston 1999
Vic.	Central Victoria excluding Mornington Peninsula NP	124	21.8	Weston 2000a
Vic.	Western Victoria	14	21.4	Weston & Morrow 2000
SA	Coorong	6	31.0	Buick & Paton 1989
SA	Kangaroo Is	9	22.0	Bransbury 1991
Tas.	South Eastern Tasmania; Disturbed	16	18.8	Hanisch 1998
Tas.	South Eastern Tasmania; Undisturbed	9	33.3	Hanisch 1998
Tas.	Mt William NP, North Eastern Tasmania	54	31.5	Berry in prep.

[a] proportion of eggs

Other recorded fates of eggs include predation by Goannas (Schulz 1995) and Pied Oystercatchers (P. Kambouris in litt.). Snakes have been seen near Hooded Plover nesting beaches (MAW pers. obs.) and so are potential predators - they are suspected of taking eggs at Rigby Island (P. Kambouris in litt.). Rats are considered possible nest predators (Berry in prep., MAW pers. obs., B. Baird pers. comm.) and two nests in Tasmania were apparently depredated by rats (Hanisch 1998). Cats and dogs are nest predators (Hanisch 1998). Native nocturnal mammalian predators may also take nests (Berry in prep.).

The suite of managements targeting predation and human activity employed at Mornington Peninsula National Park increased nest success (Dowling & Weston 1999) implying that predation or human visitation plays a significant role in nest mortality.

Crushing accounts for the failure of many nests at sites that are heavily used by recreationists (e.g., Mornington Peninsula National Park, Dowling & Weston 1999). The tendency of some nests to move downhill means that even foredune nests may end up on the beach where they could be crushed.

Disturbance by humans has also been suggested to result in lowered nest success. The absence of the incubator from the nest caused by humans is thought to leave the nest open to either: 1) predation because the defending adult is absent or 2) thermal stress to the embryos in the eggs (Schulz & Bamford 1987, Weston 2000a). An examination of these possibilities in Victoria suggested that thermal stress probably did cause egg mortality, and

that although potential predators did approach nests more closely during disturbance, that this did not result in depredation of the eggs (Weston 2000a). A study in Tasmania showed that increased rates of non-viability and predation occurred at nests on disturbed beaches (Hanisch 1998), however the increased rates of predation may have been due to increased predator populations rather than to disturbance itself.

Defensive strategies

Hooded Plovers use three strategies to defend their nests: crypsis, aggression and distraction.

The main strategy Hooded Plovers use to defend their nest is crypsis, the combination of secretive adult behaviour and highly camouflaged nests and eggs. The typical response of incubating birds to nearby human and natural stimuli such as a potential predator is to leave the nest and return at a later time. Absences are by far the most common response to an encounter; 90.9% of encounters that caused a response (*n*=580) resulted in an absence from the nest. Other responses involved the incubator crouching over the nest (9.1%) (Weston 2000a). Despite thousands of people passing close by nests, they never located a single nest (Weston 2000a), indicating the high effectiveness of Hooded Plovers at keeping nests hidden from humans (but increasing the risk of crushing). Even when nests had a close-encounter with a potential predator, they remained safe on 97.6% of occasions (after Weston 2000a).

Hooded Plovers are also aggressive when defending nests. They attack and drive off a variety of bird species including: other species of plovers, oystercatchers and sandpipers, gulls, Galahs *Cacatua roseicapilla*, and passerines including Common Starlings *Sturnus vulgaris*, White-fronted Chats *Epthianura albifrons* and Australian Magpies *Gymnorhina tibicen* (Marchant & Higgins 1993, Schipper & Weston 1998, Weston 1998b, Weston 2000a). However, they do not attempt to drive off ravens, instead they use a cryptic response. Even pairs watching a raven eat their eggs do not attack (MAW pers. obs.).

Like other waders, Hooded Plovers give distraction displays. Such displays are rarely given during the egg phase (Weston 2000a), but nesting birds have given distraction displays to humans, ravens and magpies (Hanisch 1998, Weston 2000a, MAW unpubl. data).

Management overview

The managements that can be used for nesting Hooded Plovers are described in Chapter 11. The currently available research on managing nesting Hooded Plovers is summarised in Chapter 12. The managements effectively used on nests involve those aimed at reducing the

risk of predation, crushing and/or disturbance (e.g., Dowling & Weston 1999). Nests are *relatively* easy to manage in comparison with broods because they are spatially localised, and it is easier to test the effectiveness of management techniques on nests.

The information regarding successful management of nesting Hooded Plovers is correlational (Dowling & Weston 1999) and experimental (Baird & Dann 1999).

BROOD-REARING PHASE

Basic biology

Like most other shorebirds, chicks leave the nest almost as soon as they hatch and are able to start feeding immediately. The adults do not feed the young but brood them and provide information which apparently guides the hiding and antipredator behaviour of the chicks (Marchant & Higgins 1993).

Although chicks from all nest habitats are led to the beach (Dowling & Weston 1999, Weston 2000a), observations revealed that in large blowouts, it can take over one and a half days before the chicks reach the beach (MAW pers. obs.). Young chicks predominantly feed in the upper beach (Bear 2000, Weston 2000a) – there is a substantial amount of data on chick foraging that is unpublished (MAW unpubl. data). Broods are mobile, moving up to 2 km during a day (Weston 2000a). Growth rates are presented in Weston (2000a).

Chicks are thought to fledge at about 35 days after hatching, at which time they often leave their natal territory (Marchant & Higgins 1993, Weston 2000a). There is an unconfirmed report of fledging at 32 days of age (B. Dowling pers. comm.). Territorial parents have been seen chasing and fighting with their fledged offspring (Weston 1998c). Once departure from the territory occurs, the juveniles may travel hundreds of kilometres east or west (or both) along the coast (MAW unpubl. data). They may breed in the breeding season after hatching, but most begin breeding in the second breeding season after hatching (Weston 2000a). They may breed considerable distances from their natal territory, or may breed nearby (Dowling & Weston 1999, Weston 2000a).

Chicks have been recorded in Victoria from October to April (Weston 2000a).

Mortality, survival and threatening processes

The decline of the threatened Piping Plover has been attributed in part to low chick survival (Loegering & Fraser 1995), and low chick survival plays a major role in the poor reproductive success of Hooded Plovers (Weston 2000a). This has been emphasised by the Phillip Island experience, where hatching success increased substantially with the use of nest cages, but

overall reproductive success did not increase because chick mortality remained high (B. Baird in litt.).

The causes of mortality of chicks are so poorly known that the vast majority of chick deaths occur due to unknown causes (Weston 2000a). Chicks typically disappear, so it is very difficult to know what caused their deaths – their bodies are rarely found (MAW pers. obs.). Table 15.3 summarises the known and probable causes of chick mortality. Those sources of mortality that are suspected, but for which there is no evidence, are listed in Chapter 8 but excluded from Table 15.3.

Table 15.3. Known and possible causes of mortality of chicks.

Cause	Definite cause of mortality	Possible cause of mortality	Source
Nankeen Kestrel (Bird of Prey)	*		Weston 1998a
Silver Gull		*	D. Ryan in litt., I.D. Stewart pers. comm.
Conspecific aggression		*	Teoh & Weston in prep.
Interspecific aggression – Fairy Terns		*	P. Park in litt.
Dog	*	*	Weston 1998a, B. Baird in litt.
Crushing by vehicle	*		Buick & Paton 1989, V. Natt in litt.
Crushing by people	*		P. Park in litt.
Collection of chicks by recreationists		*	see Weston 2000a
Disease/injury		*	MAW unpubl. data[a]
Drowning/washed out to sea		*	MAW unpubl. data[b]
Dehydration or overheating	*		B. Dowling pers. comm.
Starvation		*	I.D. Stewart pers. comm.

[a] The author has observed 1) a chick which hatched with a leg deformity (swollen and lengthened knee joint) at Powlett River and 2) a chick which had a graze or disease over much of its back. This chick was also drastically underweight compared with it's sibling (they were captured on the same day and had weights of 28.8 g and 38.5 g respectively).

[b] The author has seen broods hit by large waves, and chicks washed seaward before they were able to escape. An additional observation of chicks disappearing by the water's edge has been made at Mornington Peninsula National Park (M. Bell pers. comm.).

Chick mortality is greatest in the youngest chicks (Dowling & Weston 1999, Weston 2000a, B. Baird in litt.). On Phillip Island about 80% of chicks are lost in the first ten days (B. Baird in litt.). This finding offers little in the way of determining the causes of chick mortality, because the youngest chicks are less energetically and thermally capable, and their anti-predator capabilities are relatively poorly developed (see discussion in Weston 2000a).

Fewer fledging rates are available compared with the hatching rates. An additional problem is that fledging rates are expressed differently by different researchers and this hampers comparisons. The available fledging rates are presented in Table 15.4.

Table 15.4. The available information on fledging success and overall reproductive success.

State	Location	n (chicks)	Percentage Fledging	No. fledged per pair per season	Source
Vic.	Phillip Island (2000/2001)	14	71.4		B. Baird in litt.
Vic.	Mornington Peninsula NP	128	27.3		Dowling & Weston 1999
Vic.	Central Victoria excluding Mornington Peninsula NP	56	19.6	0.2	Weston 2000a
Vic.	Western Victoria		8.3[a]	0.0 – 0.4	Weston & Morrow 2000
SA	Coorong			0.2	Buick & Paton 1989
SA	Kangaroo Is			1.0	Buick & Paton 1989
Tas.	South Eastern Tasmania; Disturbed	7	42.9	0.3	Hanisch 1998[a]
Tas.	South Eastern Tasmania; Undisturbed	8	75.0	0.9	Hanisch 1998[a]

[a] These figures had to be estimated based on other statistics cited.

The suite of managements employed at Mornington Peninsula National Park increased chick survival (Dowling & Weston 1999) implying that predation or human visitation plays a significant role in chick mortality.

Disturbance has been suggested to cause mortality in chicks (Schulz & Bamford 1987) although the mechanisms involved are unknown. The only available information on disturbance to broods is found in Weston (2000a), who showed disturbance disrupted brooding and so thermal stress could kill chicks. Failure of adults to defend eggs or chicks due to disturbance did not lead to brood failure. For broods, foraging time decreased and the level of the habitat used for foraging changed with increasing levels of disturbance. Energetic stress is therefore another potential mechanism whereby disturbance could decrease chick survival (Weston 2000a). Young chicks have remained unbrooded for periods up to 250 minutes due to disturbance (Weston 2000a).

Measures of fledging rates per pair provide information on overall reproductive success, of which brood survival is only one component. These measures can be made by using non-breeding season counts, and determining the proportion of juveniles. In eastern Victoria in autumn 1993, 9.7% of all birds located were juveniles (n=340 Hooded Plovers, Heislers & Weston 1993). This count was about a little later than the perfect late March/early April window (see Chapter 6). In western Victoria, a May 1998 count revealed that 15.8% of the

235 Hooded Plovers counted were juveniles (Ressom 1998). If the flock counts of Cooper (1997) that occurred before the end of April are considered, then the proportion of juveniles in North East Tasmania varied between years from 2.3% to 18.2% (*n* varied from 32 to 57).

Defensive strategies

Chicks respond to disturbance and threats by crouching and freezing. Chicks are camouflaged and difficult to detect when crouching, and young chicks often remained "frozen" while being handled. Chicks often hide next to seaweed and in footprints, and occasionally under boulders and bushes and in crevices in rocks (Weston 2000a). Chicks often run before hiding, and most hiding occurs in the foredunes and dunes (Weston 2000a). Chicks will also swim to avoid capture (MAW per. obs.).

When disturbed or threatened, brood-rearing adults usually moved away from chicks, and either retreated and watched, or used aggressive or distraction tactics. When adults responded by moving away, there was a risk of adults losing their chicks. On some occasions, adults engage in distinct chick-searching behaviour following a disturbance (Weston 2000a). Brood-rearing adults fed little and spent a considerable amount of time being vigilant – they also had a lower average body mass than at any other time during their life cycle (Weston 2000a).

Brood-rearing adults are extremely aggressive to intruding Hooded Plovers, very occasionally this aggression escalates to violent attacks (e.g., at Wilsons Promontory, Weston 1998c).

Management overview

The managements that can be used for brood-rearing Hooded Plovers are described in Chapter 11. The currently available research on managing brood-rearing Hooded Plovers is summarised in Chapter 12. Most management techniques that have been tested are those that benefit nest rather than chick outcome. This is probably because of two reasons. Firstly, nest fate is much easier to determine compared with chick fate, and this facilitates the development and testing of management techniques. Secondly, broods are mobile making it more difficult to direct managements that are highly localised (e.g., fences etc.).

The information regarding successful management of brood-rearing Hooded Plovers is correlational i.e. increases in fledging rates associated with improved managements. Such correlations have been uncovered at Mornington Peninsula National Park and recently at Phillip Island with increasing efforts to control dogs, cats and foxes (B. Baird in litt.).

BREEDING HABITAT

Habitat preference

In eastern Australia, Hooded Plovers almost exclusively nest on or adjacent to ocean beaches, with very occasional nests up creek mouths (e.g., at Harmers Haven, MAW pers. obs.) and in near-coastal lakes (e.g., Lake Victoria, Point Lonsdale, J.M. Pratt pers. comm.). Thus, most Hooded Plover nests are on the beach, in the foredunes or in the dunes (Weston 2000a). Only in Western Australia do they commonly nest in inland areas (Marchant & Higgins 1993, Newbey 1996, Singor 1999). Once chicks hatch, they move to the beach where they do most of their feeding, however they still use the dunes and foredunes where they hide and are brooded (Dowling & Weston 1999, Weston 2000a).

Anecdotal accounts of habitat preference suggest that wide, gently sloping beaches with beachcast seaweed, backed by sparsely vegetated dunes are the preferred habitat (e.g., Lane 1987). The only systematic studies of Hooded Plover habitat are from Tasmania: Hanisch (1997), Berry (in prep.) and Bear (2000).

Hanisch (1997) investigated nest habitat, and found that Hooded Plovers preferred to nest in heterogeneous microhabitats, and that they preferred to nest on beaches that were wide. Importantly, the study areas of Hanisch (1997) was dominated by Marram Grass, and so it seems likely that he measured the habitat preference in already modified environments. Hanisch (1997) also reported high rates of beach nesting and nest flooding.

Berry (in prep.) has a chapter on nest site preference in North East Tasmania, in an area where Marram Grass was present. Substrate was the dominant factor in nest site selection, with birds preferring to nest in the wrack. No nest site characteristic was found to influence outcome of nest, but higher sample sizes are required in order to confirm this contention (Berry in prep.).

Bear (2000) examined Hooded Plover densities, and the density of their nests, in relation to physical and biological characteristics of the habitat in South Eastern Tasmania. Although beaches could be divided into distinctly different types based on their physical and biological characteristics, the densities of birds and nests did not vary between the beach types. Importantly, densities did not vary between beaches with native vegetation on the dunes versus those with Marram Grass (Bear 2000).

Apart from the specific microhabitat preferences, there is a growing body of information on nest site habitat. Table 15.5 shows the nesting habitat in different areas. This information highlights the important role of dunes and foredunes as nest habitat; the importance of these habitats for nesting was formerly under-appreciated.

Table 15.5. The nest habitats of Hooded Plovers. N/A indicates categories not used by particular authors.

State	Location	*n* (nests)	Percentage on beach	Percentage in foredune	Percentage in dunes	Source
Vic.	Mornington Peninsula NP	171	25.0	16.0	32.8	Dowling & Weston 1999[a]
Vic.	Central Victoria excluding Mornington Peninsula NP	146	27.4	30.8	41.8	Weston 2000a
Vic.	Western Victoria	22	68.2	27.3	4.5	Weston & Morrow 2000
Vic.	Wilsons Promontory NP	11	9.1	0.0	90.9	MAW unpubl. data
Vic.	Waratah Bay	5	60.0	40.0	0.0	MAW unpubl. data
Tas.	Mt William NP	51	66.7	21.6	11.8	Berry in prep.
Tas.	South East	25	96.0	N/A	4.0	Hanisch 1998

[a] additionally, 20.5% were cliff top nests and 7.0% of nests were in unknown habitats.

Steve Gilbert (in V. Natt in litt.) suggests Coorong nests occur from 1.5 to 10 metres from the foredune with an average of about 3.5 metres. He suggests approximately 5% of nests occur lower than this (see also Buick & Paton 1989). On Kangaroo Island, one nest was located 3 km from the coast in a land-locked dune system (T. Dennis pers. comm.). In Victoria, blowout nests occur up to about 1 km from the beach (MAW pers. obs.).

Threatening processes

The two main processes affecting Hooded Plover habitat are 1) dune morphology and vegetation, and 2) rising sea levels. Recreational pressure tends to be concentrated on the beach (Weston 2000a), and so may also alter habitat use. Habitat processes could work in two broad ways: by exclusion from habitats or by displacement within habitats.

There is little data on whether Hooded Plovers leave habitat as it is modified by processes such as invasion of Marram Grass. Certainly, Hooded Plovers do occur in areas where Marram Grass is common e.g., in western Victoria. Different habitat types did not appear to affect the densities of birds or nests in Tasmania (Bear 2000).

Habitat processes could displace breeding attempts within the habitat. For example, overgrown dunes may cause the birds to nest on the beach, and rising sea-levels may cause

the birds to nest in the dunes. A diagrammatic representation of the processes affecting habitat and habitat use is shown in Figure 15.2. Although habitats did not appear to affect the densities of birds or nests in Tasmania, it could affect breeding success (Bear 2000). The study areas of Hanisch (1997) were dominated by Marram Grass, and he also reported high rates of beach nesting and nest flooding. Bear (2000) recommends that studies into the effect of Marram Grass on breeding success be conducted.

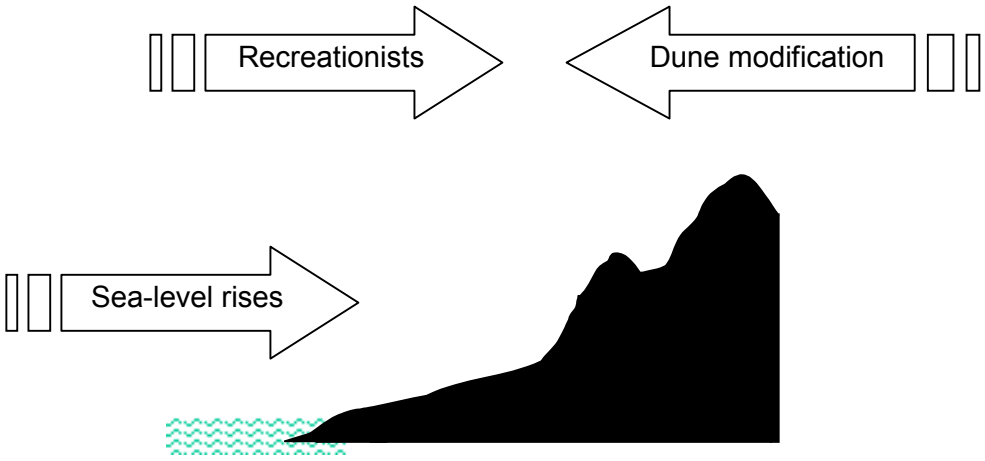


Figure 15.2. Diagrammatic representation of the "habitat squeeze" on Hooded Plover nest sites. Arrows show the suspected influence of different processes on nest site selection.

Management overview

The managements that can be used for Hooded Plover habitats are described in Chapter 11. All these managements are passive (i.e. they involve not doing certain things), except for the removal of invasive dune stabilising plants. There is no information available on the rehabilitation of dunes that have been colonised by dune stabilising plants. However, a dune fire at Mornington Peninsula National Park effectively removed the Marram Grass that was replaced by native species (J. Burke pers. comm.).

There is no information on how rates of plant colonisation can be reduced or controlled, although it has been suggested that fire and grazing regimes may influence colonisation in some areas (see Bennett 1994).

CONCLUSIONS

- A critical review of the available information suggests that:

  1. Hooded Plover populations are declining because of low breeding success, and;

  2. Habitat is likely to limit the amount of breeding.

- This chapter summarises the available information on:

    1. The nesting (egg) phase,
    2. The brood-rearing (chick) phase, and;
    3. Breeding habitat.

Chapter 16 – Identification of information gaps and research needs for the management of Hooded Plovers.

SUMMARY

This chapter presents the information gaps specific to the aspects of the life cycle already identified as being of paramount importance from a conservation and management viewpoint. Research needs addressing the information gaps are identified and prioritised.

The review of available information presented in the previous chapter allows information gaps to be identified. This in turn allows the identification of research needs.

DEFINITIONS

For the purposes of this report, 'information gaps' is defined as those areas where there is inadequate information to either: 1) understand the operation or impact of threatening processes affecting the species, or; 2) to manage the species. In other words, the knowledge gaps to be identified are those relevant to conservation and management rather than those of strictly academic interest. Similarly, the 'research needs' identified by this report are intended to address the knowledge gaps as defined above, and they are not intended to constitute a complete list of possible research projects.

Many biological studies have peripheral benefits that can aid conservation or management. Given current funding priorities, there is a growing temptation for academic studies to be presented as conservation biology, despite the fact that the benefit in terms of conservation or management may be marginal (see Sutherland 1998c). If these studies engage in potentially risky methods, such as banding or disturbing the birds, then they cannot be reasonably justified in terms of conservation or management. Thus, this report will identify only those research needs with tangible and significant benefits in terms of managing or conserving the Hooded Plover in Victoria.

INFORMATION GAPS

Nesting (egg) phase

- Considerable amounts of nest mortality occur from unknown causes.
- Regional variation in causes of nest mortality are apparent, and the extent and nature of this variation across Victoria is yet to be determined. In many areas (e.g., far East

Gippsland outside Little Tern colonies) there are no data on nest success or nest fates (P. Kambouris and A. Murray pers. comms).

Brood-rearing phase

- The causes of chick mortality are virtually unknown, despite the fact that mortality of chicks is high (Weston 2000a).
- The factors which may mediate survival rates of chicks are unknown.

Breeding habitat

- The habitat requirements and preferences of Hooded Plovers on the mainland need to be identified (also recommended by Bear 2000). This would allow predictive models to be derived to assess the impact of new developments or management regimes (Bear 2000).

Management

- The effectiveness of public awareness and educational management in changing recreational behaviour is unknown. For instance, how many people read signs and then how many modify their behaviour?
- The effectiveness of many management techniques when used in isolation is unknown (see Table 12.1).
- Methods for the maintenance and rehabilitation of breeding habitat are unknown and untested. The effectiveness of current methods is limited (Chapter 13).
- The methods for the control of native predators and scavengers (e.g., ravens) are not known. The effectiveness of current methods is limited (Chapter 13).

RESEARCH NEEDS

This section presents research needs that address the information gaps identified. The research needs presented take full account of research currently being conducted and unpublished research (e.g., the large colour-banding database and the forthcoming analysis of the interdependence of sites). In other words, the research needs identified are not currently being addressed.

Nesting (egg) phase

- Apply new technologies (e.g., remote infra-red cameras) to ensure that there are not other nest fates that have been undetected so far. In particular, these technologies should focus on nocturnal nest fates.
- Determine hatching success and nest fate in areas where no data are available i.e., eastern Victoria, east of the Gippsland Lakes. Such data need to be comparable with those data already collected elsewhere in Victoria. Specifically, hatching success should be expressed as a percentage of clutches (or better, the Daily Survival Rate of clutches, see Bart & Robinson 1982).

Brood-rearing phase

- Determine the causes of chick mortality. This is very difficult because broods are uncommon and so difficult to locate, and because methods for determining chick mortality are primitive and intrusive (radio-tracking chicks is a method being used in New Zealand on Double-banded Dotterel chicks).
- Assess whether chicks will use artificial chick shelters, and determine the ideal spatial pattern for the arrangement of chick shelters. This management technique is singled out because it has the possibility of reducing the deleterious effects of predation, crushing and disturbance.

Breeding Habitat

- Determine the breeding habitat preference of Hooded Plovers in Victoria. In addition to physical attributes of the habitat, disturbance can also be treated as a habitat variable.
- Assess the habitat factors influencing territory stability. Such a study would require historical data on territory occupancy, which is available for central Victoria.
- Compare breeding success in pristine habitat compared with highly modified habitat.
- Model the decline of habitat to estimate rates of decline and areas most at risk from deleterious habitat processes.
- Investigate methods of rehabilitating dunes colonised by invasive dune stabilising plants.
- Determine how rates of colonisation by invasive plants can be reduced or controlled (e.g., fire regimes).

Management

In theory, any management technique where the effectiveness has not been tested (see Table 12.1) is a potential research need. However, priority areas can be identified. The following research needs address threats which affect both egg and chick phases of the breeding cycle. Additionally, these research needs address significant and widespread threats, with an emphasis on 1) promoting coexistence with plovers and 2) long-term (sustainable) solutions:

- Determine the most effective methods of changing the behaviour of recreationists, both in the short and long term. Such a study should identify the most effective methods of inducing behavioural change. The study could be based on entry and exit surveys of beach-goers, combined with behavioural observations.
- Investigate ways of improving compliance with dog laws. This research would have two components:

1. Measure attitudes of dog walkers to their activity, their attitudes to different management options, and identify barriers to compliance. Two studies which measure attitudes in relation to environmental issues are Burger (1998) and Burger *et al*. (1998). Attitudes are not always manifested in consistent behaviour, thus;
2. Assess compliance under different management options e.g., zoning, restricting public access, signage, enforcement, wardening etc.

- Assess the effectiveness of fox, dog and cat control on Hooded Plover reproductive success (see, for example, Weston & Morrow 2000). In particular, determine the most effective methods and protocols of predator control.
- Develop and test practical methods of raven control on beaches. Such research should draw heavily on research on Corvid control at airports.

Table 16.1. Research priorities for Hooded Plovers in Victoria. H=high priority, M=medium priority, L=low priority.

Category	Project	Priority
Nesting (egg) phase	Nest fate – new technologies	M
Nesting (egg) phase	Hatching success - new areas	L
Brood-rearing phase	Chick fate	H
Brood-rearing phase	Chick shelters	H
Breeding Habitat	Preference	L
Breeding Habitat	Territory stability	H
Breeding Habitat	Breeding success	M

Category	Project	Priority
Breeding Habitat	Model decline	L
Breeding Habitat	Dune rehabilitation	H
Breeding Habitat	Limit colonisation	M
Management	Changing human behaviour	M
Management	Compliance with dog laws	H
Management	Effectiveness of predator control	H
Management	Raven control	L

Research priorities

All of the research options listed above are considered useful for Hooded Plover management and conservation, and are not currently being conducted by any researchers. Nevertheless, some options are considered more important than others. Table 16.1 prioritises the research options.

CONCLUSION

- Fourteen research needs are identified to address the critical information gaps. These research needs are prioritised, and five are deemed to be most important. Of these, only two focus specifically on unknowns about the species (chick fate and factors influencing territory stability), the remainder examine the effectiveness of management techniques.

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References

American Ornithologists Union (AOU). (1992) *The Birds of North America. Volume 2.* Smith, Edwards & Dunlop, Philadelpia, USA.

Anon. (1992) Move to protect vulnerable species. *Coorong Tattler* **1992**: 1.

Anon. (1994) Where can we camp? *Tattler (SA)***1994**: 3.

Anon. (1997) Abstracts of the Parks Victoria Hooded Plover Seminar Series. *Stilt* **31**: 54-5.

Anon. (1999a) Leave plover nests alone: rangers. *The Mail*, **14(46)**: 1.

Anon. (1999b) Proceedings of the Australasian Wader Studies Group, Phillip Island, Victoria. AWSG, Melbourne.

Anon. (2000a) Walpole-Albany. Hooded Plover talk to be held at Walpole Recreation Centre. *WA Bird Notes* **95**: 12.

Anon. (2000b) *Hoodies diary - boy or girl?* South Gippsland Sentinel Times, December 19.

Anon. (2001a) Hooded Plover Survey. Eurobodalla Natural History Society Newsletter. **85**: 3.

Anon. 2001b. Hooded Plovers: they made it! *South Gippsland Sentinel Times*, **January 31**: 15.

Anon. undated. Four-wheel driving. *Tattler (SA)* **8**: 2.

Atkin, B. (1998) Fox baiting program – Nooramunga Marine and Coastal Park, South Gippsland, Victoria March 1997-March 1998. *Victorian Wader Study Group Bulletin*. **22**: 44-51.

Baird, B. & P. Collins. 1996. The Hooded Plover on Phillip Island. *Victorian Wader Study Group Bulletin.* **20**: 44-8.

Baird, B. & P. Dann. (1999). Breeding Biology of Hooded Plovers on Phillip Island and methods of increasing breeding success. In: Anon. (1999b) *Proceedings of the Australasian Wader Studies Group, Phillip Island, Victoria*. AWSG, Melbourne.

Baker-Gabb, D. & M.A. Weston. (2001) *Draft New South Wales Hooded Plover Recovery Plan.* NPWS, Sydney.

Bart, J. & D.S. Robinson. (1982) Estimating survivorship when the subjects are visited periodically. *Ecology* **63**: 1078-90.

Bear, E. (2000) *Habitat requirements of the Hooded Plover* Thinornis rubricollis. Unpubl. BSc. Hons. thesis, Univ. Tas.

Belcher, C.F. (1900). The birds of the district of Geelong, Australia. W.J. Griffiths, Geelong.

Bennett, L.T. (1983) The decline of Banksia integrafolia on the Yanakie Isthmus, Wilsons Promontory National Park, under changes in burning and grazing regimes. PhD thesis, University of Melbourne.

Bennett, L.T. (1994) The expansion of *Leptospermum laevigatum* on the Yanakie Isthmus, Wilsons Promontory, under changes in the burning and grazing regimes. *Australian Journal of Botany.* **42**: 555-64.

Bennett, S. R. Brereton, I. Mansergh, S. Berwick, K. Sandiford & C. Wellington. (1991) *The potential effect of enhanced greenhouse climate change on selected Victorian fauna*. ARI Technical Report 123.

Berry, L. In prep. Nest predation in Australian woodland and shoreline-nesting birds. Unpubl. PhD thesis, Monash Univ.

Birrell, M. (1994) Discussion paper on creating a coastal and bay management council. Government Printer, Melbourne.

Blakers, M. S.J.J.F. Davies, & P.N. Reilly. (1984) *The atlas of Australian birds*. University of Melbourne Press, Melbourne.

Bransbury, J. (1983) *A study of the Hooded Plover in the South-East of South Australia.* Report to Department of Environmental Protection, Adelaide, SA.

Brown, M. (1998) Hooded Plover Network. *Friends of the Hooded Plover Newsletter* **1**.

Buick, A.M. & D.C. Paton. (1989) Impact of off-road vehicles on the nesting success of Hooded Plovers *Charadrius rubricollis* in the Coorong Region of South Australia. *Emu* **89**: 159-72.

Burger, J. (1998) Attitudes about recreation, environmental problems, and estuarine health along the New Jersey shore, USA. *Environmental Management* **22**: 869-76.

Burger, J.J. Sanchez, J.W. Gibbons and M. Gochfeld. (1998) Gender differences in recreational use, environmental attitudes, and perceptions of future land use at the Savannah River site. *Environment and Behaviour* **30**: 472-86.

Cameron, D. & M.A. Weston. (1999) The Hooded Plover: first confirmed record in Queensland, the longest movement yet recorded, and a discussion of range contraction in eastern Australia. *Australian Bird Watcher* **18**: 8-18.

Christidis, L. & W.E. Boles. (1994) The taxonomy and species of birds of Australia and its territories. *RAOU Monograph* **2**.

Cooper, R. (1997) Hooded Plover *Thinornis rubricollis*: winter flocks and breeding success in North-East Tasmania, Australia. *Stilt* **30**: 23-5.

Cross, R.R. (1992) Research proposal: Conditioned taste aversion: a field test on Piping Plover egg predators. Virginia Dept. of Game and Inland Fisheries, Richmond, Virginia.

Dann, P. and Baird, B. (1997) An experiment: a study of egg loss in Hooded Plovers on Phillip Island. *Stilt* **31**: 54.

Department of Natural Resources and Environment (DNRE). (1996) *Otway National Park Management Plan.* National Parks Service, DNRE, Melbourne.

Dolbeer, R.A. J.L. Belant, & J.L. Sillings. (1993) Shooting gulls reduces strikes with aircraft at John F. Kennedy International Airport. *Wildlife Society Bulletin* **21**: 442-50.

Dowling, B. & M.A. Weston. (1999) Managing a breeding population of the Hooded Plover *Thinornis rubricollis* in a high-use recreational environment. *Bird Conservation International* **9**: 255-70.

Dowling, B. (1997) Sharing the beach, how fair is it? Monitoring and management of the Hooded Plover within Mornington Peninsula National Park. *Stilt* **31**: 54 and *Victorian Wader Study Group Bulletin* **21**: 46-7.

Dowling, B. (1999) Managing a breeding population of the Hooded Plover *Thinornis rubricollis* in a high-use recreational National Park. *Stilt* **35**: 61.

Environment Protection and Biodiversity Act. (2000) *EPBC Act: Administrative guidelines on significance July 2000*. Environment Australia, Canberra.

Garnett, S.T. & G. Crowley. (2000). *The action plan for Australian birds.* Environment Australia, Canberra.

Garnett, S.T. (1993) Threatened and extinct birds of Australia. RAOU Report 82.

Gould, J. (1865) Handbook to the Birds of Australia. Volume 2. The author, London.

Haig, S.M. (1992) Piping Plover. Pp: 1-18. In: *American Ornithologists Union 1992.*

Hanisch, D. (1998) Effects of human disturbance on the reproductive performance of the Hooded Plover. Unpubl. BSc. Hons. thesis, Univ. Tas.

Harvey, J. (1989) Hooded Plover. *Coorong Tattler* **1**: 3.

Hayman, P. J. Marchant & T. Prater. (1986) *Shorebirds: An identification guide to the waders of the world.* Christopher Helm, London.

Heislers, D. & M.A. Weston. (1993) An examination of the efficacy of counting Hooded Plovers in autumn in eastern Victoria. *Stilt* **23**: 20-22.

Hockley, C. (2000) Sanctuary for a bird at risk. *Advertiser* **December**: 39.

Holdsworth, M.C. & S.L. Bryant. (1995) Rescue and rehabilitation of wildlife from the Iron Baron oil spill in Northern Tasmania. *Tasmanian Naturalist* **117**: 39-43.

James, J. (1992) Hooded Plover. *Bird Observer* **719**: 7.

Jessop, R. & P. Collins. (1999) Abstracts of the Australasian Wader Studies Group Conference Phillip Island, Victoria, 12 to 13th June 1999. *Stilt* **35**: 59-70.

Jones, B. (2000). Hooded Plovers and "adopt a beach". *Far South Coast Birdwatchers Newsletter* **5**: 2.

Judd, T.S. (1990) *The ecology and water relations of the invasive shrubs* Kunzea ambigua*,* Kunzea ericoides *and* Leptospermum laevigatum. PhD thesis, University of Melbourne.

Kesby, N. & G. Druett. (1997) *Beach management plan for Venus Bay* Beach No. 1. Report to DNRE and Venus Bay Foreshore Committee.

Lane, B. (1981) The Hooded Plover survey – October 1980. *Victorian Wader Study Group Bulletin*. **3**: 6-8.

Lane, B.A. (1987) *Shorebirds in Australia*. Nelson, Melbourne.

Lane, B.A. G.W. Carr, M.R. Bezuijen & M.R.G. McMahon. (1997) *The Flora and Fauna Potential Impacts of the Proposed ATM Ltd Mine Lease Area, King Island, Tasmania*. Ecology Australia. Report to Austalian Titanium Minerals Ltd.

Learmonth, N. (1954) Nature Notes. *Portland Guardian* **March 1954**.

Little Tern Taskforce. (1997) *Report on the Little Tern (Sterna albifrons) breeding season 1996/7 East Gippsland*. Department of Natural Resources and Environment, Yarram.

Loegering, J.P. & J.D. Fraser. (1995) Factors affecting Piping Plover chick survival in different brood-rearing habitats. *Journal of Wildlife. Management*. **59**: 646-55.

Mabee, T.J. & V.B. Estelle. (2000) Assessing the effectiveness of predator exclosures for plovers. *Wilson Bulletin*. **112**: 14-20.

MacIvor, L.H. (1991) Research proposal: Conditioned taste aversion: a technique to reduce red fox predation at Piping Plover nests on Assateague Island National Seashore. Maryland Dept. Natural Resources, Annapolis, Maryland.

Mansergh, I. & C. Marks. (1993) *Predation of native wildlife by the introduced Red Fox Vulpes vulpes.* Flora and Fauna Guarantee Action Statement No. 44. Department of Natural Resources and Environment, East Melbourne.

Marchant, S. & P. Higgins. (1990) The handbook of Australian, New Zealand and Antarctic birds. Volume 1. Part B. RAOU and OUP, Melbourne.

Marchant, S. & P. Higgins. (1993) The handbook of Australian, New Zealand and Antarctic birds. Volume 2. RAOU and OUP, Melbourne.

Martin, N. (1999) *Draft Moyne Shire coastal action plan.* Moyne Shire, Port Fairy.

Mathews, G.M. (1913-14). *Birds of Australia*. Witherby, London.

Maud, N. (1994) Volunteers vigil to save an egg. *South Gippsland Sentinel Times*, **January** 20.

McAllan, I.A.W. In press. Care with historical records: the case of northern reports of the Hooded Plover. *Australian Bird Watcher*

Meek, P.D. & G. Saunders. (2000) Home range and movement of foxes (*Vulpes vulpes*) in coastal New South Wales, Australia. *Wildlife Reserch.* **27**: 663-8.

Melvin, S.M. A. Hetch & C.R. Griffith. (1994) Piping Plover mortalities caused by off-road vehicles on Atlantic coast beaches. *Wildlife Society Bulletin* **19**: 22: 209-14.

Melvin, S.M. C.R. Griffin, & L.H. MacIvor. (1991) Recovery strategies for Piping Plovers in Managed Coastal Landscapes. *Coastal Management* **19**: 21-34.

Murray, A.J. & J. Reside. (1995) *Management of the Little Tern in Victoria 1994/95*. Department of Conservation and Natural Resources, Melbourne.

Natural Resources and Environment (NRE). (1996). *The Lakes National Park and Gippsland Lakes Coastal Park. Draft Management Plan*. Department of Natural Resources and Environment, Melbourne.

Natural Resources and Environment (NRE). (1996b). *Corner Inlet and Nooramunga Marine and Coastal Parks. Draft Management Plan.* Department of Natural Resources and Environment, Melbourne.

Newbey, B.J. (1996) Report on Hooded Plover project. *Supplment WA Bird Notes* **79**.

Newman, O.M.G. & R.M. Patterson. (1984). A population survey of the Hooded Plover in Tasmania, October 1982. *Occasional Stint* **3**: 1-6.

North, A.J. (1913-14). *The nests and eggs of Australian birds. Volume 4.* Australian Museum, Sydney.

Park, P. (1994) Hooded Plovers and Marram Grass. *Stilt* **25**: 22.

Parks Victoria. (1997) Port Campbell National Park and Bay of Islands Coastal Park. Management Plan. Parks Victoria, Kew, Melbourne.

Parks Victoria. (1998a) *Discovery Bay Parks Draft Management Plan*. Parks Victoria, Kew, Melbourne.

Parks Victoria. (1998b) Mornington Peninsula National Park and Arthurs Seat State Park. Management Plan. Parks Victoria, Kew, Melbourne.

Parks Victoria. (1999) *Angahook-Lorne State Park. Management Plan.* Parks Victoria, Kew, Melbourne.

Piersma, T. Wiersma, P. & J. Van Gils. (1997) The many unknowns about plovers and sandpipers of the world: introduction to the wealth of research opportunities highly relevant to shorebird conservation. *International Wader Study Group Bulletin* **82**: 23-33.

Pringle, J.D. (1987) *The Shorebirds of Australia.* National Photographic Index of Australian Wildlife, Sydney.

Raines, J. (2001) Hooded Plover survey September 2000. *WA Bird Notes* **97**: 7-9.

Reside, J. (1998) Discussion of fencing techniques for protecting shorebirds. *Bird Observer* **783**: 11-12.

Ressom, R. (1998) Recovery roundup: Hooded Plover. *Volunteer* **6**: 4.

Ressom, R. (2001) Monitoring Hooded Plovers on the Codrington Coast, Western Victoria. Parks Victoria Report.

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

Rimmer, D.W. & R.D. Deblinger. (1990) Use of predator exclosures to protect Piping Plover nests. *Journal of Field Ornithology*. **61**: 217-23.

Rose, A. (2000) Hooded Plovers and four wheel drive vehicles. *WA Bird Notes* **94**: 16.

Ryan, M.R. B.G. Root, & P.M. Mayer. (1993) Status of Piping Plovers in the Great Plains of North-America – a demographic simulation model. *Conservation Biology* **7**: 581-5.

Schipper, C.J. & M.A. Weston. (1998) Interference by Galahs at nests of Charadriiformes. *Australian Bird Watcher* **17**: 260-62.

Schulz, M. (1992) *Hooded Plover* - Flora and Fauna Guarantee Action Statement No. 9. Department of Natural Resources and Environment, Melbourne.

Schulz, M. (1993) A survey of the Hooded Plover on the North-West Tasmanian coastline, from Macquarie Harbour to Bluff Point. *Stilt* **22**: 40-43.

Schulz, M. (1995) Observations on the Hooded Plover *Thinornis rubricollis* on Kangaroo Island, South Australia. *Stilt* **26**: 54-7.

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

Schulz, M. A. Grant & L. Lumsden. (1984) Some aspects of the feeding behaviour and diet in the Hooded Plover, *Charadrius rubricollis* (Charadriidae), during the non-breeding season. *Stilt* **5**: 2-8.

Seebeck, J. & P. Clunie. (1997). *Predation of native wildlife by the cat Felis catus.* Flora and Fauna Guarantee Action Statement No. 80. Department of Natural Resources and Environment, Melbourne

Singor, M. (1999) Hooded Plover Report No. 2: 1996-99. The search continues… *Stilt* **35**: 42.

Smith, F.T.H. (1972) Victorian wader records, 1969-71. *Bird Observer* **1972**: 4.

South Australian Government (1993) National Parks regulations 1990. *South Australian Government Gazette* **March 1993**: 889-90.

Sova, M. & M.A. Weston. (1998) The foraging ecology of the Hooded Plover in eastern and western Australia. Proc. 2nd AWSG Conference, Phillip Island, Victoria. *Stilt* **35**: 65-6.

Stove, K. & D. Paton. (1989) A place of our own. *Coorong Tattler* **1**: 1.

Sutherland, W.J. (Ed.) (1998a) *Conservation Science and Action*. Blackwell Science, Oxford, UK.

Sutherland, W.J. (1998b) Managing habitats and species. Pp: 202-19. In: Sutherland, W.J. (Ed.) (1998a) *Conservation Science and Action*. Blackwell Science, Oxford, UK.

Sutherland, W.J. (1998c) The importance of behavioural studies in conservation biology. *Animal Behaviour* **56**: 801-809.

Teoh, V. & M.A. Weston. In prep. Hooded Plover *Thinornis rubricollis* chick attacked by conspecifics.

Traill, B. & C. Porter. (2001) *Nature conservation review, Victoria 2001*. Victorian National Parks Association, Melbourne.

Urquhart, M. (2000) (Draft)[4]. Strategies for the management of the Hooded Plover in Victoria. Parks Victoria, Melbourne.

Vaske, J.J. D.W. Rimmer, & R.D. Deblinger. (1994). The impact of different predator exclosures on Piping Plover nest abandonment. *Journal of Field Ornithology* **65**: 201-209.

Victorian Coastal Council. (1997) *Victorian Coastal Strategy.* Victorian Government, Melbourne.

Watkins, D. (1993) A national plan for shorebird conservation in Australia. AWSG and RAOU, Melbourne.

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

Weston, M.A. & M. Elgar. (2000). The effect of a major rainfall effect on Hooded Plovers on a salt-lake in Western Australia. *Emu* **100**: 64-9.

Weston, M.A. & S. Paton. (2001) The 2000 Hooded Plover count for Victoria: report to participants and newsletter (1). 1:1-2.

Weston, M.A. (1993) Twelve years of counting the Hooded Plover in Victoria, Australia. *Stilt* **23**: 15-19.

Weston, M.A. (1995) Fencing as a technique for managing disturbance on beaches for the Hooded Plover *Thinornis rubricollis*. *Bird Observer* **759**: 12.

Weston, M.A. (1998a) Nankeen Kestrel takes Hooded Plover chick. *Australian Bird Watcher* **17**: 266-7.

[4] This report is presently being finalised, and will become "Urquhart, M. & V. Teoh. 2001. Strategies for the management of the Hooded Plover in Victoria. Parks Victoria, Melbourne." (V. Teoh pers. comm.).

Weston, M.A. (1998b) An observation of aggression between a Hooded Plover and a Black-fronted Dotterel. *Australian Bird Watcher* **17**: 301-302.

Weston, M.A. (1998c) Some undescribed aggressive behaviours, displays and calls of the Hooded Plover in Western Australia. *WA Naturalist*. **22**: 105-14.

Weston, M.A. (2000a) The effect of human disturbance on the breeding biology of the Hooded Plover. Unpubl. PhD thesis, Univ. Melbourne.

Weston, M.A. (2000b) Outfoxing the Hooded Plover. *Wingspan* **10**: 6-7.

Weston, M.A. In prep. An experimental assessment of the potential effectiveness of temporary beach closures in reducing disturbance of incubating Hooded Plovers by humans.

Weston, M.A. In press. The evaluation of historical reports and the precautionary principle; a reply to McAllan (2001). *Aust. Bird Watcher*

Weston, M.A. A.J. Burke, V.L. Ford, I.D. Stewart, & B. Dowling. (1998) Four-egg clutches in the Hooded Plover: description, occurrence and female investment. *Australian Bird Watcher* **17**: 383-9.

Yapp, G.A. (1986) Aspects of population, recreation, and management of the Australian coastal zone. *Coastal Zone Management Journal* **14**: 47-66.

Appendix 1

ABBREVIATIONS AND ACRONYMS

ARI	Arthur Rylah Institute (Department of Natural Resources and Environment)
AWSG	Australasian Wader Studies Group (special interest group of Birds Australia).
BA	Birds Australia
BELLBOCA	The Bellarine Peninsula group of the Bird Observers Club of Australia.
BOC	British Ornithologists Club
CP	Coastal Park
DEP	Department of Environment and Planning (SA)
EPBC	Environment Protection and Biodiversity Conservation Act.
GFNC	Geelong Field Naturalists Club
GPS	Global Positioning System
MAW	Michael A. Weston
NP	National Park
NR	Nature Reserve
RAOU	Royal Australasian Ornithologists Union (now known as Birds Australia)
SAOA	South Australian Ornithological Association
VNPA	Victorian National Parks Association Inc.
VORG	Victorian Ornithological Research Group.
VWSG	Victorian Wader Study Group Inc.

Appendix 2

OTHER RELEVANT STRATEGIES OR MANAGEMENT PLANS.

Baird, B. Undated. Some suggested management strategies for Hooded Plovers on Phillip Island. Unpubl. report to Phillip Island Nature Reserve.

Baker-Gabb, D. & M.A. Weston. (1999) *Draft New South Wales Hooded Plover Recovery Plan*. National Parks and Wildlife Service, Sydney.

Department of Natural Resources and Environment (DNRE). 1996. *Otway National Park Management Plan*. National Parks Service, Department of Natural Resources and Environment, Melbourne.

Garnett, S.T. & G. Crowley. (2000). *The action plan for Australian birds.* Environment Australia, Canberra.

Mansergh, I. & C. Marks. (1993) *Predation of native wildlife by the introduced Red Fox* Vulpes vulpes. Flora and Fauna Guarantee Action Statement No. 44. Department of Natural Resources and Environment, Melbourne.

Natural Resources and Environment. (1996a). *The Lakes National Park and Gippsland Lakes Coastal Park. Draft Management Plan*. Department of Natural Resources and Environment, Melbourne.

Natural Resources and Environment. (1996b). *Corner Inlet and Nooramunga Marine and Coastal Parks*. Draft Management Plan. Department of Natural Resources and Environment, Melbourne..

Parks Victoria. (1997a). Port Campbell National Park and Bay of Islands Coastal Park. Management Plan. Parks Victoria, Kew, Melbourne.

Parks Victoria. (1997b). *Wilson's Promontory National Park. Management Plan.* Parks Victoria, Kew, Melbourne.

Parks Victoria. (1998a). *Discovery Bay Parks Draft Management Plan.* Parks Victoria, Kew, Melbourne.

Parks Victoria. (1998b). Mornington Peninsula National park and Arthurs Seat State Park. Management Plan. Parks Victoria, Kew, Melbourne.

Parks Victoria. (1998c). The Lakes National Park and Gippsland Lakes Coastal Park. Management Plan. Parks Victoria, Kew, Melbourne.

Parks Victoria. (1999a). *Angahook-Lorne State Park. Management Plan*. Parks Victoria, Kew, Melbourne.

Schulz, M. (1992). *Hooded Plover* - Flora and Fauna Guarantee Action Statement No. 9. Department of Natural Resources and Environment, Melbourne.

Seebeck, J. & P. Clunie. (1997). Predation of native wildlife by the cat *Felis catus*. Flora and Fauna Guarantee Action Statement No. 80. Department of Natural Resources and Environment, Melbourne.

Urquhart, M. (2000) (Draft). Strategies for the management of the Hooded Plover in Victoria. Parks Victoria, Melbourne.

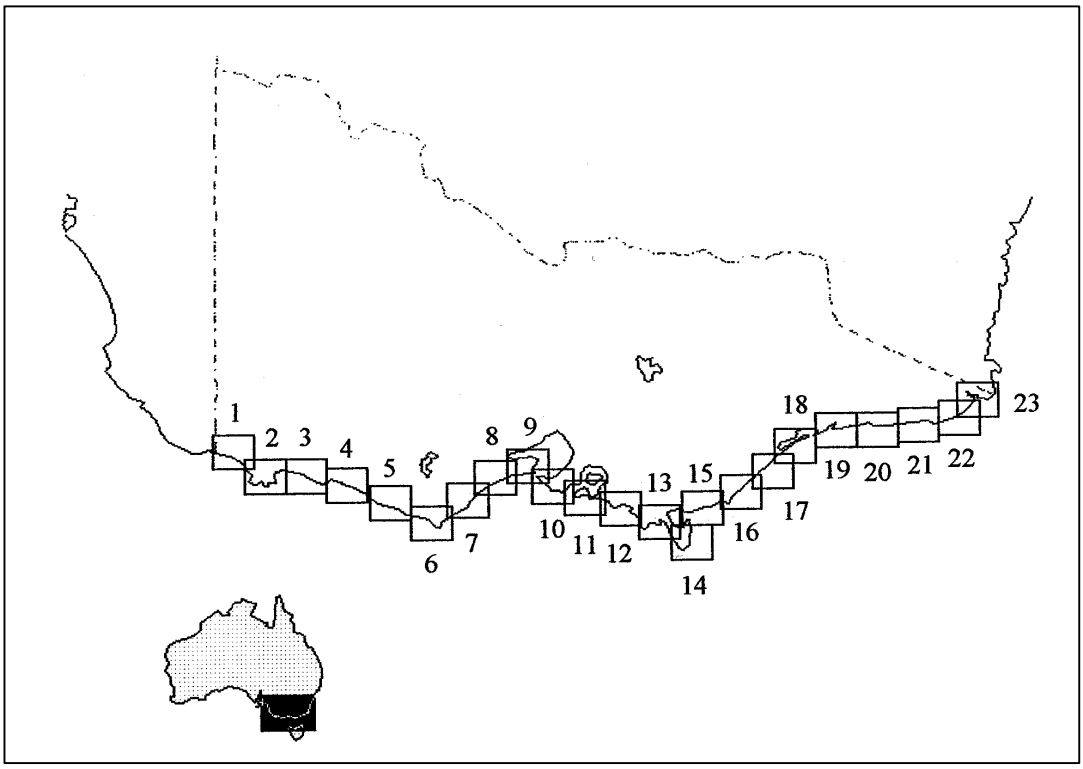
Weston, M.A. & F. Morrow. (2000). *Managing the Hooded Plover in western Victoria*. Report to Parks Victoria, Melbourne.

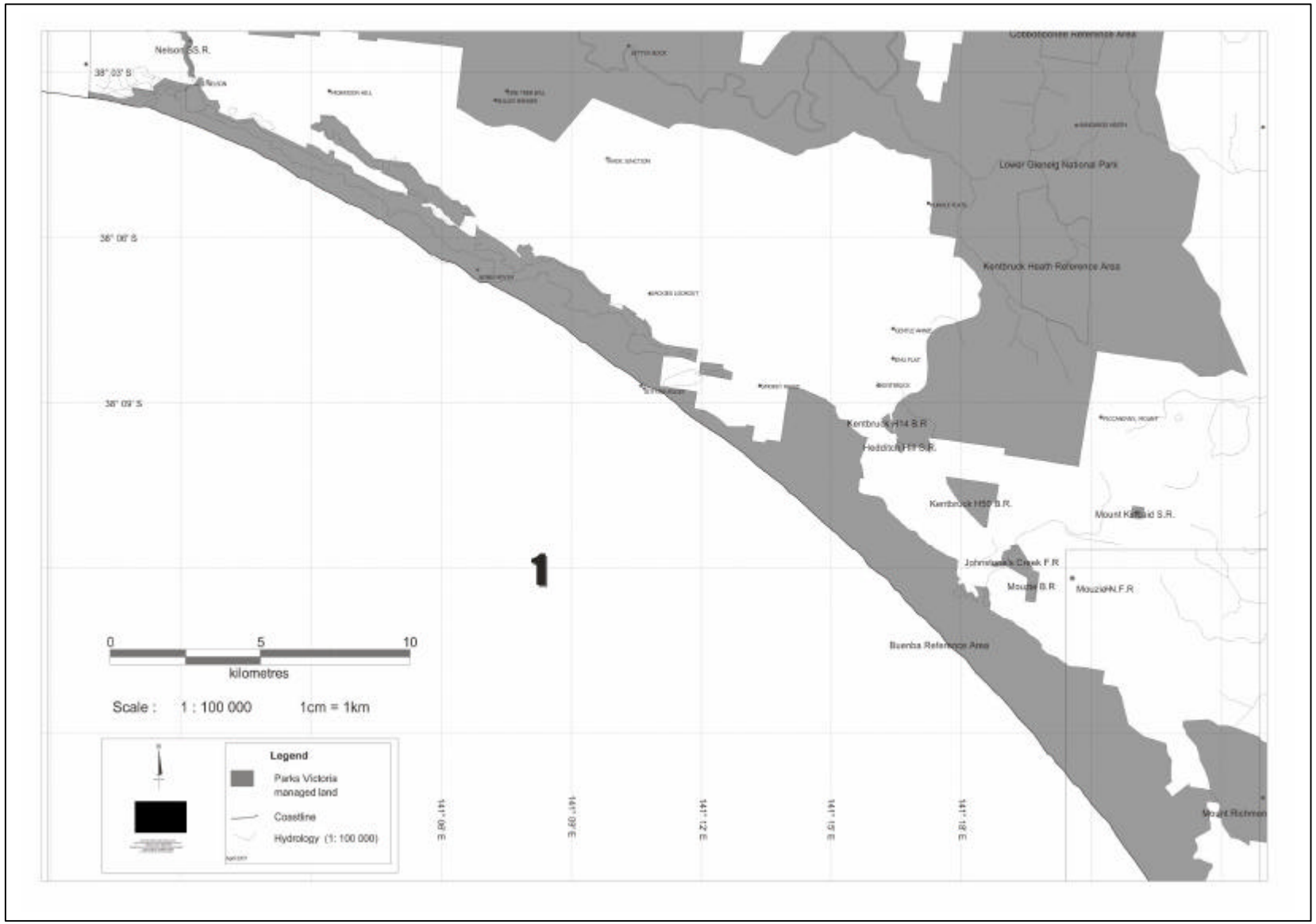
Appendix 3

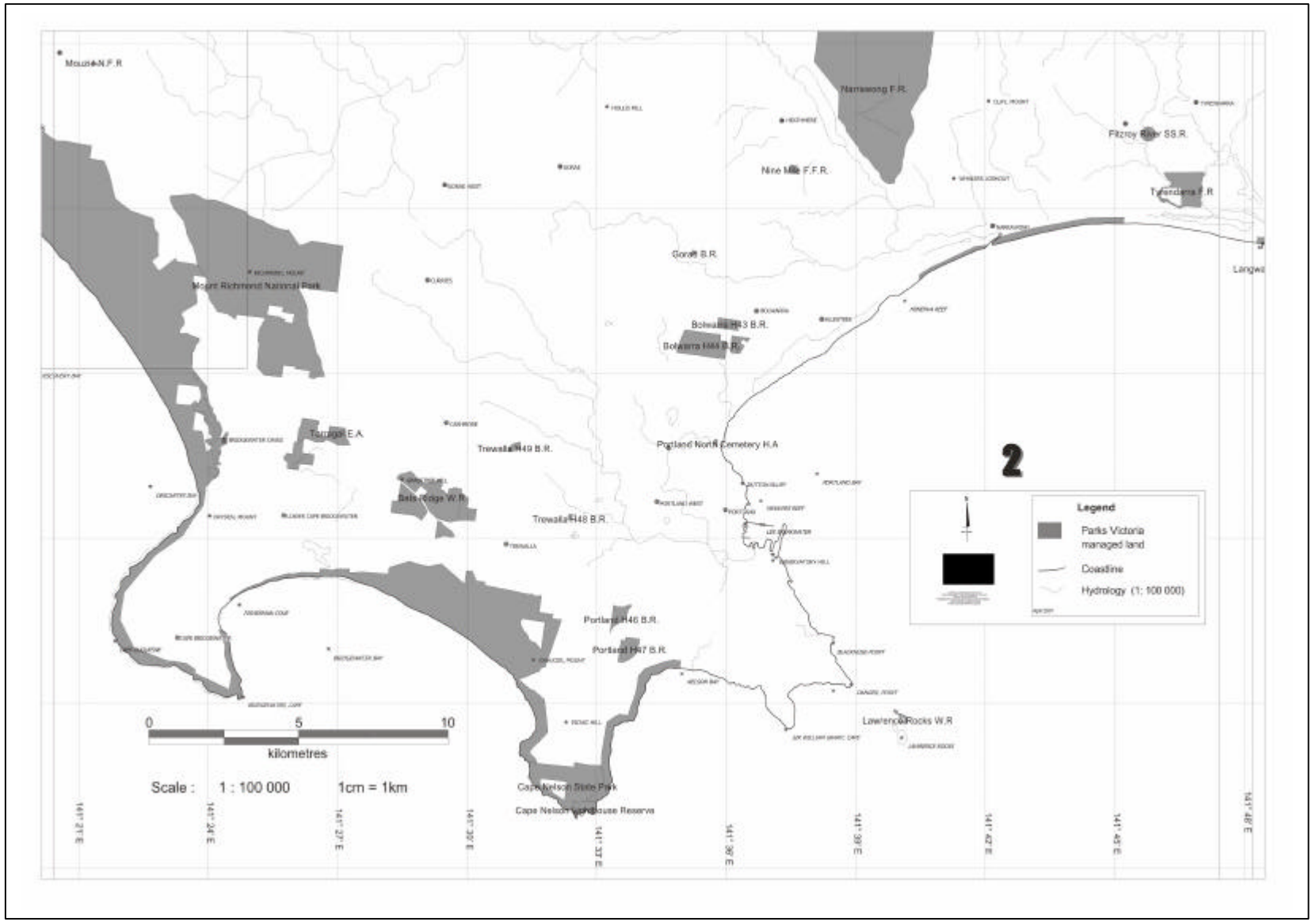
PARKS VICTORIA LAND ON THE COAST

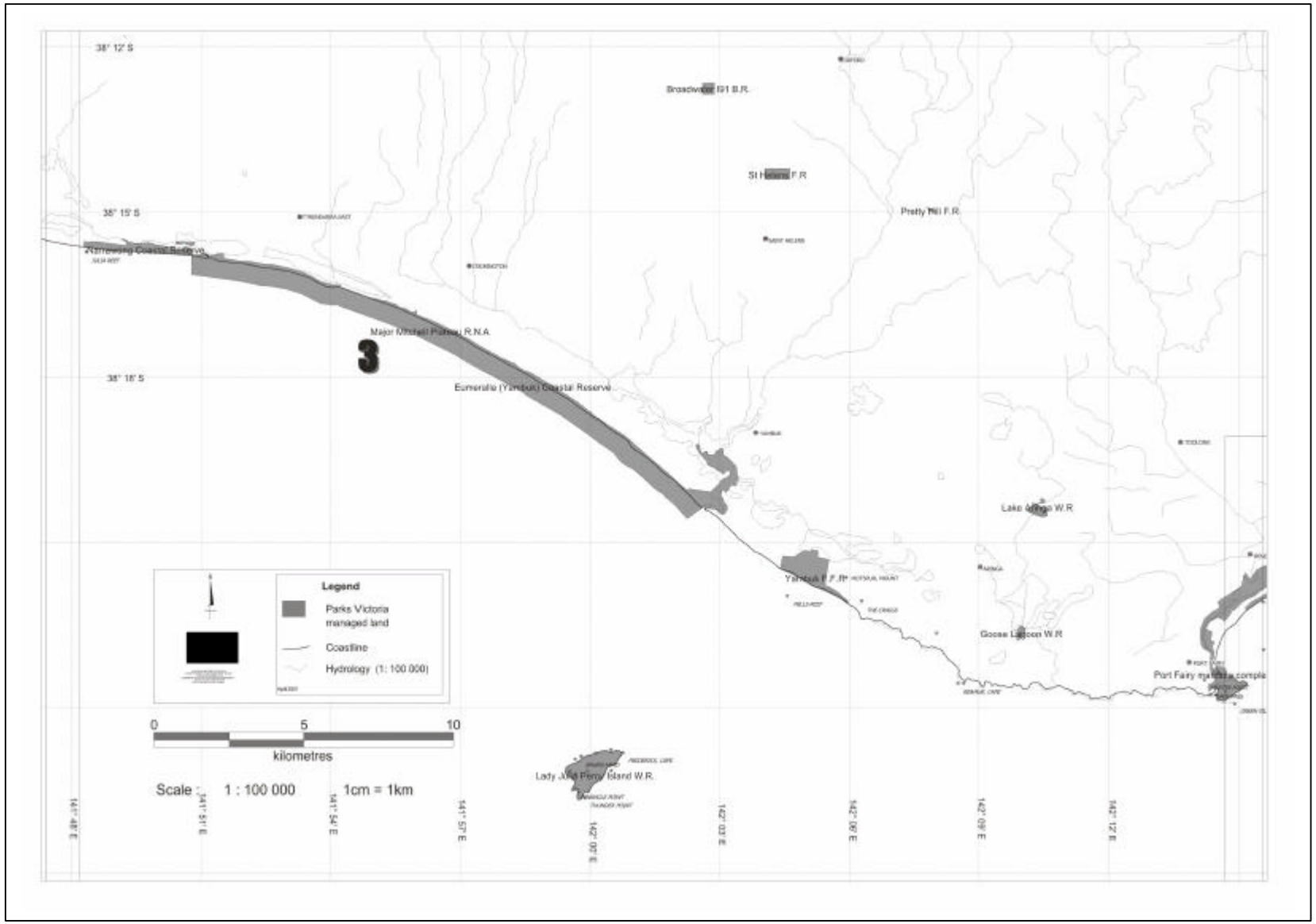
This appendix presents 23 maps of coastal Victoria. These maps indicate Parks Victoria managed land, and show major coastal features. A key to these maps is presented in Figure 3.1.

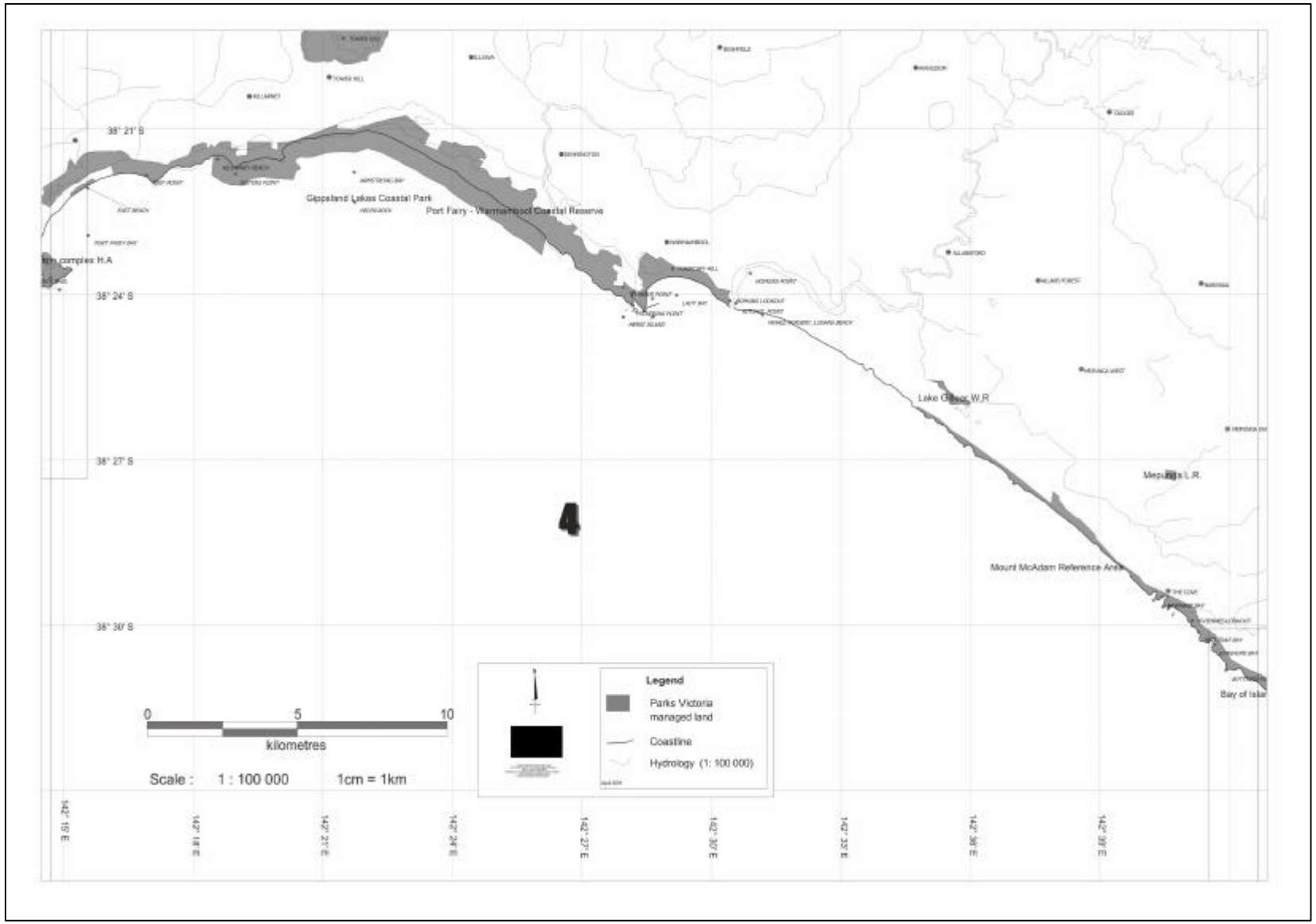
Figure 3.1. Key to the maps.

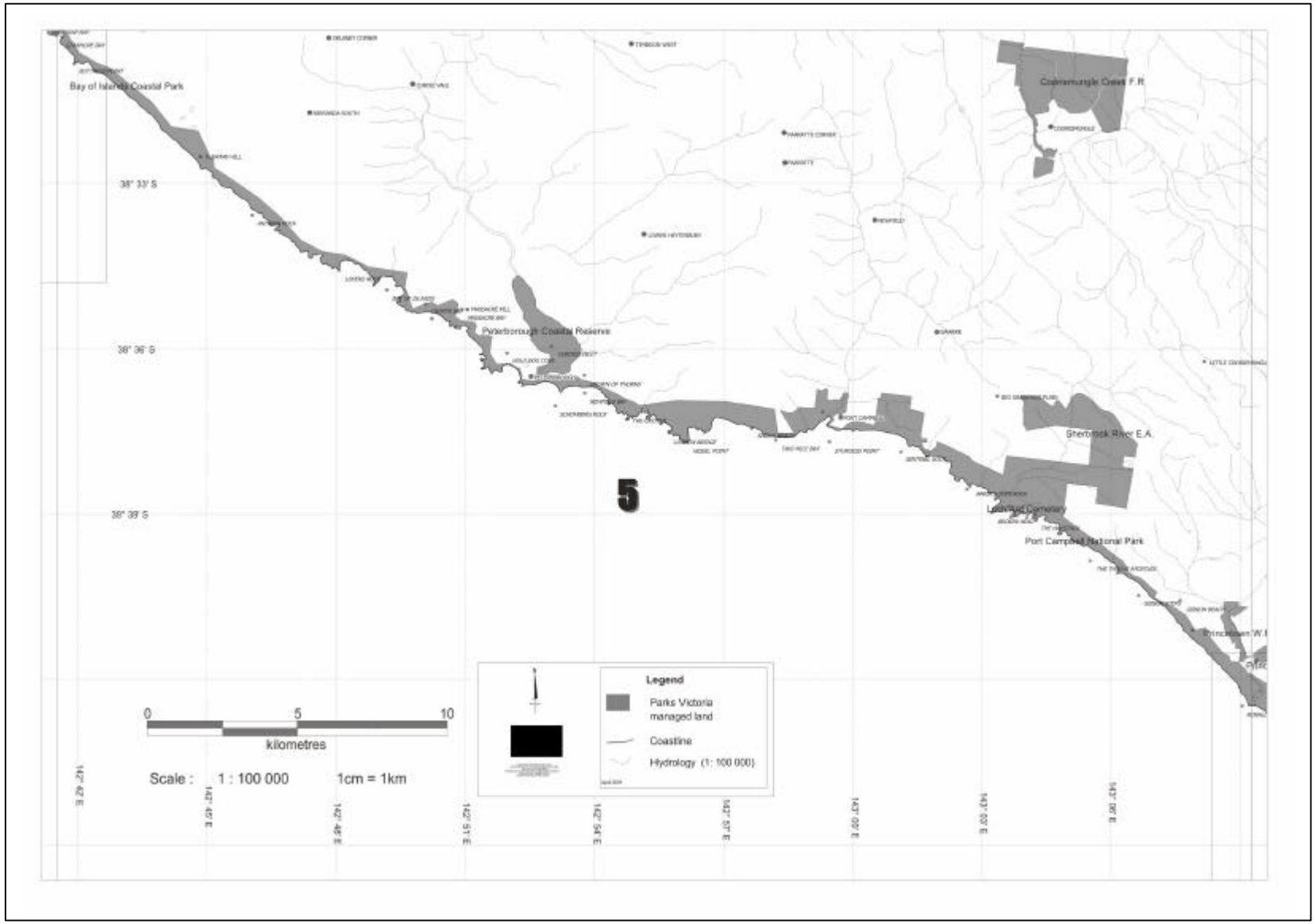


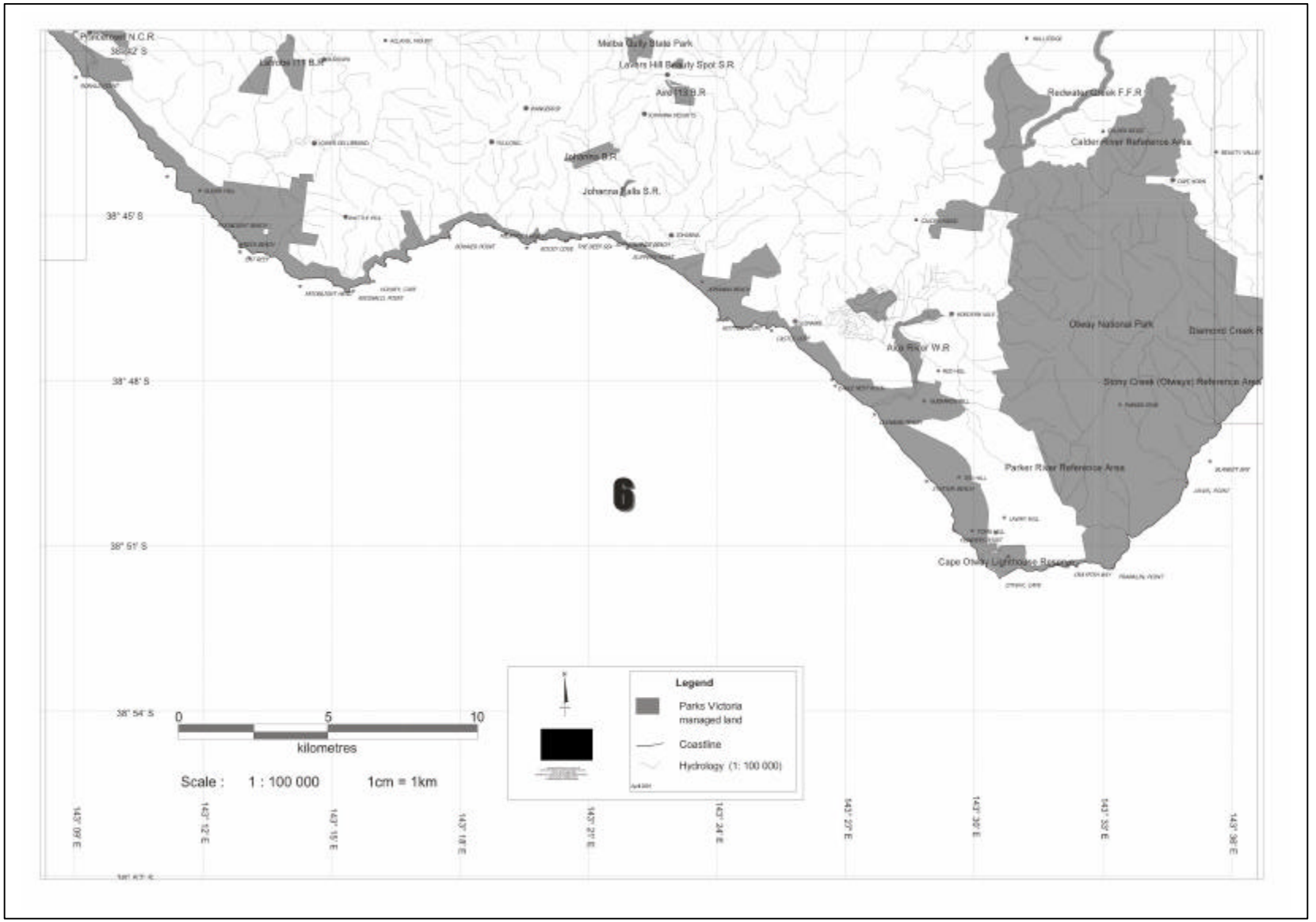

Nelson S.R.
38° 03' S
38° 06' S
38° 09' S
Lower Glenelg National Park
Kentbruck Heath Reference Area
Kentbruck H14 S.R.
Heddon H11 S.R.
Kentbruck H50 S.R.
Mount Kincaid S.R.
Johnstons Creek F.R.
Mouth B.R.
Mouth N.F.R.
Buenba Reference Area
Mount Richmon
1
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
141° 06' E
141° 09' E
141° 12' E
141° 15' E
141° 18' E

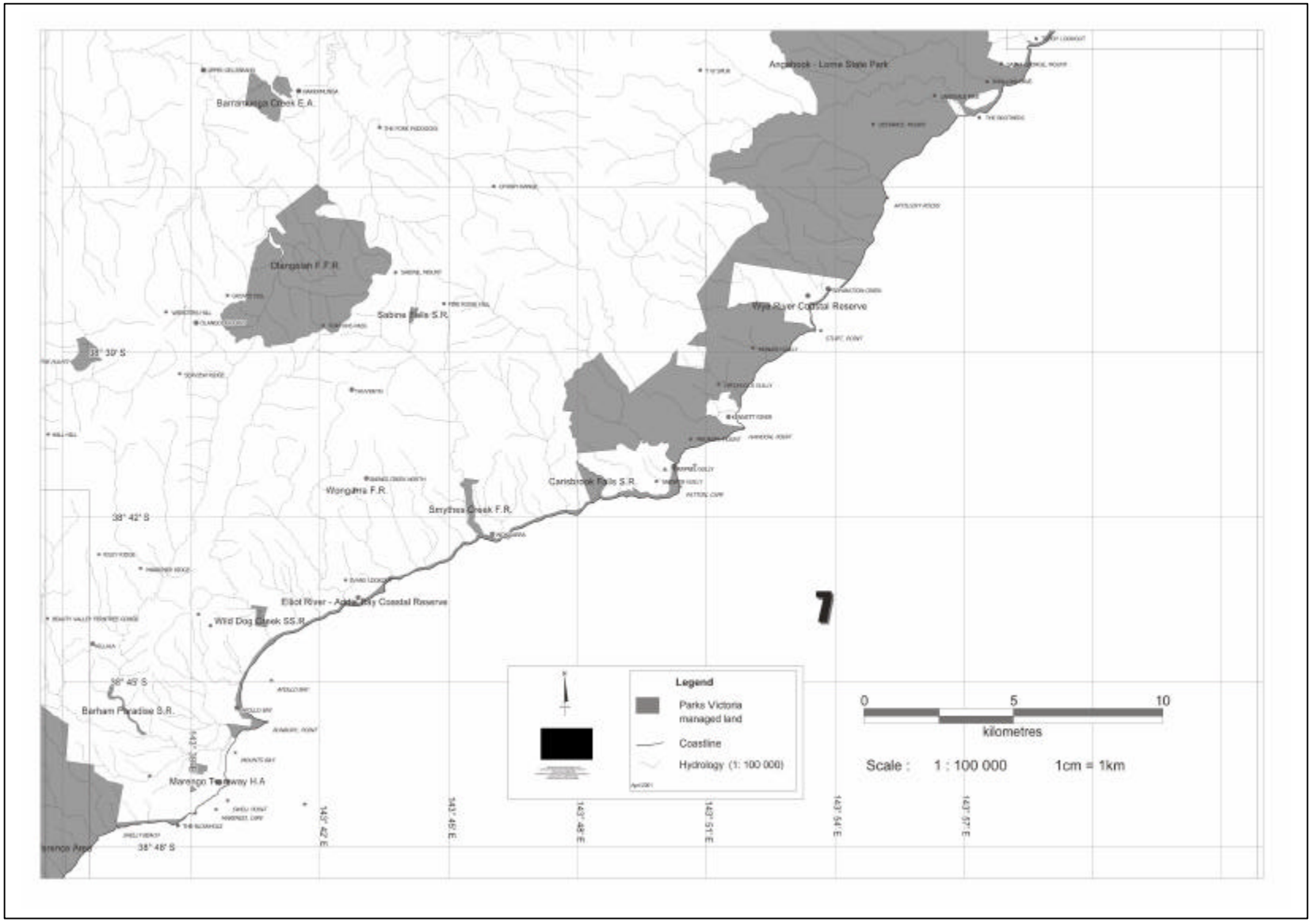

Mount N.F.R.
Narrawong F.R.
Fitzroy River S.S.R.
Nine Mile F.F.R.
Tyrendarra F.R.
Gorae B.R.
Mount Richmond National Park
Bolwarra H43 B.R.
Bolwarra H44 B.R.
Tarragal E.A.
Trewalla H49 B.R.
Portland North Cemetery H.A
Bats Ridge W.R.
Trewalla H48 B.R.
Portland H46 B.R.
Portland H47 B.R.
Lawrence Rocks W.R
Cape Nelson State Park
Cape Nelson Lighthouse Reserve
2
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km

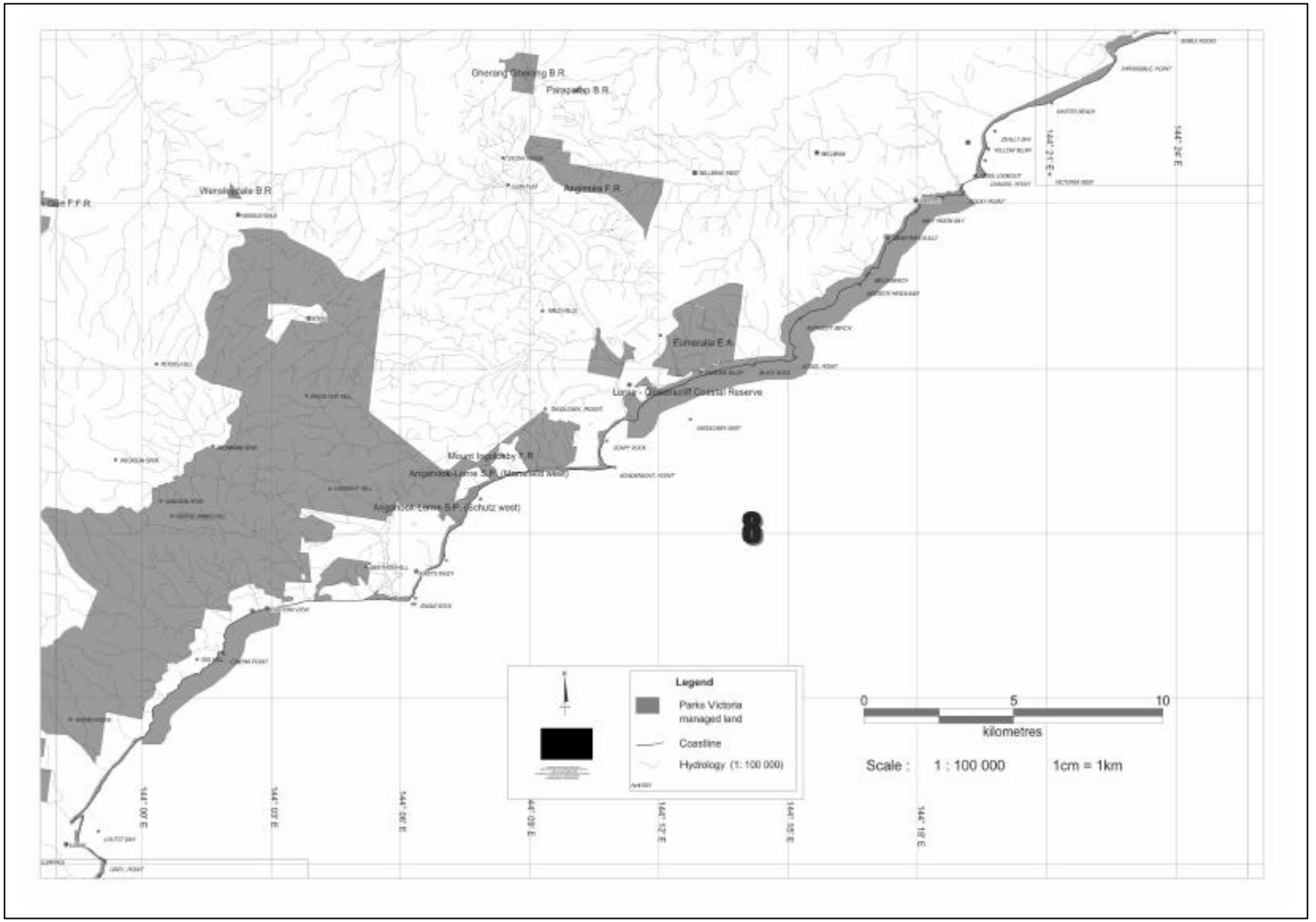

38° 12' S
38° 15' S
38° 18' S
Broadwater Is'l S.R.
St Helens F.R.
Pretty Hill F.R.
Major Mitchell Plateau R.N.A.
3
Eumeralla (Yambuk) Coastal Reserve
Lake Gillear W.R.
Yambuk F.F.R.
Goose Lagoon W.R.
Port Fairy
Lady Julia Percy Island W.R.
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale 1 : 100 000 1cm = 1km
141° 48' E
141° 51' E
141° 54' E
141° 57' E
142° 00' E
142° 03' E
142° 06' E
142° 09' E
142° 12' E

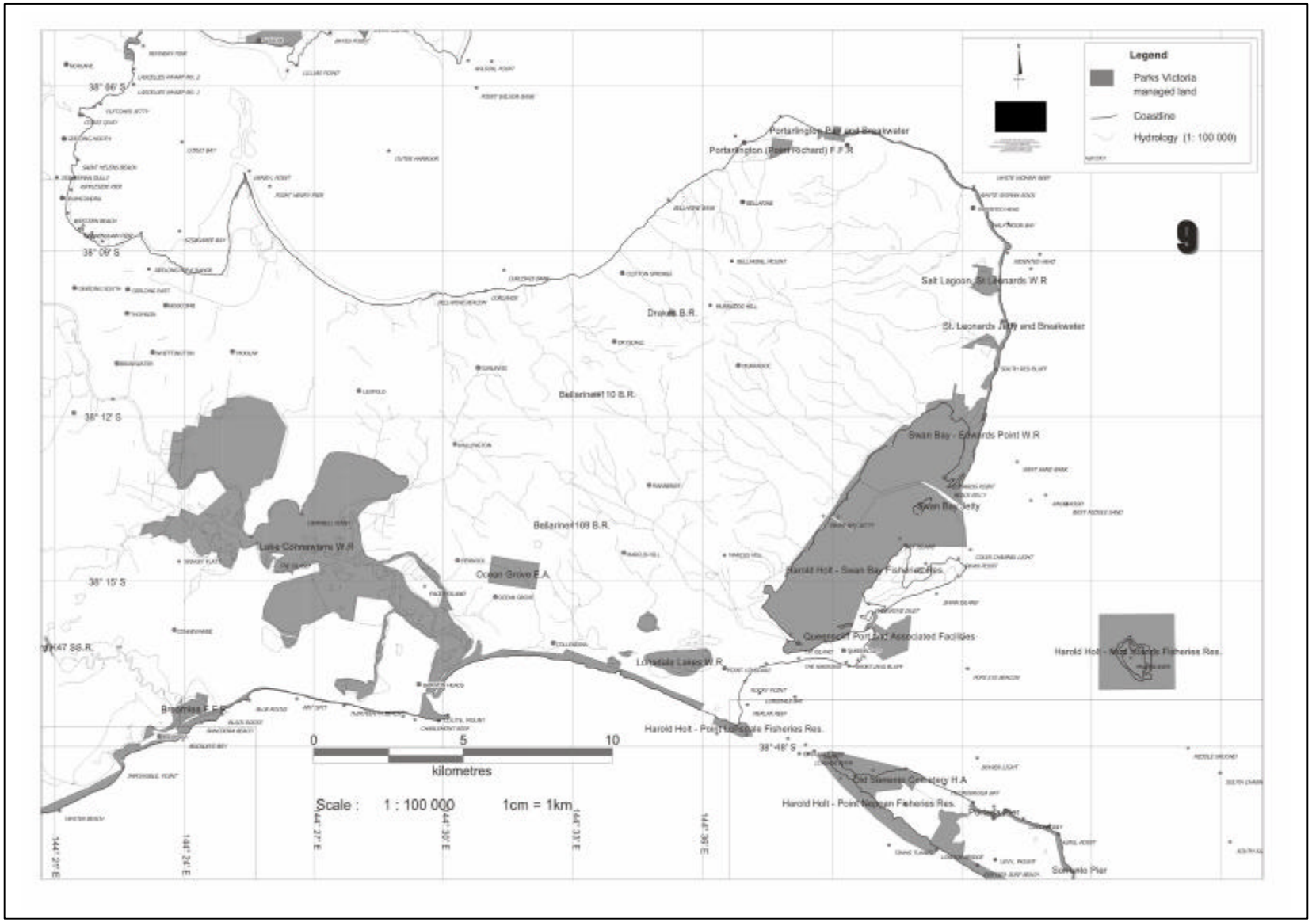

38° 21' S
38° 24' S
38° 27' S
38° 30' S
Gippsland Lakes Coastal Park
Port Fairy - Warrnambool Coastal Reserve
Lake Guttrer W.R
Mount McAdam Reference Area
Bay of Islands
4
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
142° 15' E
142° 18' E
142° 21' E
142° 24' E
142° 27' E
142° 30' E
142° 33' E
142° 36' E
142° 39' E

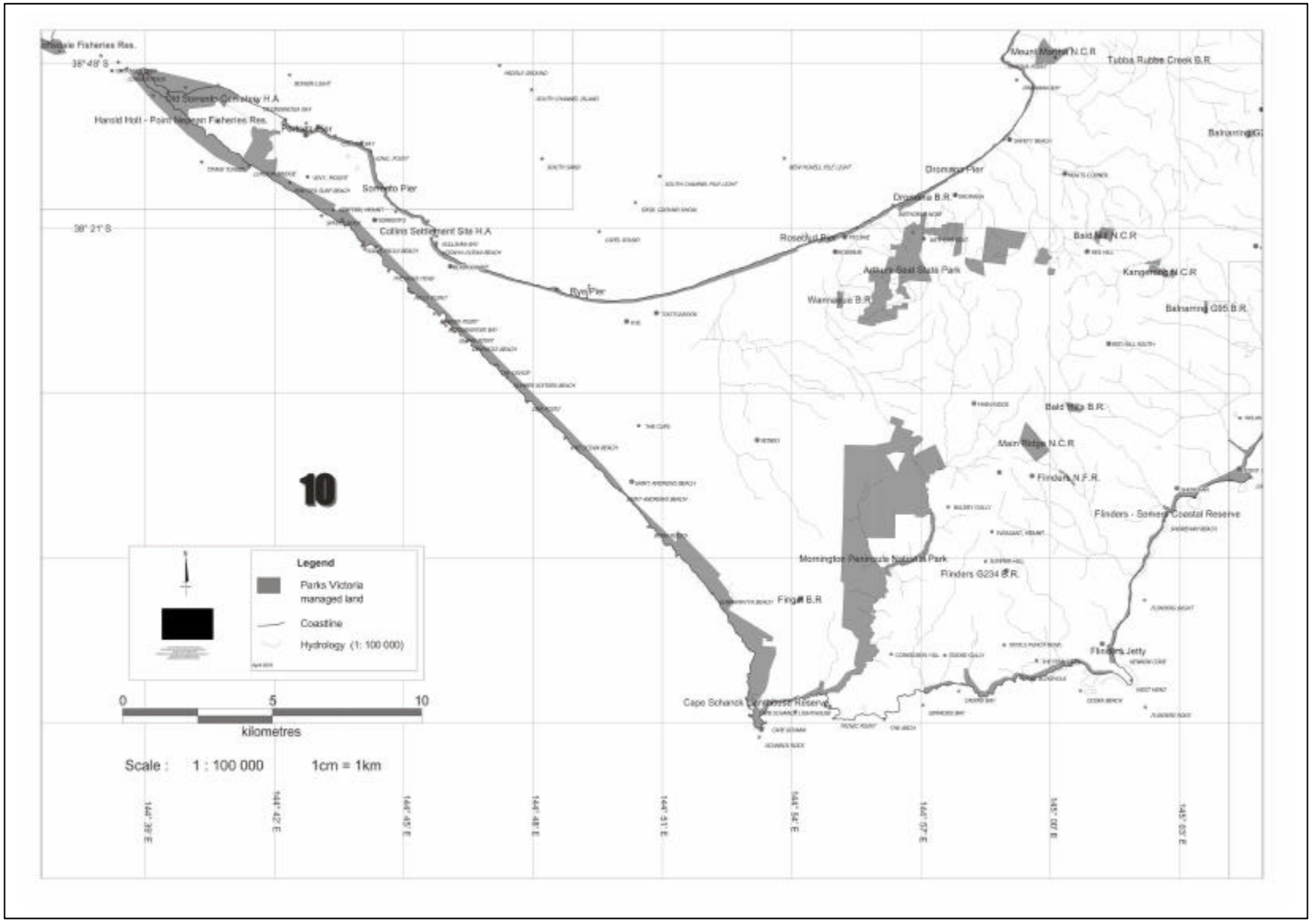

Bay of Islands Coastal Park
Peterborough Coastal Reserve
Curdievrindle Creek F.R.
Sherbrook River E.A.
Port Campbell National Park
38° 33' S
38° 36' S
38° 39' S
5
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)

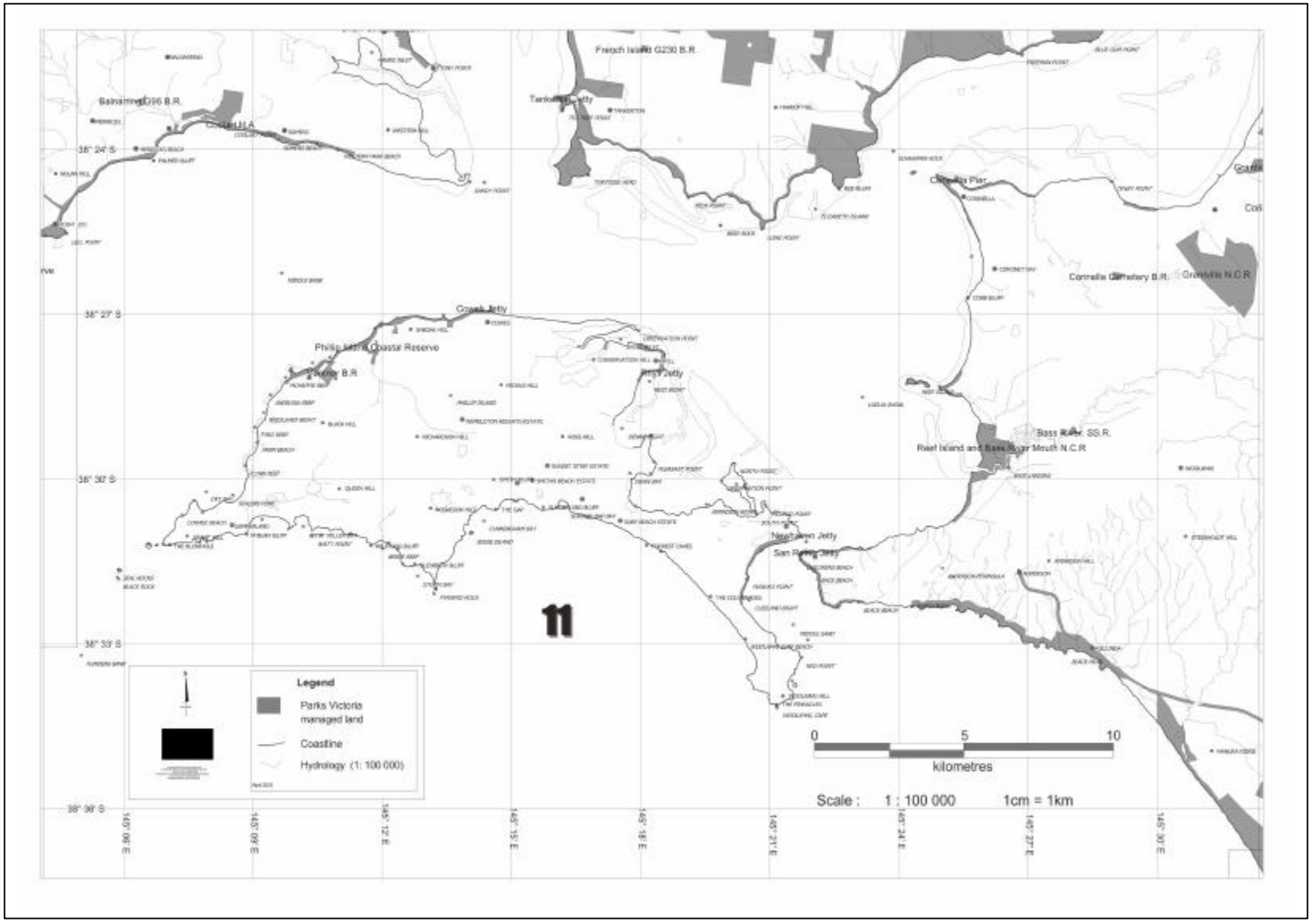

Melba Gully State Park
Lavers Hill Beauty Spot S.R.
Johanna S.R.
Johanna Falls S.R.
Recreation Creek F.F.R.
Calder River Reference Area
Otway National Park
Stony Creek (Otways) Reference Area
Parker River Reference Area
Cape Otway Lighthouse Reserve
38° 45' S
38° 48' S
38° 51' S
38° 54' S
143° 09' E
143° 12' E
143° 15' E
143° 18' E
143° 21' E
143° 24' E
143° 27' E
143° 30' E
143° 33' E
143° 36' E
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)

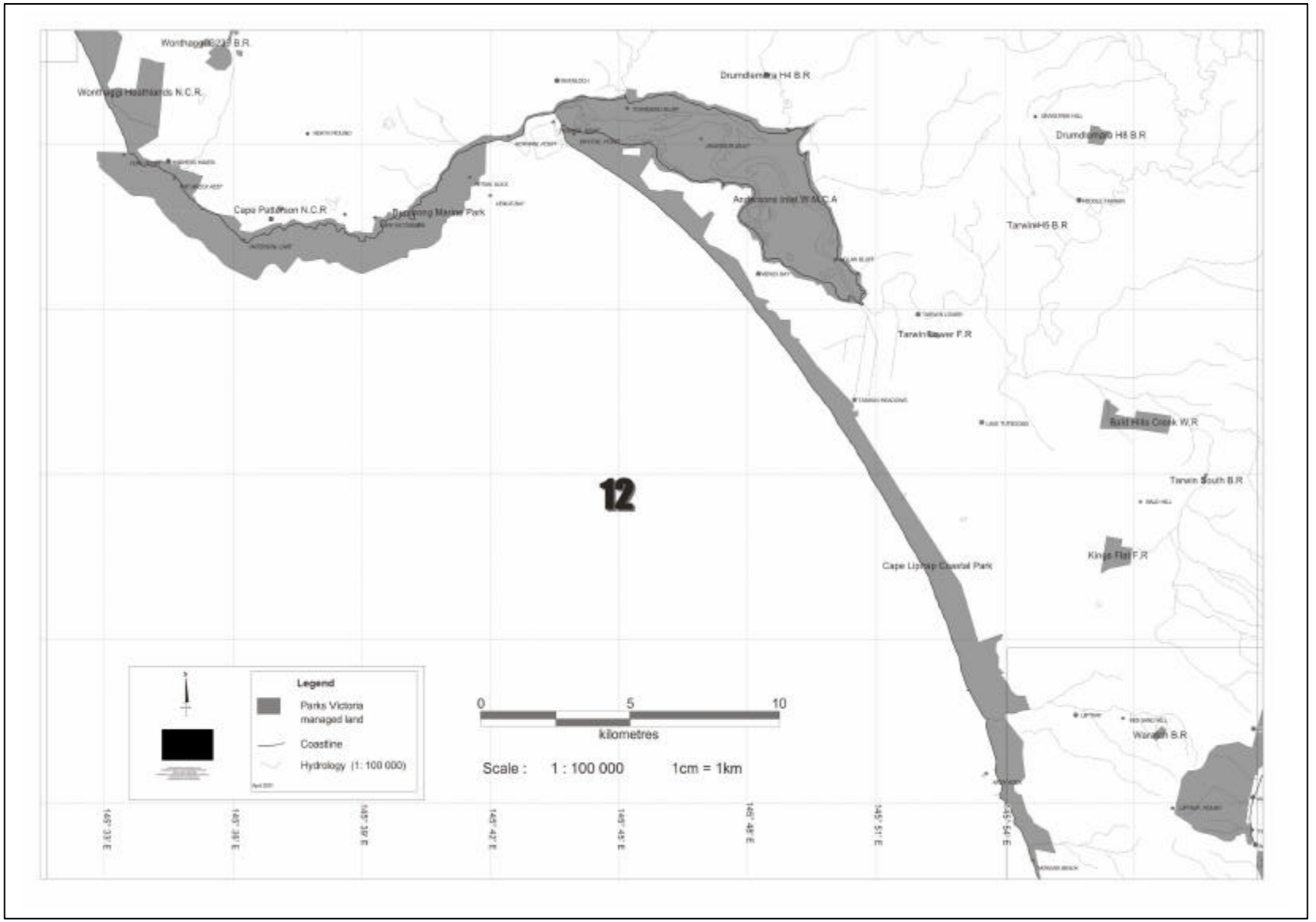

Barramunga Creek E.A.
Otanguin F.F.R.
Sabina Falls S.R.
38° 30' S
Wonguma F.R.
Carisbrook Falls S.R.
Smythes Creek F.R.
38° 42' S
Elliot River - Anderson Inlet Coastal Reserve
Wild Dog Creek SS.R.
38° 45' S
Barham Paradise S.R.
Marengo Tramway H.A
38° 48' S
143° 42' E
143° 45' E
143° 48' E
143° 51' E
143° 54' E
143° 57' E
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km

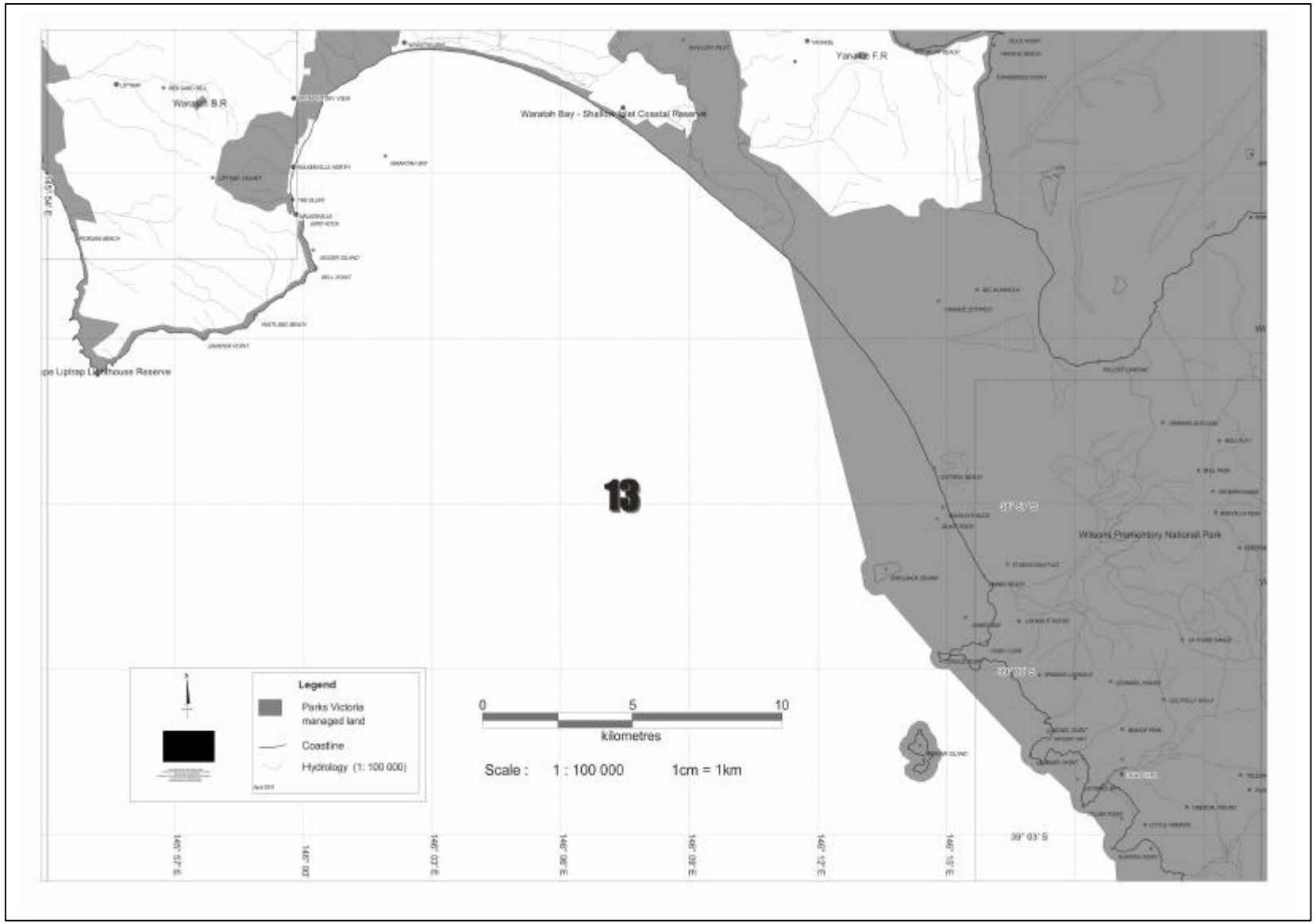

Gherang Gherang B.R.
Parapadap B.R.
Wensleydale B.R.
Angasea F.R.
Eumeralla E.A.
Mount Ingoldsby F.R.
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km


Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
38° 06' S
38° 09' S
38° 12' S
38° 15' S
38° 48' S
Portarlington Pier and Breakwater
Portarlington (Point Richard) F.P.R.
Salt Lagoon, St Leonards W.R.
St. Leonards Jetty and Breakwater
Drake B.R.
Ballarine110 B.R.
Swan Bay - Edwards Point W.R.
Swan Bay Jetty
Ballarine109 B.R.
Lake Connewarre W.R.
Ocean Grove E.A.
Harold Holt - Swan Bay Fisheries Res.
Queenscliff Port and Associated Facilities
Harold Holt - Mud Islands Fisheries Res.
Lonsdale Lakes W.R.
Harold Holt - Point Lonsdale Fisheries Res.
Old Barwon Cemetery H.A.
Harold Holt - Point Nepean Fisheries Res.
Portsea Pier
Sorrento Pier
Breamlea F.F.R.
0 5 10
kilometres
Scale : 1 : 100 000 1cm = 1km
144° 27' E
144° 30' E
144° 33' E
144° 36' E

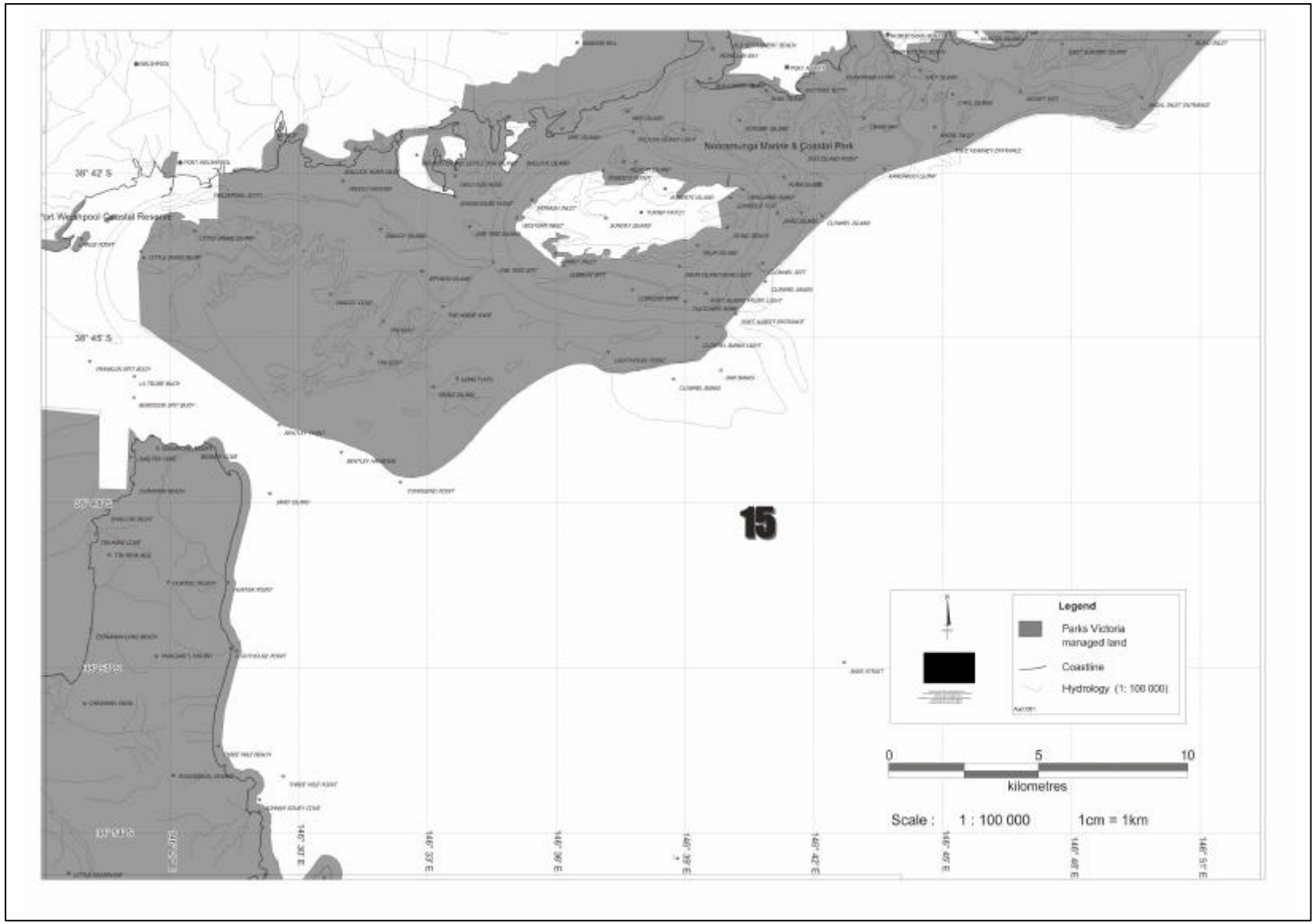

10
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km
38° 48' S
38° 21' S
Harold Holt - Point Nepean Fisheries Res.
Old Sorrento Cemetery H.A
Portsea Pier
Sorrento Pier
Collins Settlement Site H.A
Rye Pier
Rosebud Pier
Dromana Pier
Dromana B.R.
Arthurs Seat State Park
Warrandyte B.R.
Mount Martha N.C.R.
Tubbs Rubbe Creek B.R.
Bald Hill N.C.R.
Kangerong N.C.R.
Balnarring G95 B.R.
Bald Hill B.R.
Main Ridge N.C.R.
Flinders N.F.R.
Flinders - Somers Coastal Reserve
Mornington Peninsula National Park
Flinders G234 B.R.
Flinders Jetty
Cape Schanck Lighthouse Reserve
144° 36' E
144° 42' E
144° 49' E
144° 48' E
144° 51' E
144° 54' E
144° 57' E
145° 00' E
145° 03' E

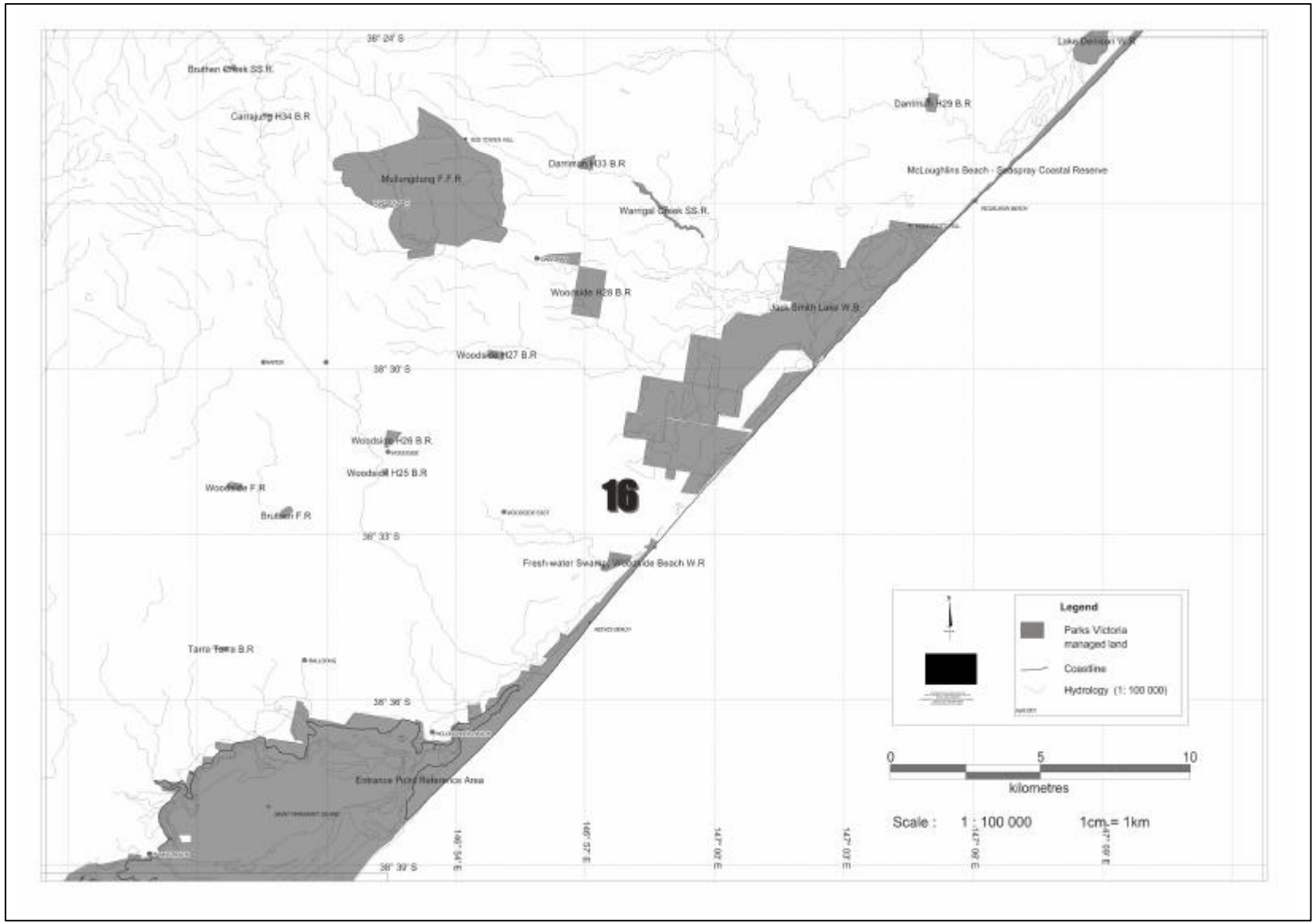

French Island G230 B.R.
Balnarring G96 B.R.
Tankerton Jetty
Cowes Jetty
Phillip Island Coastal Reserve
Corinella Cemetery B.R.
Grantville N.C.R
Bass River SS.R.
Reef Island and Bass River Mouth N.C.R
Newhaven Jetty
San Remo Jetty
38° 24' S
38° 27' S
38° 30' S
38° 33' S
38° 36' S
145° 06' E
145° 09' E
145° 12' E
145° 15' E
145° 18' E
145° 21' E
145° 24' E
145° 27' E
145° 30' E
11
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km

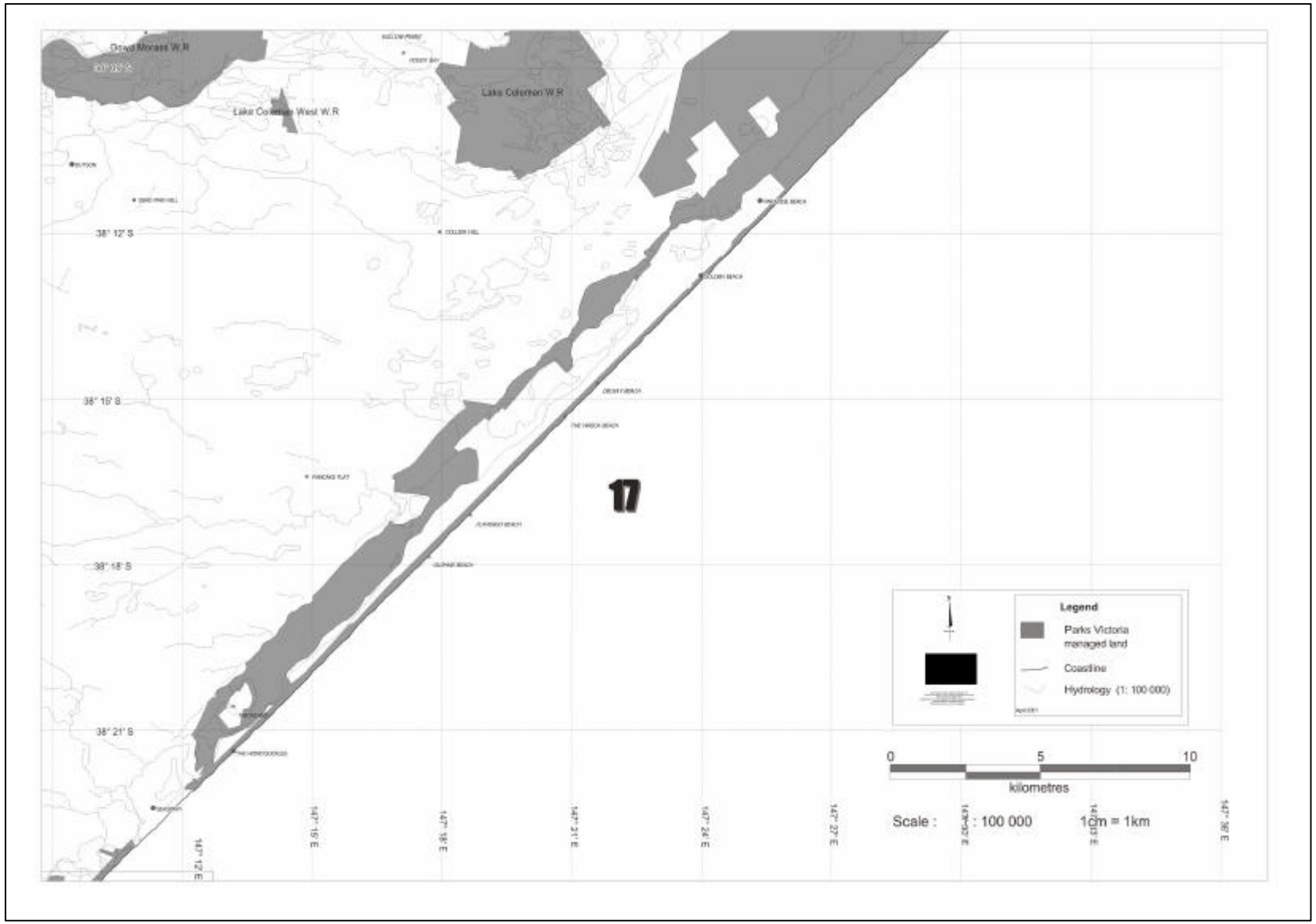

Drumdemmera H4 B.R
Drumdemmera H8 B.R
Tarwin H5 B.R
Tarwin Lower F.R
Bald Hills Creek W.R
Tarwin South B.R
Kings Flat F.R
Cape Liptrap Coastal Park
Waratah B.R
Cape Patterson N.C.R
Bunyong Marine Park
12
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km

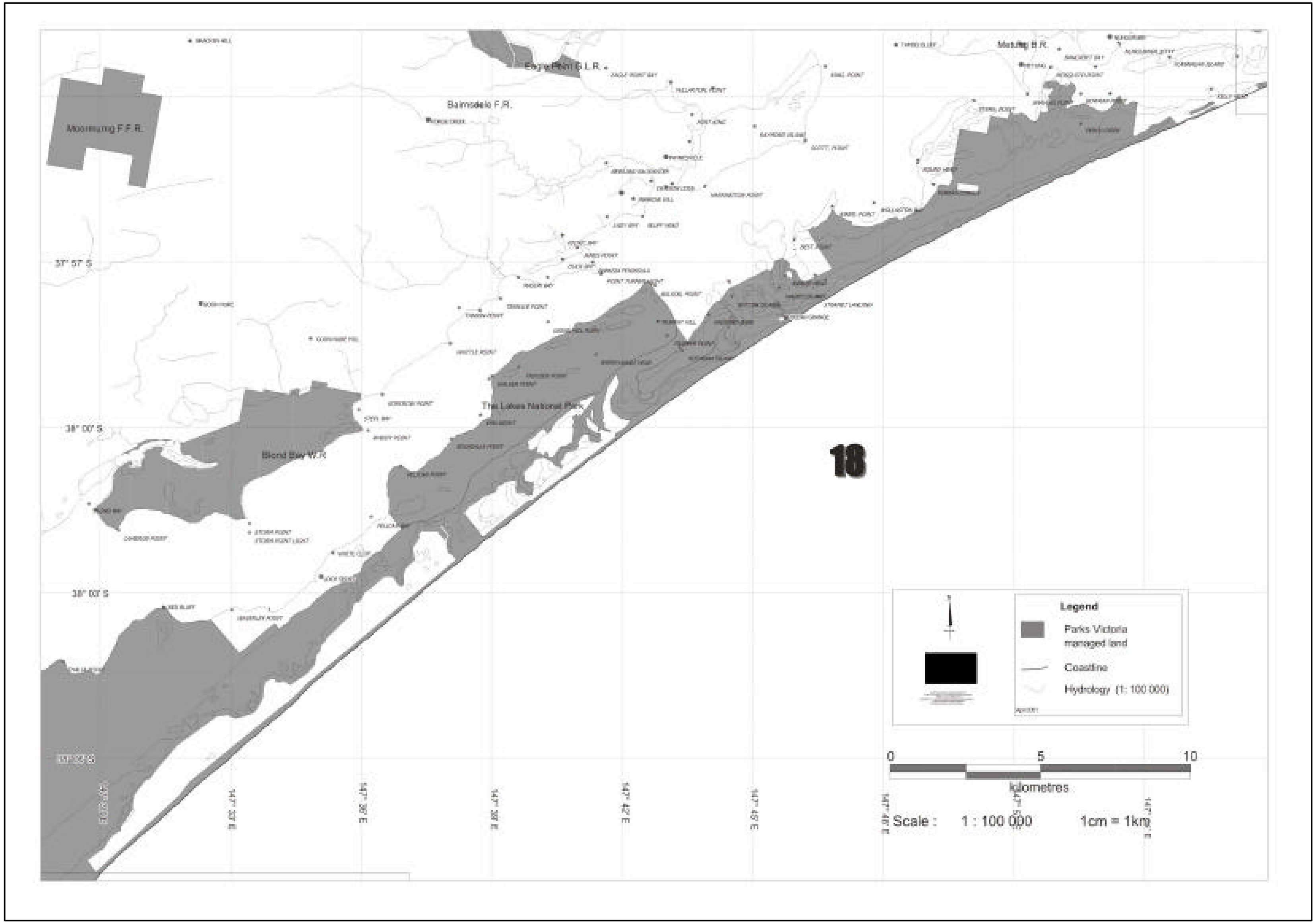

13
Wilsons Promontory National Park
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km

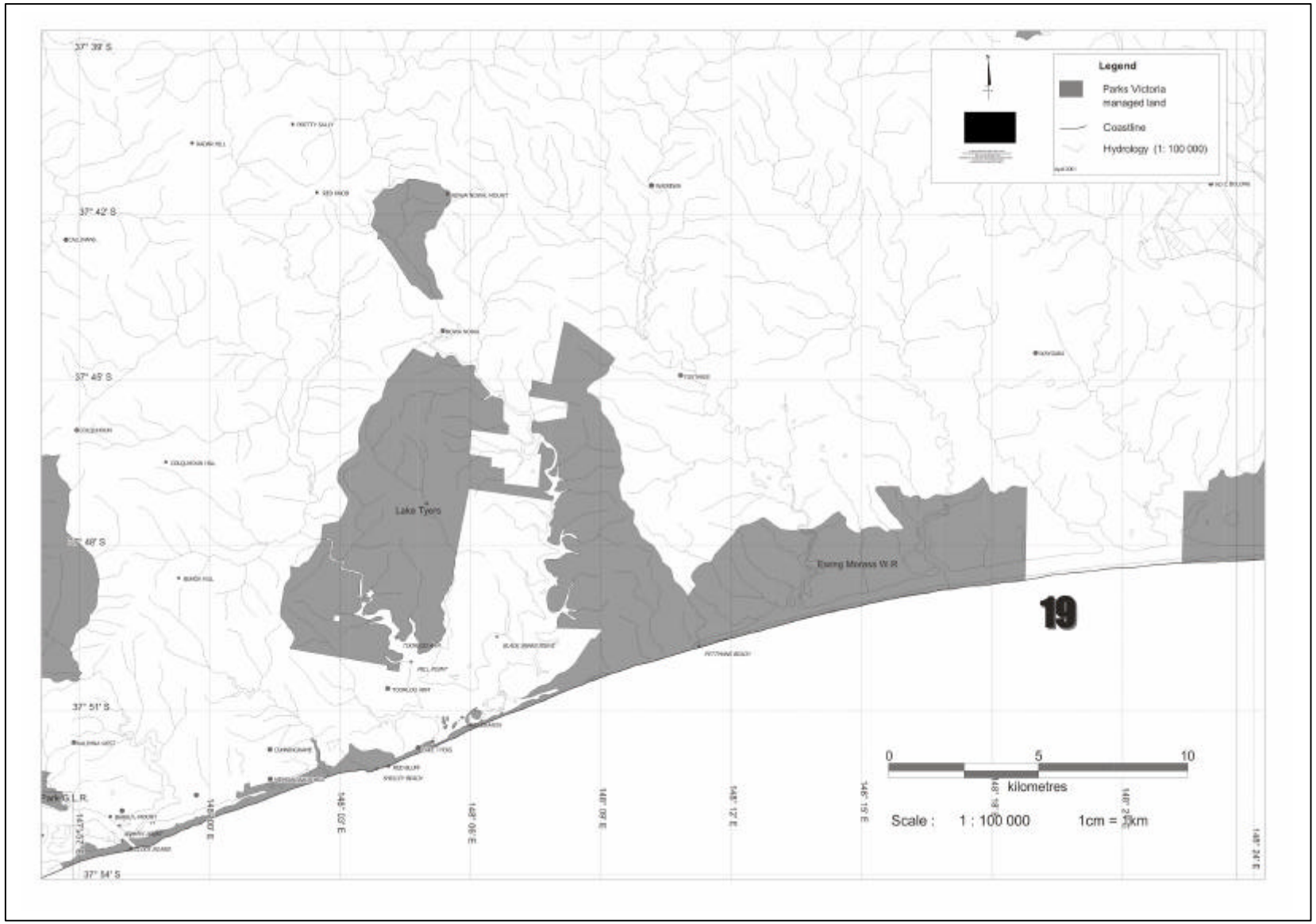

Wilsons Promontory National Park
Wilsons Promontory Marine Park
Vereker Creek Reference Area
Wilsons Promontory Lighthouse Reserve
Anser Island Reference Area
Seal Islands W.R.
39° 03' S
39° 06' S
146° 21' E
146° 24' E
14
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km

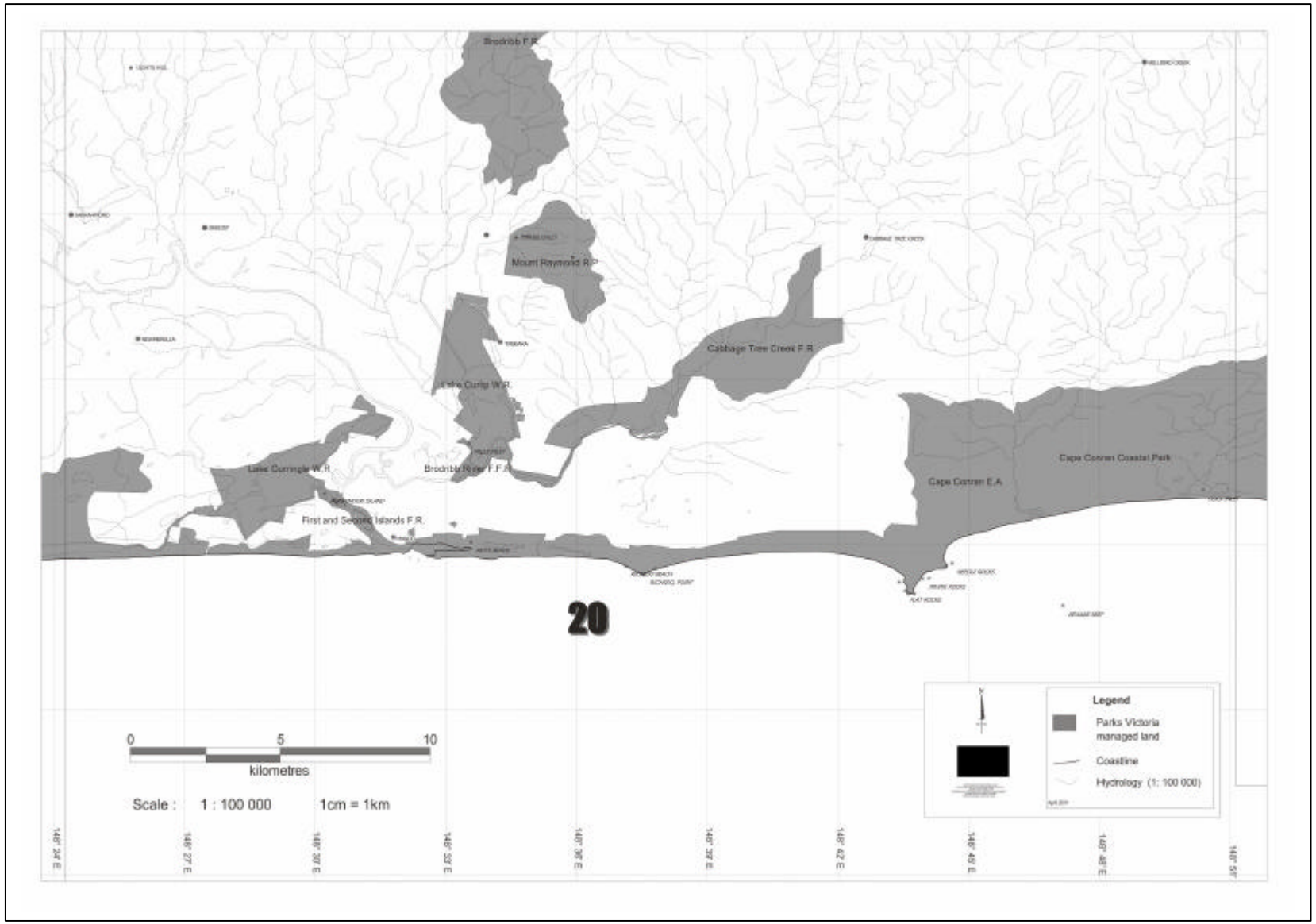

Nooramunga Marine & Coastal Park
38° 42' S
38° 45' S
15
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km

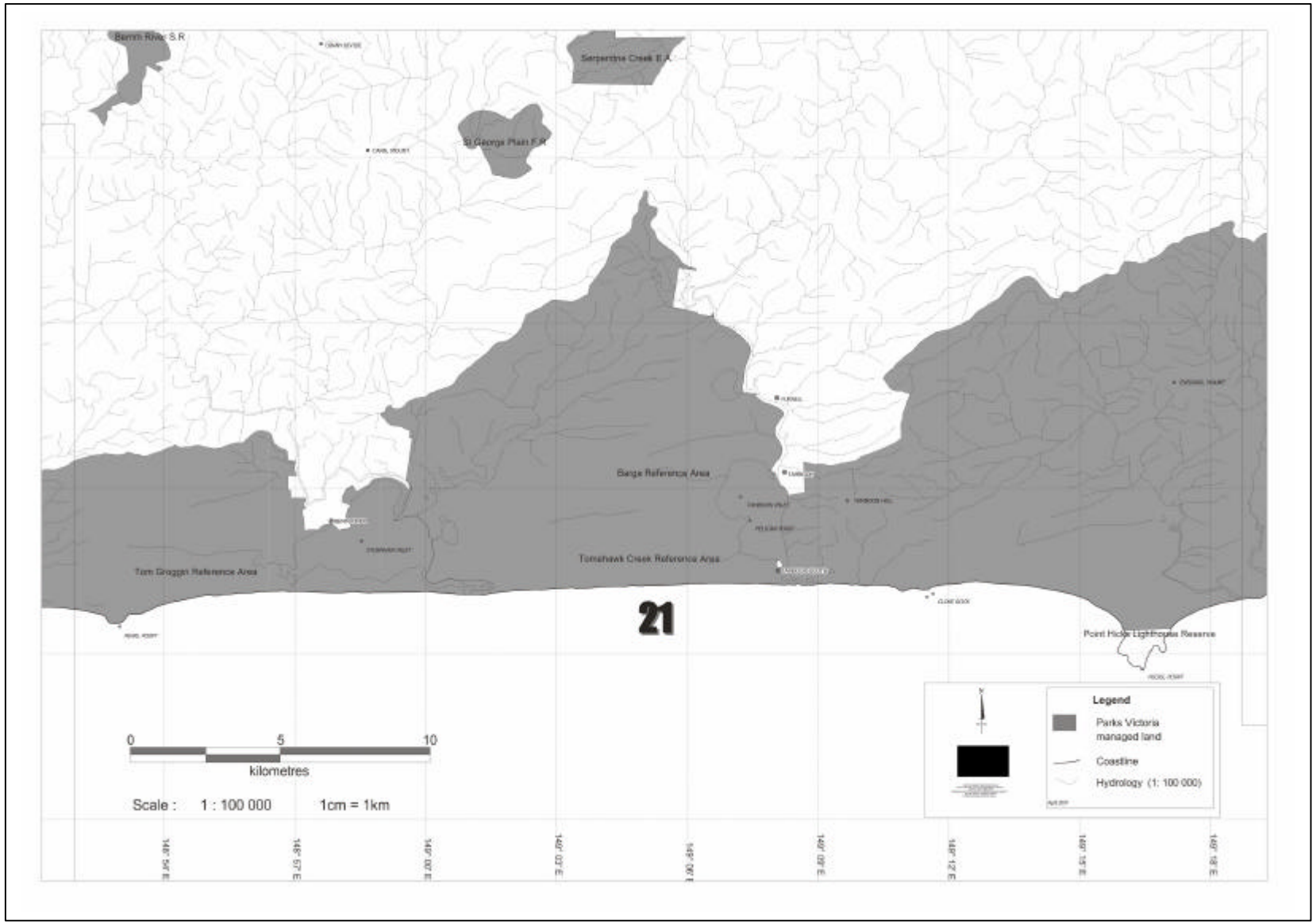

38° 24' S
Brutten Creek SS.R.
Carrajung H34 B.R
Mullungdung F.F.R
Dammah H33 B.R
Warrigal Creek SS.R.
Dammah H29 B.R
McLoughlins Beach - Seaspray Coastal Reserve
Woodside H28 B.R
Jack Smith Lake W.R
Woodside H27 B.R
38° 30' S
Woodside H26 B.R
Woodside H25 B.R
Woodside F.R
Brutten F.R
16
38° 33' S
Fresh-water Swamp Woodside Beach W.R
Tarra Tarra B.R
38° 36' S
Entrance Point Reference Area
38° 39' S
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km

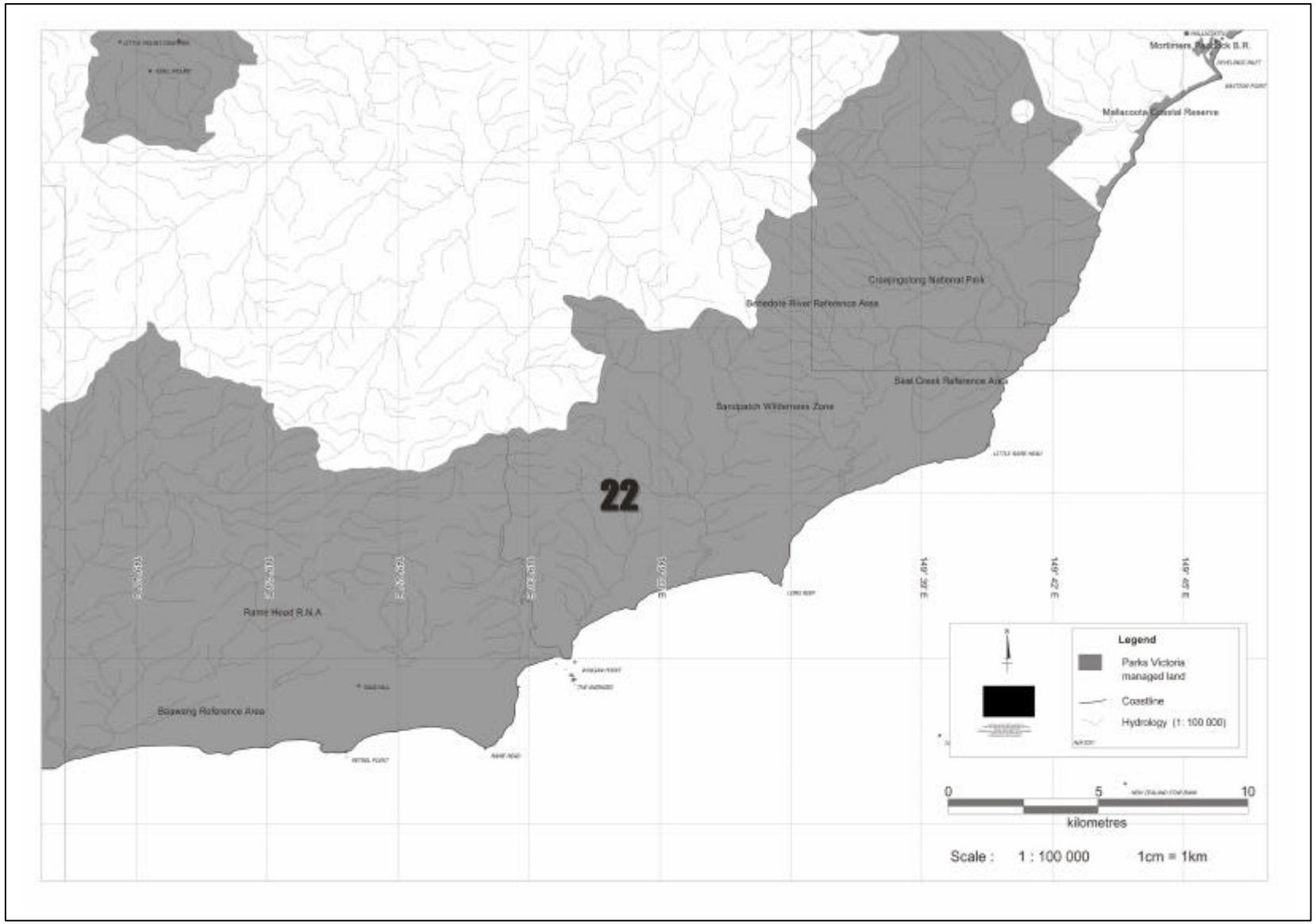

Lake Colemen W.R
38° 12' S
38° 15' S
38° 18' S
38° 21' S
17
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : : 100 000
10cm = 1km

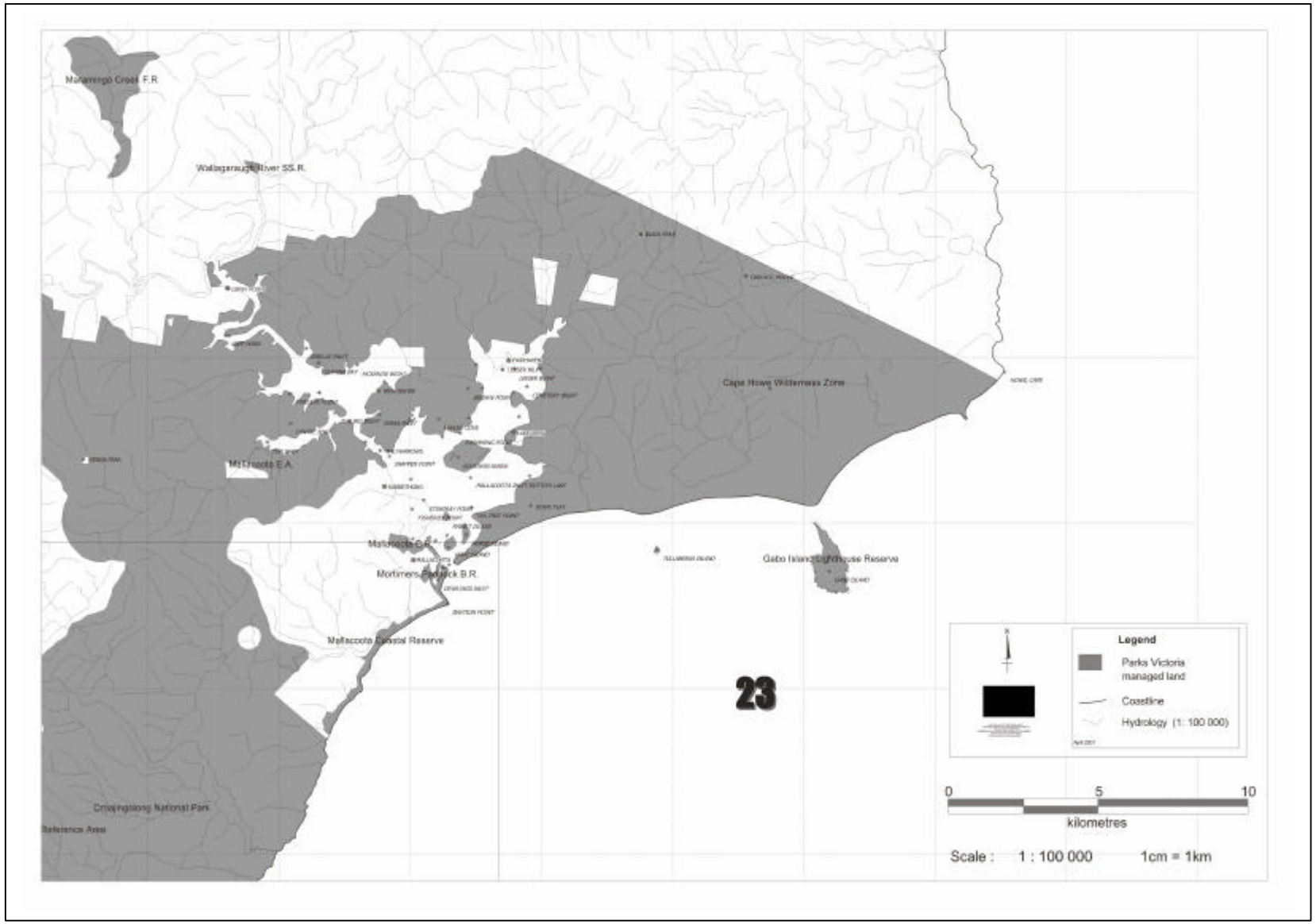

Moormurng F.F.R.
Bairnsdale F.R.
The Lakes National Park
Blond Bay W.R.
18
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km
37° 57' S
38° 00' S
147° 33' E
147° 36' E
147° 39' E
147° 42' E
147° 45' E


Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
37° 39' S
37° 42' S
37° 45' S
37° 48' S
37° 51' S
37° 54' S
Lake Tyers
Ewing Morass W.R.
19
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km


Brodribb F.R.
Mount Raymond R.P.
Cabbage Tree Creek F.R.
Lake Curnip W.R.
Lake Curnigla W.R.
Brodribb River F.F.A.
First and Second Islands F.R.
Cape Conran Coastal Park
Cape Conran E.A.
20
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)


Serpentine Creek S.A.
St George Plain F.R.
Banga Reference Area
Tomahawk Creek Reference Area
Tom Groggin Reference Area
21
Point Hicks Lighthouse Reserve
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)


Mallacoota Coastal Reserve
Croajingolong National Park
Sandpatch Wilderness Zone
22
Rame Head R.N.A
Boawang Reference Area
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km


Wallagaraugh River S.S.R.
Cape Howe Wilderness Zone
Mallacoota Coastal Reserve
23
Legend
Parks Victoria managed land
Coastline
Hydrology (1: 100 000)
0
5
10
kilometres
Scale : 1 : 100 000 1cm = 1km

Appendix 4

A DATASHEET AND COUNTER INSTRUCTIONS

HOODED PLOVER SURVEY – INSTRUCTIONS TO COUNTERS

Read these instructions before commencing your count and take these instructions with you on your count. If you have any questions please contact the count organisers.

What to take: Binoculars, a data sheet plus a spare, pens/pencils plus spares, small clipboard and spare paper, sunscreen, hat, warm clothes, raincoat, water, food, a small first aid kit. Optional equipment (if you have or need them): GPS plus spare batteries, telescope, mobile phone, EPIRB, field guide.

Take a friend: having another person with you increases your personal safety, and provides another set of eyes (particularly important if you are counting by vehicle). You can even train a friend to count Hooded Plovers!

Before you start: Ensure that you are in the correct start position (as advised by your Regional Organiser). Check you have a current data sheet (the year is on the top). Look at the data sheet and read it and these instructions. Fill in the top of the data sheet and take a GPS reading or mark your location on the attached map. Check the tide and weather charts.

How to count: on foot walk slowly along the firm sand as close to the mid-beach as possible. by vehicle drive slowly along the firm sand as close to the mid-beach as possible – avoid kelp or other cover where chicks may be hiding (only authorised vehicles can be driven on beaches in Victoria).

Keep an eye out above and below you for birds. Do not be fooled – Hooded Plovers may be boldly marked but they can be very difficult to find. Check every bird through binoculars to confirm your identification. When passing birds note whether the bird moves behind or ahead of you – if it moves ahead be careful not to double-count it.

When you pass birds check the data sheet for what information is required – you will need to take a GPS reading or mark the location on a map.

Do not:

- Search for nests or chicks – you will disturb the birds.
- Search the upper beach or dune areas – you might crush eggs or chicks.

- Touch eggs or chicks if you happen across them – Hooded Plovers do not abandon their eggs or chicks but the adults will hide from you when you are near them.
- Take your dog with you – your dog may disturb the birds and compromise your count.
- Forget the tide – keep an eye on it at all times and watch for large waves.
- Take risks either with waves or climbing on rocks – be careful.

When you finish: Check you have filled in all the required sections on the data sheets and post them (along with any other data sheets and maps) promptly back to address on the sheets. If you recorded additional information, send that in as well. If you wish to transpose your results onto another data sheet please do so, and request more copies of the sheet if needed.

What bird am I looking at: If you are unsure of a bird identification, note that on the data sheet. One helpful clue to identifying Hooded Plovers is the white band at the back of the neck – this is evident in all ages classes and is shown by lines below:

Recording colour-bands: the species of bird, the colours, the side (left or right) and the order (top to bottom) are essential pieces of information when recording colour bands. Draw a picture if you need to.

We thank you for your help, your time and your effort – it is much appreciated and will help ensure that Hooded Plovers have a bright future in Victoria.

HOODED PLOVER COUNT SHEET

Fill this sheet in while counting, read and understand it before your start.

Your details: *fill this panel in before you start.*			
Name:		Address:	
Phone:	Date:	Email:	
I counted by (circle one): Foot Car Boat		If you used more than 1 sheet, number them here:	
Starting point:		Finishing point:	

Count results*: fill in this panel as you go*					
Species	*Total number*	*Number of adults*	*Number of juveniles*	*Number of eggs (E) or chicks (C)*	*GPS or AMG*
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Species	*Total number*	*Number of adults*	*Number of juveniles*	*Number of eggs (E) or chicks (C)*	*GPS or AMG*
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					

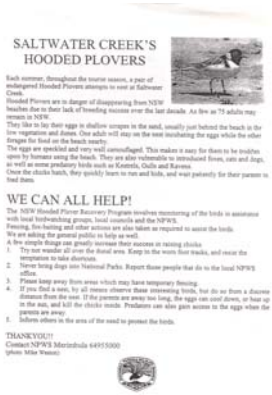
Return to: **Threatened Bird Network, 415 Riversdale Rd, hawthorn East, 3123**

Appendix 5

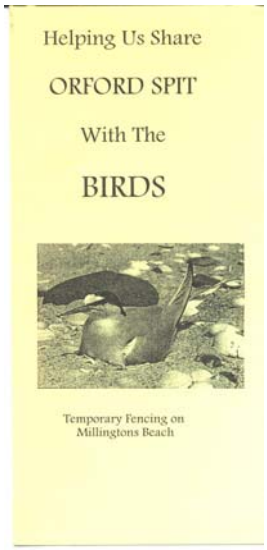
BROCHURES

The following brochures contain at least a large Hooded Plover content.

Title: The Hooded Plover Conservation Statement
Produced by: Birds Australia
Circulation: Out of print / Unavailable
Specificity: Australia wide



Title: Saltwater Creek's Hooded Plovers
Produced by: New South Wales National Parks and Wildlife Service
Circulation: Available with camping permit at camp ground at Ben Boyd NP
Specificity: Saltwater Creek Camping Area, NSW



Title: Helping us share Orford Spit with the birds
Produced by: Tasmanian Parks and Wildlife Service
Circulation: Available at Orford Spit and at camp grounds generally
Specificity: Orford Spit, Tas.

Title: Save us from extinction (front and back shown).

Produced by: Phillip Island Nature Park

Circulation: Broadly available and handed out by volunteer counters and wardens.

Specificity: Phillip Island

Title: Whose beach?

Produced by: Birds Australia Western Australia Group

Circulation: Broadly available in coastal WA.

Specificity: Coastal WA, specific to Hooded Plovers

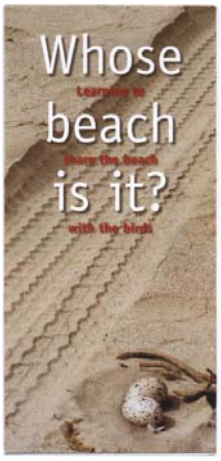
Title: Hooded Plovers

Produced by: Simone Zmitrowicz, University of Ballarat, 3rd year project

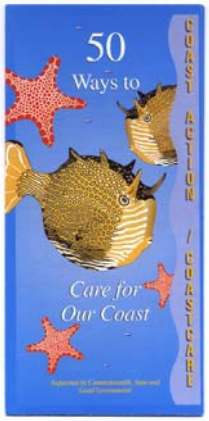
Circulation: Schools, Geelong area

Specificity: Coastal Vic., specific to Hooded Plovers

Title: Hooded Plover
Produced by: Department of Natural Resources and Environment
Circulation: Formerly was broadly available in coastal Vic.
Specificity: Coastal Vic., specific to Hooded Plovers



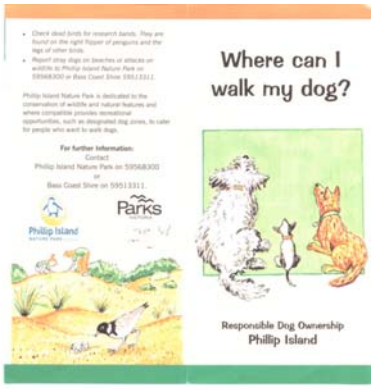
Title: Whose beach is it?
Produced by: World Wildlife Fund
Circulation: Broadly available in coastal Tas.
Specificity: Coastal Tas., shorebirds.



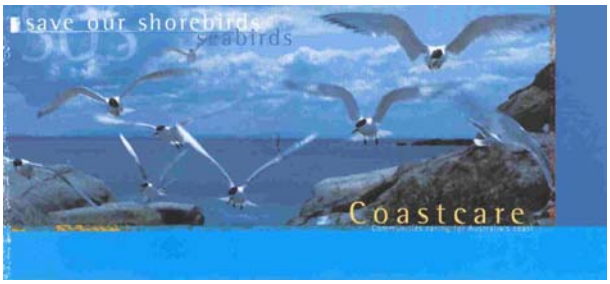
Title: 50 ways to care for our coast
Produced by: Coastaction/Coastcare
Circulation: Broadly available throughout Australia.
Specificity: Very general, mentions some general shorebird conservation issues.

Title: Thank you card.
Produced by: New South Wales National Parks and Wildlife Service
Circulation: NSW.
Specificity: Volunteers in NSW.

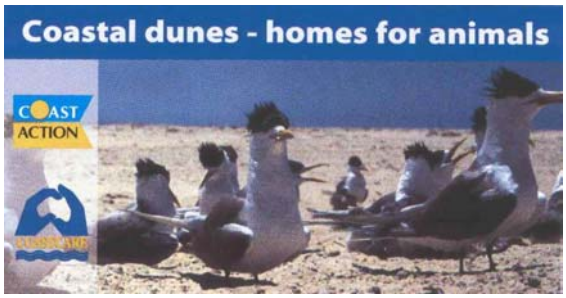
Title: Where can I walk my dog?
Produced by: Phillip Island Nature Park and Parks Victoria
Circulation: Phillip Island.
Specificity: Dog owners on Phillip Island.



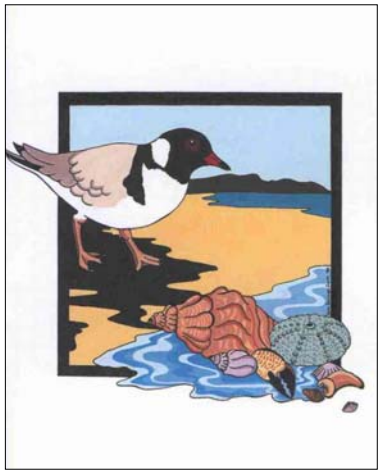
Title: Save our shorebirds
Produced by: Coastcare
Circulation: Australia
Specificity: Generally



Title: Coastal dunes - homes for animals (Sticker)
Produced by: Coastaction
Circulation: Australia
Specificity: Generally



Title: Greeting card
Produced by: Birds Australia
Circulation: For sale.
Specificity: General



Appendix 6

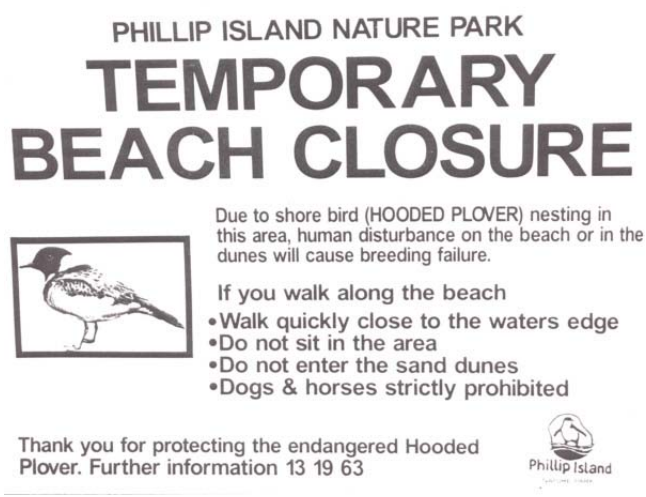
SIGNS

This appendix presents a selection of signs on Hooded Plovers.

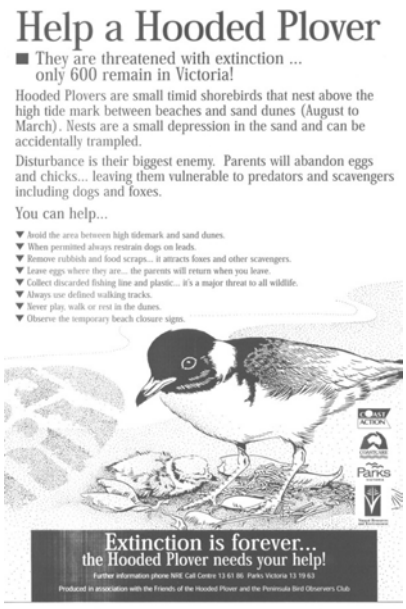
The Tasmanian National Parks and Wildlife "Whose beach is it?" sign.

The "Give them a wide berth" sign used in Bass Coast Shire.

The “Special Shorebirds” sign used on Phillip Island.



The Temporary Beach Closure sign - the Phillip Island version.



The Surfcoast sign.

The National Parks and Wildlife signs at the Coorong, South Australia.

Appendix 7

POSTERS

This appendix presents a selection of poters on Hooded Plovers. Many posters are laminated and used as signs.

The Threatened Bird Network 1996 poster, which was distributed to about 1700 volunteers.

The Friends of the Hooded Plover poster (Mornington Peninsula).

The Coastal Wildlife - Hooded Plover poster by South Australia's Parks and Wildlife Service

Appendix 8

NEWSPAPER ARTICLES ON THE HOODED PLOVER

The following table presents the details of newspaper articles on the Hooded Plover. All known articles are included, but the list is not complete. Asterisks indicate the relevant category. Entries are in alphabetical order.

Details						Type	
Source	**Year**	**Title**	**Reference**	**State**	**Location**	**Public debate**	**Advice to the public**
Anon.	1988	Plover at risk.	Weekly Times March 30: 20.	Vic.	statewide.		*
Anon.	1992	Count for beach plovers.	Warrnambool Standard December.	Vic.	Warrnambool		*
Anon.	1994	A case of mistaken identity.	South Gippsland Sentinel Times, February 17: 7.	Vic.	South Gippsland		*
Anon.	1997	Campaign begins to help save the Hooded Plover.	Portland Observer, March 24: 1.	Vic.	Portland		*
Anon.	1999	Leave plover nests alone: rangers.	The Mail, 14(46): 1.	Vic.	Mornington Peninsula NP		*
Anon.	1999	National Parks plea on peninsula plover nests.	Mornington Peninsula Leader, November 30: 8.	Vic.	Mornington Peninsula NP		*
Anon.	1999	Nature's nursery springs into life.	Herald Sun, November 6: 9.	Vic.	Phillip Is		*
Anon.	2000	Hoodies diary - boy or girl?	South Gippsland Sentinel Times, December 19.	Vic.	Inverloch		*
Anon.	2000	Little birds in big trouble.	Merimbula New Weekly, November 8: 21.	NSW	Merimbula		*
Anon.	2001	Hooded Plovers: they made it!	South Gippsland Sentinel Times, January 31: 15.	Vic.	Inverloch		*
Anon.	2001	Search for last Hooded Plovers	Merimbula New Weekly, January 31: 20.	NSW	Merimbula		*
Bolam, R.	2000	Protecting the Hooded Plover.	South Gippsland Sentinel Times, November 21: 2.	Vic.	Inverloch		*
Dent, S.	1998	Plover saved from extinction.	Herald Sun, March 19: 14.	Vic.	central Vic.		*

Details						Type	
Source	Year	Title	Reference	State	Location	Public debate	Advice to the public
Douglass, S.	1996	Birds doing quite well.	Portland Observer, May 10.	Vic.	Portland	*	
Douglass, S.	1997	Have a go	Portland Observer, May 9.	Vic.	Portland	*	
Douglass, S.	1997	Hooded Plover (2)	Portland Observer, April 18.	Vic.	Portland	*	
Fannin, P.	1999	Bird lovers stand vigil over vanishing plover.	The Age, November 29: 5.	Vic.	Phillip Is		*
Hoog Antink, M.	1996	Bird survival rate.	Portland Observer, June 10: 4.	Vic.	Portland	*	
Hoog Antink, M.	1997	Hooded Plovers	Portland Observer, May 9.	Vic.	Portland	*	
Hoog Antink, M.	1997	Hooded Plover (1)	Portland Observer, April 18.	Vic.	Portland	*	
Maud, F.	1994	Volunteers vigil to save an egg.	South Gippsland Sentinel Times, January 20.	Vic.	Phillip Is		*
Maud, N.	1997	Our cutest bird is so endearing, and … endangered.	South Gippsland Sentinel Times, November 18: 2.	Vic.	South Gippsland		*
Maud, N.	1999	Hooded Plover scoreline: 34 humans, four birds.	South Gippsland Sentinel Times, April 7.	Vic.	Phillip Is		*
Maud, N.	1999	Rescuing the Hooded Plover.	South Gippsland Sentinel Times, January 19: 2.	Vic.	Phillip Is		*
Meyer, D.	1997	Hooded Plover	Portland Observer, June 23.	Vic.	Portland	*	
Novotny, P. & R. Gilby.	1997	Bird survey disagrees with claim.	Portland Observer, March 28: 5.	Vic.	Portland	*	
Phillipps, L.	1997	Hooded Plover	Portland Observer, May 9.	Vic.	Portland	*	
Siddon, B	1999	Rain washes away evidence.	Western Weekly December Edition	Vic.	western Vic.		*
Weston, M. & H. Phillipps.	1996	Biological issues "incorrect"	Portland Observer, May 1: 10.	Vic.	Portland	*	
Weston, M. & H. Phillipps.	1996	Hooded Plovers	Portland Observer, May 29: 12.	Vic.	Portland	*	

Appendix 9

PUBLICATIONS ON THE HOODED PLOVER

This appendix presents the information published on Hooded Plovers. In the tables, asterisks indicate which option is appropriate for each publication. Abbreviations used in the appendix are given in Table 9.1. Entries are presented in alphabetical order.

Table 9.1. Abbreviations used in this appendix. General abbreviations are given in Appendix 1.

Relevant column	Abbreviation	Meaning
Source	Anon.	Anonymous
Reference	Bull.	Bulletin
	Nat.	Naturalist
	Orn.	Ornithologist
	Proc.	Proceedings
	Soc.	Society
Location	Gen.	General
Type	A	Abstract
	J	Journal
	M	Magazine
	N	Newsletter
	R	Report
	T	Thesis
Techniques	B	Banding
	S	Sexing

Details						Type of publication						Subjects covered								
Source	Year	Title	Reference	State	Location	Type	Review	Request for assistance	Popular article	New data/ observations	Major study	Techniques	Breeding biology	Foraging ecology	Habitat	Social biology/ behaviour	Taxonomy	Threatening process or mortality	Decline/ range contraction	Management
Anon.	1983	National Hooded Plover survey 1982 – W.A. results.	WA Bird Notes 25: 6.	WA	statewide	J				*										
Anon.	1995	Hark to the Hooded Plover.	Outdoors 5: 17.	Vic.	statewide	N		*												
Anon.	1995	Colour-banded Hooded Plovers - a plea for help.	VORG Newsl. August 1995.	Vic.	statewide	N		*				B								
Anon.	1995	Hooded Plovers.	Natural Selection 6: 1.	Vic.	Geelong area	N		*				B								
Anon.	1995	Meeting report.	VORG Newsl. October 1995: 2.	Vic.	statewide	N		*										*		
Anon.	1998	Hooded Plover Count-November 8th 1998.	Geelong Nat. 34: 3.	Vic.	statewide	J		*												
Anon.	1998	Hooded Plover/beach nesting bird survey.	Tattler 17: 2-3.	NSW, SA, Vic.	statewide	N		*												
Anon.	2000	Reducing threats to Hooded Plovers at beaches and coastal lakes.	WA Bird Notes 96: 19.	WA	statewide	J		*		*										*
Anon.	2000	Hooded Plover survey.	WA Bird Notes 93: 25-6.	WA	statewide	J		*												
Anon.	2001	Volunteer wanted.	Bird Observer 810: 27.	Vic.	Mornington Peninsula NP	N		*												
Anon.	2001	Volunteer wanted.	Bird Observer 811: 27.	Vic.	Mornington Peninsula NP	N		*												
Bailey, M.	1996	Esperance weekend January 26-28 1996.	WA Bird Notes 77: 9-10.	WA	Esperance area	J														
Bailey, M. & J. Blyth.	1996	Plover aggression.	WA Bird Notes 77:11.	WA	Lake Benje Benjenup	J				*						*				
Baird, B.	1997	Monitoring the Hooded Plover on Phillip Island.	Stilt 31: 54 and VWSG Bull. 21: 47.	Vic.	Phillip Is	J				*	*		*							
Baird, B. & P. Collins.	1996	The Hooded Plover on Phillip Island	VWSG Bull. 20: 44-8.	Vic.	Phillip Is	J				*	*		*			*		*		*
Baird, B. & P. Dann.	1999	Breeding Biology of Hooded Plovers on Phillip Island and methods of increasing breeding success.	Proc. AWSG Conference, Phillip Is. and Stilt 35: 59-60.	Vic.	Phillip Is	A				*	*		*							*
Baker-Gabb, D. & M.A. Weston.	2001	Draft New South Wales Hooded Plover Recovery Plan.	New South Wales National Parks and Wildlife Service, Sydney, Australia.	NSW	southern half of state	R	*											*		*
Bear, E.	2000	Habitat requirements of the Hooded Plover *Thinornis rubricollis*.	Unpubl. Hons thesis, Univ. Tas.	Tas.	eastern coast	T				*	*			*	*					
Blyth, J., & J. Blyth.	1998	Hooded Plovers at Bennetts Lake, Dunn Rock Nature Reserve.	WA Bird Notes 85: 15.	WA	Dunn Rock NR	J				*										
Bransbury, J.	1983	A study of the Hooded Plover in the South-East of South Australia.	Report to DEP, Adelaide	SA	south-east coast	R				*	*									

Details						Type of publication						Subjects covered								
Source	Year	Title	Reference	State	Location	Type	Review	Request for assistance	Popular article	New data/ observations	Major study	Techniques	Breeding biology	Foraging ecology	Habitat	Social biology/ behaviour	Taxonomy	Threatening process or mortality	Decline/ range contraction	Management
Bransbury, J.	1987	The status and distribution of the Hooded Plover in South Australia.	Report to DEP, Adelaide	SA	statewide	R				*	*									
Bransbury, J.	1990	A late breeding record of the Hooded Plover.	South Aust. Orn. 31: 55-6.	SA	south-east coast	J				*			*							
Bransbury, J.	1991	Biology and Behaviour of Breeding Hooded Plovers.	Final Report to the DEP Adelaide, South Australia.	SA	Kangaroo Is, entire coastline	R				*	*		*			*		*		
Brown, M.	1998	Hooded Plover network.	VWSG Bull. 21: 49.	Vic.	statewide	J		*												
Brown, M.	1998	Hooded Plover network.	Friends of the Hooded Plover newsletter 1.	Vic.	statewide	N		*										*		
Brown, M.	1999	Hooded Plover protection.	Coastline 16: 6.	Vic.	statewide	N		*												*
Buick, A.M.	1985	The behavioual ecology of the Hooded Plover *Charadrius rubricollis* on the Coorong during the non-breeding season.	Unpubl. Hons thesis, Univ. Melbourne	SA	Coorong	T				*	*			*	*					
Buick, A.M. & D.C. Paton.	1989	Impact of off-road vehicles on the nesting success of Hooded Plovers *Charadrius rubricollis* in the Coorong region of South Australia.	Emu 89: 159-72.	SA	Coorong	J				*	*							*		*
Cameron, D. & M.A. Weston	1999	The Hooded Plover: first confirmed record in Queensland, the longest movement yet recorded, and a discussion of range contraction in eastern Australia.	Aust. Bird Watcher 18: 8-18.	NSW, Qld	east coast Aust.	J				*	*								*	
Chafer, C.	1984	Northern distribution of the Hooded Plover in NSW.	Stilt 5: 27.	NSW	southern half of state	J				*									*	
Clarke, C.	1965	Disturbance of breeding and resting birds by bird-watchers.	S. Aust. Orn. 24: 41.	SA	unknown	J				*								*		
Cochrane, H.L.	1918	Hooded Dottrels.	Emu 17: 234-5.	Gen.		J														
Collier, S. & P. Collier.	1995	A survey of Hooded Plovers on Cape Barren Island.	Tas. Nat. 117: 28-31.	Tas.	Cape Barren IS	J				*										
Cooper, R.	1994	Hooded Plover – a measure of breeding success in north east Tasmania.	Tas. Bird Rep. 22: 12-13.	Tas.	north-east Tas.	J				*			*			*				
Cooper, R.	1997	Hooded Plover *Thinornis rubricollis*: winter flocks and breeding success in north-east Tasmania, Australia.	Stilt 30: 23-5.	Tas.	Cape Portland	J				*			*			*				
Crowley, M.A.	1991	Breeding of the Hooded Plover *Charadrius rubricollis*.	Nature in Eurobodalla 6: 50-52.	NSW	Eurobodalla Shire	J				*			*							

Details						Type of publication						Subjects covered								
Source	Year	Title	Reference	State	Location	Type	Review	Request for assistance	Popular article	New data/ observations	Major study	Techniques	Breeding biology	Foraging ecology	Habitat	Social biology/ behaviour	Taxonomy	Threatening process or mortality	Decline/ range contraction	Management
Crowley, M.A.	1996	Hooded Plover Survey.	Nature in Eurobodalla 11: 70-71.	NSW	Eurobodalla Shire	J				*										
Dann, P. & Baird, B.	1997	An experiment: a study of egg loss in Hooded Plovers on Phillip Island.	Stilt 31: 54 and VWSG Bull. 21: 47-8.	Vic.	Phillip Is	A				*	*									*
Dowling, B.	1997	Sharing the beach, how fair is it? Monitoring and management of the Hooded Plover within Mornington Peninsula National Park.	Stilt 31: 54 and VWSG Bull. 21: 46-7.	Vic.	Mornington Peninsula NP	A				*	*									*
Dowling, B.	1999	Managing a breeding population of the Hooded Plover *Thinornis rubricollis* in a high-use recreational National Park.	Proc. AWSG Conference, Phillip Is. and Stilt 35: 61.	Vic.	Mornington Peninsula NP	A				*	*		*							*
Dowling, B. & M.A. Weston.	1999	Managing a breeding population of the Hooded Plover *Thinornis rubricollis* in a high-use recreational environment.	Bird Conservation International 9: 255-70.	Vic.	Mornington Peninsula NP	J				*	*							*		*
Dowling, B., B. Baird, & M.A. Weston.	1997	Breeding success of the Hooded Plover in Victoria - a synthesis of results from Mornington Peninsula National Park, Phillip Island and the Bellarine Peninsula.	Stilt 31: 55 and VWSG Bull. 21: 48.	Vic.	statewide	A				*	*		*							
Farlam, D.	1987	Hooded Plover colour banding project, South Australia.	Stilt 11: 2.	SA	Coorong	J						B								
FitzGerald, B.	1990	Hooded Plovers at Bull-pup Beach.	Canberra Bird Notes 15(2): 37-8.	NSW	near Bawley Point	J				*										
Hanisch, D.	1998	The effect of human disturbance on the reproductive performance of the Hooded Plover, *Thinornis rubricollis*, in the south-east of Tasmania.	Unpubl. Hons thesis, Univ. Tas.	Tas.	south-east	T				*	*		*		*			*		
Heislers, D. & M.A. Weston	1993	An examination of the efficacy of counting Hooded Plovers in autumn in eastern Victoria, Australia.	Stilt 23: 20-22.	Vic.	eastern half of coast	J				*										
Hewish, M.	1989	Hooded Plovers, Pied Oystercatchers and a windy weekend at Discovery Bay, Victoria.	Stilt 15: 24-6.	Vic.	Discovery Bay CP	J				*										
Holdsworth, M. & P. Park	1993	1992 survey of the Hooded Plover in Tasmania	Stilt 22: 37-40	Tas.	statewide	J				*										
Houghton, S.	1996	Hooded Plovers at Lake Gore.	WA Bird Notes 17: 13-14.	WA	Lake Gore	J									*					
James, J.	1992	Hooded Plover.	Bird Obs. 719: 7.	Vic.	Mornington Peninsula NP	N				*			*							*
Jones, A.K.	1997	Further Hooded Plover surveys.	WA Bird Notes 83: 18.	WA	statewide	J														
Jones, A.K.	1997	WAHOOPS - further Hooded Plover surveys.	WA Bird Notes 84: 18.	WA	statewide	J		*												

Details						Type of publication						Subjects covered								
Source	Year	Title	Reference	State	Location	Type	Review	Request for assistance	Popular article	New data/ observations	Major study	Techniques	Breeding biology	Foraging ecology	Habitat	Social biology/ behaviour	Taxonomy	Threatening process or mortality	Decline/ range contraction	Management
Jones, A.K.	1998	Hooded Plover project.	WA Bird Notes 87: 22.	WA	statewide	J		*												
Jones, A.K.	1999	Hooded Plover news.	WA Bird Notes 90: 10.	WA	statewide	J		*												
Jones, B.	2000	Hooded Plovers and “adopt a beach”.	Far Sth Coast Birdwatchers Newsl. 5: 2.	NSW	Merimbula area	N														*
Kraaijeveld-Smit, F, R. MacIntosh & M.A. Weston.	1999	Sexing the Hooded Plover.	Proc. AWSG Conference, Phillip Is. and Stilt 35: 63.	Vic., WA		A				*	*	S								
Lane, B.	1980	The Hooded Plover (*Charadrius rubricollis*) Survey, October 1980.	VORG Notes 16: 59-60.	Vic.	statewide	J				*										
Lane, B.	1981	The Hooded Plover Survey, October 1980.	VWSG Bull. 3: 6-8.	Vic.	statewide	J				*										
Lane, B.	1990	Hooded Plover Survey.	RAOU Vicgroup Newsl. 18: 1.	Vic.	statewide	N														
Lane, B.A.	1982	Hooded Plover Survey, October 1982.	Stilt 2: 46.	Vic.	statewide	J				*										
Lane, B.A.	1982	Colour-banded Hooded Plovers.	VWSG Bull. 4: 15.	Vic.	statewide	J						B								
Lane, B.A.	1991	Survey of Victorian Beaches for Hooded Plovers - October 1990	Stilt 19: 7-8	Vic.	statewide	J				*										
Lane, S.G.	1985	The Hooded Plover - northern distribution in eastern Australia.	Stilt 6: 35.	NSW	southern half of state	J				*									*	
Lashmar, A.	1987	Colour-banded Hooded Plovers.	Stilt 10: 7.	SA	Kangaroo Is	J		*				B								
Lewis, L.	1994	Hooded Plover breeding.	SAOA Newsl. 149: 6.	SA	Carrickaling a	N				*			*							
Lingham, B.	1996	Hooded Plover.	GFNC Monthly News 19: 17.	Vic.	Bellarine Peninsula	N		*		*										
McAllan, I.A.W., & L. Christidis	1998	Neotype of the Hooded Plover *Charadrius rubricollis* Gmelin, 1789.	Bull. BOC 118(1): 59-61.	N/A	N/A	J											*			
McGill, A.R.	1969	The Hooded Dotterel.	Birds 3: 28-9.	NSW	southern half of state	J	*			*										
McIntyre, A., H. Hines & A. Pollock.	1995	Colour banding Hooded Plover Thinronis rubricollis in east Gippsland, Victoria.	Stilt 26: 50-53.	Vic.	east Gippsland	J				*	*	B								
Moore, E.	1994	Hooded Plover on Cape Barren Island, Tasmania.	Stilt 24: 24-5.	Tas.	Cape Barren IS, Bass Strait	J				*										
Morris, A.	1989	Hooded Plover Survey - New South Wales	Stilt 14: 37	NSW	statewide	J				*										
Murlis, M.	1989	Hooded Plover and Pied Oysterctahcre Survey – Victoria 1988	Stilt 14: 33-6	Vic.	statewide	J				*										
Myers, S.	1999	The breeding biology of the Hooded Plover - a talk to the Fauna Survey Group by Mike Weston.	Field Nat. News 75: 7.	Vic.	statewide	N							*						*	

Details						Type of publication						Subjects covered								
Source	Year	Title	Reference	State	Location	Type	Review	Request for assistance	Popular article	New data/ observations	Major study	Techniques	Breeding biology	Foraging ecology	Habitat	Social biology/ behaviour	Taxonomy	Threatening process or mortality	Decline/ range contraction	Management
Natt, V. & M.A. Weston	1995	The results of the 1994 Hooded Plover Survey for South Australia.	Stilt 27: 36-8.	SA	statewide	J				*										
Newbey, B.	1996	Hooded Plovers in Western Australia to 31 May 1994.	WA Bird Notes 77: 11-15.	WA	statewide	J				*										
Newbey, B.	2000	Successful September survey for Hooded Plovers.	WA Bird Notes 96: 9.	WA	statewide	J														
Newbey, B.	2000	Hooded Plover project.	WA Bird Notes 94: 10.	WA	statewide	J		*												*
Newbey, B.	2000	Hooded Plover project.	WA Bird Notes 95: 7-8.	WA	statewide	J		*												*
Newbey, B.J.	1996	Report on Hooded Plover project.	Suppl. WA Bird Notes 79.	WA	statewide	J				*										
Newman, M.	1982	Hooded Plover: is Tasmania the real stronghold?	Stilt 3: 8-9.	Tas.	statewide	J				*										
Newman, M. & I. Patterson	1984	A population survey of the Hooded Plover (*Charadrius rubricollis*) in Tasmania, October 1982.	Occ. Stint 3: 1-6.	Tas.	statewide	J				*										
Newman, O.M.G.	1986	Hooded Plover breeding at Mortimer Bay.	Occasional Stint 4: 18-20.	Tas.	Mortimer Bay	J				*			*							
Newman, O.M.G. & P. Park	1992	Egg laying interval: Pied Oystercatcher and Hooded Plover.	Stilt 20: 22-3.	Tas.	Mortimer Bay or Lauderdale	J				*			*							
Newman, O.M.G. & P. Park.	1993	Hooded Plovers – further breeding information including association with Pied Oystercatcher.	Stilt 23: 12-14.	Tas.	Mortimer Bay	J				*			*							
Nicholls, J.	1999	Hooded Plover Report No. 2: 1996-99. Book review.	Corella 23: 62.	WA	statewide	J	*													
Oberholser, H.C.	1919	The Status of *Charadrius rubricollis* Gmelin.	Auk 34: 279.	Gen.		J											*			
Olsen, S.	1998	Lectotypification of *Charadrius rubricollis* Gmelin, 1789.	Bull. BOC 118: 256-9.	Gen.		J											*			
Park, P.	1993	Observations on the breeding of the Hooded Plover.	Tas. Bird Report 22: 14.	Tas.	south east	J				*			*							
Park, P.	1994	Hooded Plovers and Marram Grass.	Stilt 25: 22.	Tas.	statewide	J				*								*		
Raines, J.	2001	Hooded Plover survey September 2000.	WA Bird Notes 97: 7-9.	WA	statewide	J		*		*										*
Reside, J.	1998	Discussion of fencing techniques for protecting shorebirds.	Bird Observer 783: 11-12.	Vic.	Gippsland Lakes	N														*
Retallick, R.W.R., & E.E. Bolitho	1993	Disturbance of Hooded Plovers by domestic dogs.	Stilt 23: 23.	Vic.	Mornington Peninsula NP	J				*								*		
Rose, A.	2000	Hooded Plovers and four wheel drive vehicles	WA Bird Notes 94: 16.	WA	Cape Arid NP	J				*								*		
Scarborough, D. & P. Scarborough.	1998	Try inland for a change.	Tas. Bird Report 26: 51-2.	Tas.	Great Oyster Bay	J				*			*		*					

Details						Type of publication						Subjects covered								
Source	Year	Title	Reference	State	Location	Type	Review	Request for assistance	Popular article	New data/ observations	Major study	Techniques	Breeding biology	Foraging ecology	Habitat	Social biology/ behaviour	Taxonomy	Threatening process or mortality	Decline/ range contraction	Management
Schulz, M.	1984	The feeding behaviour of the Hooded Plover *Charadrius rubricollis* (Gmelin) in an ocean-shore environment.	Unpubl. Hons thesis, Univ. Adelaide	Vic.	Wilson's Promontory NP	T				*	*			*						
Schulz, M.	1986	The Hooded Plover (*Charadrius rubricollis*) as a reef-forager.	Stilt 9: 50-55.	Vic.	Thorny Beach Reef and Breamlea	J				*				*	*					
Schulz, M.	1987	Flocking behaviour in the Hooded Plover *Charadrius rubricollis*.	Corella 11: 28-9.	Vic.	Wilson's Promontory NP	J				*	*					*				
Schulz, M.	1988	The Hooded Plover - a plea for help.	Stilt 13: 12-13.	Vic.	WA, SA, Tas., NSW	J		*												
Schulz, M.	1988	The breeding of Pied Oystercatchers and Hooded Plover on wide ocean beaches - a nesting association?	Stilt 12: 58-9.	NSW, Vic.	East Gippsland and southern NSW	J				*			*							
Schulz, M.	1992	Hooded Plover taken by a Peregrine Falcon.	Stilt 21: 27.	Vic.	Discovery Bay CP	J				*								*		
Schulz, M.	1992	Hooded Plover – Flora and Fauna Guarantee Action Statement No. 9.	Department of Natural Resources and Environment. Melbourne, Australia.	Vic.	statewide	R	*			*								*		*
Schulz, M.	1993	A survey of the Hooded Plover on the north-west Tasmanian coastline from Macquarie Harbour to Bluff Point.	Stilt 22: 40-43.	Tas.	north-west coastline	J				*										
Schulz, M.	1995	Observations on the Hooded Plover Thinornis rubricollis on Kangaroo Island, South Australia.	Stilt 26: 54-7.	SA	Kangaroo Is	J							*		*	*				
Schulz, M.	1995	Observations of the Hooded Plover on Kangaroo Island.	Stilt 26: 54-7.	SA	Kangaroo IS, entire coastline	J				*										
Schulz, M. & K. Kristensen	1993	A survey of shorebirds of western Tasmania. Part two. North Head, Port Davey Entrance to Cape Sorrell.	Stilt 23: 26-9.	Tas.	Western coastline, Port Davey Entrance to Cape Sorrell	J				*										
Schulz, M. & L. Lumsden	1983	Fluctuations in Hooded Plover numbers at Venus Bay in 1981 and 1982.	VWSG Bull. 7: 11-12.	Vic.	Venus Bay	J				*	*					*				

Details						Type of publication						Subjects covered								
Source	Year	Title	Reference	State	Location	Type	Review	Request for assistance	Popular article	New data/ observations	Major study	Techniques	Breeding biology	Foraging ecology	Habitat	Social biology/ behaviour	Taxonomy	Threatening process or mortality	Decline/ range contraction	Management
Schulz, M. & M. Bamford	1987	The Hooded Plover – an RAOU Conservation Statement.	RAOU (Birds Australia) Report 35, Melbourne, Australia.	All		R	*													
Schulz, M., A. Grant & L. Lumsden	1984	Some aspects of the feeding behaviour and diet in the Hooded Plover, *Charadrius rubricollis* (Charadriidae), during the non-breeding season.	Stilt 5: 2-8.	Vic.	Wilson's Promontory NP and Venus Bay	J				*	*			*						
Serventy, D.L.	1943	Hooded Dotterel near Sydney.	Emu 43: 72	NSW	Sydney area	J				*									*	
Singor, M.	1998	Hooded Plovers at Yalgorup National Park.	WA Bird Notes 85: 10-13.	WA	Yalgorup NP	N				*	*		*		*					
Singor, M.	1998	Hooded Plover Project, Progress Report.	WA Bird Notes 86: 12-14.	WA	statewide	J				*										
Singor, M.	1999	Hooded Plover Report No. 2: 1996-99. The search continues…	Stilt 35: 42.	WA	statewide	J				*										
Sova, M. & M.A. Weston	1999	The foraging ecology of the Hooded Plover in eastern and western Australia.	Proc. AWSG Conference, Phillip Is. and Stilt 35: 65-6	WA, Vic.	statewide	A				*	*			*						
Starks, J.	1987	Results of the Victorian Hooded Plover Survey 1986.	Stilt 11: 12-13.	Vic.	statewide	J				*										
Stewart, I.D.	1989	Hooded Plover Survey-SA/Vic. Border to Murray Mouth	Stilt 14: 32-3.	SA	south-east	J				*										
Stewart, I.D.	1991	1990 Spring Hooded Plover Survey, South Australia	Stilt 19: 9-10.	SA	south-east	J				*										
Stewart, I.D.	1993	1992 Hooded Plover Survey, South Australia.	Stilt 22: 44.	SA	south-east coast	J				*										
Straw, P.	1995	Hooded Plover Survey - New South Wales.	NSW Wader News 6: 4-5.	NSW	statewide	N				*										
Taylor, S., J. Wilson, E. Thomas, S. Keenan, M. Hoskins & M.A. Weston.	1999	The distribution and numbers of Hooded Plover at Wilson's Promontory National Park.	Proc. AWSG Conference, Phillip Is. and Stilt 35: 69.	Vic.	Wilson's Promontory NP	J				*					*					
Urquhart, M.	2000	Strategies for the management of the Hooded Plover in Victoria.	Parks Victoria, Melbourne.	Vic.	statewide	R				*								*		*
Weston, M.A.	1993	Twelve years of counting the Hooded Plover in Victoria, Australia.	Stilt 23: 15-19.	Vic.	statewide	J				*	*									
Weston, M.A.	1993	Results of the 1992 Hooded Plover/Pied Oystercatcher Survey of the Victorian Coast.	Stilt 22: 45-6.	Vic.	statewide	J				*										
Weston, M.A.	1994	Beach Residents Living on the Edge.	Geo 16: 22-23.	All states		M			*											

Details						Type of publication						Subjects covered								
Source	Year	Title	Reference	State	Location	Type	Review	Request for assistance	Popular article	New data/ observations	Major study	Techniques	Breeding biology	Foraging ecology	Habitat	Social biology/ behaviour	Taxonomy	Threatening process or mortality	Decline/ range contraction	Management
Weston, M.A.	1995	Hooded Plover Study: another plea for help.	Stilt 27: 43.	Vic.	statewide	J		*				B								
Weston, M.A.	1995	Results of the 1994 Hooded Plover Survey of Victorian Beaches.	Stilt 27: 39-43.	Vic.	statewide	J				*										
Weston, M.A.	1995	Fencing as a technique for managing disturbance on beaches for the Hooded Plover *Thinornis rubricollis*.	Bird Observer 759: 12.	Vic.	Pt Lonsdale	N				*										*
Weston, M.A.	1996	Hounding the Hoodies.	VWSG Bull. 20: 49-50.	Vic.	statewide	J		*												
Weston, M.A.	1997	Keeping people on the beach - fencing as a technique for managing the Hooded Plover.	Bird Observer 779: 5-7.	Vic.	Pt Lonsdale	N				*										*
Weston, M.A.	1997	Same place, same time - same plover? Colour-banding the Hooded Plover in Victoria.	Stilt 31: 55 and VWSG Bull. 21: 48.	Vic.	statewide	A				*	*	B								
Weston, M.A.	1998	A reply to Reside.	Bird Observer 783: 11-12.	Vic.	Pt Lonsdale	N				*										*
Weston, M.A.	1998	Some undescribed aggressive behaviours, displays and calls of the Hooded Plover in Western Australia.	WA Nat. 22: 105-14.	WA	Lake Gore	J				*						*				
Weston, M.A.	1998	Nankeen Kestrel takes Hooded Plover chick.	Aust. Bird Watcher 17: 266-7.	Vic.	Collendina	J				*								*		
Weston, M.A.	1998	An Observation of Aggression Between a Hooded Plover and a Black-fronted Dotterel.	Aust. Bird Watcher 17: 301-302.	Vic.	Apollo Bay	J				*						*				
Weston, M.A.	1999	Management of the Hooded Plover in western Victoria.	Pp: 17 In: Anon. 1999. Threatened Fauna Management. Proc. Ecol. Manag. Forum, 19th October 1999, Parks Victoria, Victoria West Region.	Vic.	western district	A	*			*										
Weston, M.A.	1999	Effects of human disturbance on the breeding of the Hooded Plover.	Proc. AWSG Conference, Phillip Is. and Stilt 35: 70.	Vic.	statewide	A				*	*		*					*		
Weston, M.A.	2000	The effect of human disturbance on the breeding biology of the Hooded Plover.	Unpubl. PhD thesis, Univ. Melbourne.	Vic.	Cape Otway to Wilson's Promontory	T	*			*	*	B,S	*			*		*		*
Weston, M.A.	2000	Outfoxing the Hooded Plover	Wingspan 10: 6-7.	Vic.	western section	N				*	*							*		*

Details						Type of publication						Subjects covered								
Source	Year	Title	Reference	State	Location	Type	Review	Request for assistance	Popular article	New data/ observations	Major study	Techniques	Breeding biology	Foraging ecology	Habitat	Social biology/ behaviour	Taxonomy	Threatening process or mortality	Decline/ range contraction	Management
Weston, M.A. & F. Morrow.	2000	Managing the Hooded Plover in Western Victoria.	Birds Australia and Parks Victoria, Melbourne, Australia.	Vic.	western section	R				*	*		*					*	*	*
Weston, M.A. & M.A. Elgar.	1998	Effects of human disturbance on the breeding biology of the Hooded Plover.	Proc. Soc. Cons. Biol. 1998: 91.	Vic.	statewide	A				*	*							*		
Weston, M.A. & M.A. Elgar.	2000	The effect of a major rainfall event on Hooded Plovers on a salt-lake in Western Australia.	Emu 100: 64-70.	WA	Lake Gore	J				*	*			*						
Weston, M.A. & S. Paton.	2001	The 2000 Hooded Plover count for Victoria: report to participants and newsletter (1)	Hooded Plover Counter 1: 1-2.	Vic.	statewide	N				*										
Weston, M.A., A.J. Burke, V.L. Ford, I.D. Stewart, & B. Dowling.	1998	Four-egg clutches in the Hooded Plover: description, occurrence and female investment.	Aust. Bird Watcher 17: 383-9.	NSW, SA, Vic.	statewide	J				*			*							
Whitelaw, A.	2001	A tale of 2+2 hoodies	South Gippsland Society News, Autumn edition	Vic.	South Gippsland	N				*			*					*		*

Appendix 10

UNPUBLISHED ARTICLES ON THE HOODED PLOVER

This appendix presents the unpublished articles on Hooded Plovers that are known to be in preparation or have been cited as “In preparation” but have not as yet been published. In the table, asterisks indicate which option is appropriate for each publication. Abbreviations used in the appendix are given in Table 9.1 of Appendix 9.

Details in the table are subject to change, and it is likely that not all articles in the table will end up being published.

Details						Subjects covered								
Source	Year	Title	State	Location	Intended Type	Techniques	Breeding biology	Foraging ecology	Habitat	Social biology/ behaviour	Taxonomy	Threatening process or mortality	Decline/ range contraction	Management
Berry, L.		Nest predation in Australian woodland and shoreline-nesting birds.	Tas.	Mt William NP	T		*							
Dowling, B. & M.A. Weston.		Does effective management of the Hooded Plover increase local populations?	Vic.	Mornington Peninsula NP	J									*
M.A. Weston , F. Kraaijeveld-Smit, R. McIntosh, G. Sofronidis & M.A. Elgar.		A male-biased sex ratio in non-breeding hooded plovers on a salt-lake in Western Australia.	WA, Vic.	Lake Gore	J					*		*		
McAllan, I.A.W.	2001[a]	Care with historical records: the case of northern reports of the Hooded Plover.	NSW, Qld	east coast Aust.	J								*	
Schulz, M.	1995[b]	The Hooded Plover *Thinornis rubricollis* on Discovery Bay, western Victoria between 1975 and 1995.	Vic.	Discovery Bay CP	?									
Teoh, V. & M.A. Weston		Hooded Plover *Thinornis rubricollis* chick attacked by conspecifics.	Vic.	Mornington Peninsula NP	J							*		
Weston, M.A.		Fringe-dwelling birds and four by fours.	All		M									
Weston, M.A.		Geographical variation in morphology and plumage of the hooded plover *Thinornis rubricollis*	WA, Vic.	Vic. and Lake Gore	J						*			
Weston, M.A.	2001 [a]	The evaluation of historical reports and the precautionary principle; a reply to Mcallan (2001).	NSW, Qld		J								*	
Weston, M.A.		People in dunes – might hooded plovers remember?	Vic.	central Vic.	J							*		*
Weston, M.A.		An experimental assessment of the potential effectiveness of temporary beach closures in reducing disturbance of incubating hooded plovers by humans.	Vic.	central Vic.	J									*
Weston, M.A.		Opportunistic counts of hooded plovers on Tasmanian beaches	Tas.	statewide	J									
Weston, M.A.		Erosion control in dunes – a hidden danger	All		N							*		*
Weston, M.A. & F. Morrow.		An examination of fox-baiting as a tool to increase hooded plover hatching success, and a lesson in assumption driven research.	Vic.	western Vic.	J		*					*		*
Weston, M.A. & J.M. Peter		The occurrence of hooded plovers in Port Phillip Bay.	Vic.	Port Phillip Bay	J				*					
Weston, M.A. & M. Sova		The foraging and diet of hooded plovers in eastern and western Australia.	WA, Vic.	Vic. and Lake Gore	J			*						
Weston, M.A., P. Straw & V. Natt.		The Hooded Plover *Thinornis rubricollis* in south eastern Australia: population, distribution and counting biases.	NSW, SA, Vic.		J									
Weston, M.A., E. Taylor, S., J. Wilson, E. Thomas, S. Keenan, M. Hoskins.		The status of the Hooded Plover in Wilson's Promontory National Park.	Vic.	Wilson's Promontory NP	J		*					*		

[a]Probable year of publication

[b]Year that the paper was cited "In preparation"

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