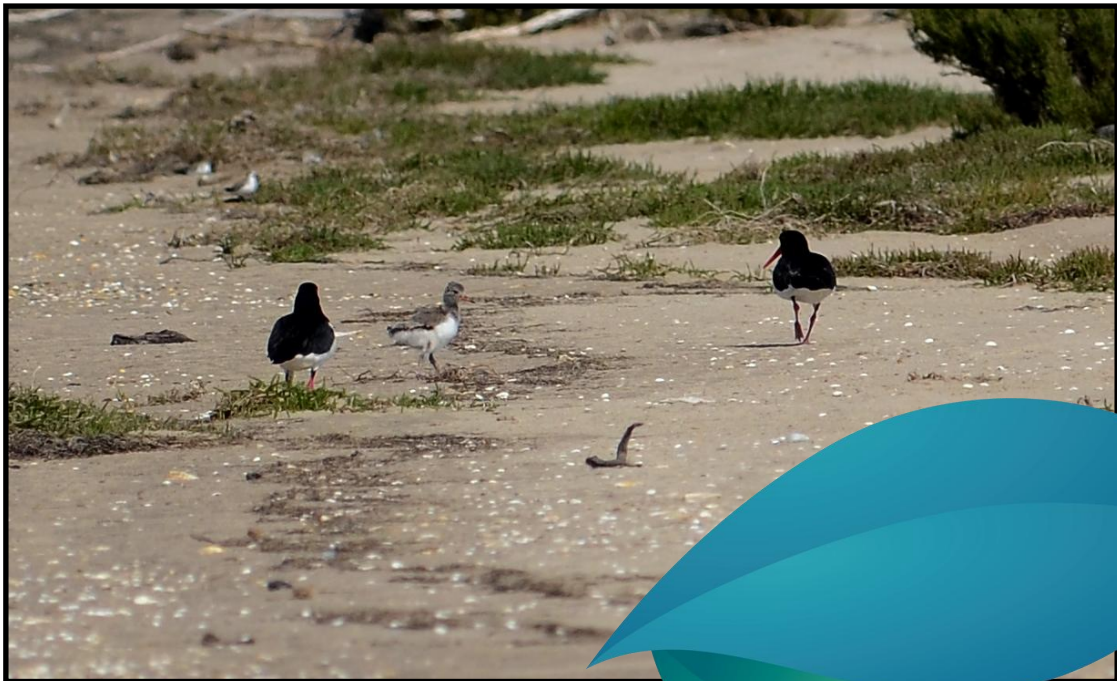


Resident Shorebirds and Seabirds of the Pitt Water Orielton Lagoon Nature Reserve and Ramsar Site

Dr Eric J Woehler, BirdLife Tasmania

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Australian Pied Oystercatchers with chick
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Executive summary

Three species of shorebird (Australian Pied and Sooty Oystercatchers and Red-capped Plover) and four species of seabird (Caspian Tern, Silver, Kelp and Pacific Gulls) breed within the Pitt Water Orielton Lagoon Nature Reserve and Ramsar Site.

Threats to these breeding species comprise livestock on foreshores, marine debris and waste materials disposed on foreshores, human disturbance and domestic and feral animals.

Relatively few historical data are available for the survey area, so the present survey establishes important baseline data for future surveys and monitoring efforts. Recognised and managed for its populations of migratory shorebirds since 1982, the Pitt Water Orielton Lagoon Nature Reserve and Ramsar Site is now known to also hold nationally- and internationally- significant numbers of breeding Australian Pied Oystercatchers, with more than 60 breeding pairs recorded in the wetlands. These birds are present year-round, and management of the Pitt Water Orielton Lagoon Nature Reserve and Ramsar Site must incorporate additional measures to conserve them.

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Introduction

The Pitt Water Orielton Lagoon (PWOL) is a Ramsar wetland of international significance (Box 1), with extensive shorebird and waterfowl populations that use the lagoon for some or all of a year. The Ramsar Site was declared in 1982 and management responsibility is with the Parks and Wildlife Service of DPIW. Full details of the known values and of the management regime for the wetlands is in Parks and Wildlife Service (2010). A map of the Ramsar Site and the PWOL Nature Reserve is shown in Figure 1.

Counts of migratory and some resident shorebirds have been undertaken in Barilla Bay and Orielton Lagoon since the mid-1960s by BirdLife Tasmania (formerly Bird Observers' Association of Tasmania - BOAT and Birds Tasmania). More than 30 species of migratory shorebirds have been recorded in the Nature Reserve (Parks and Wildlife Service 2010, BirdLife Tasmania unpubl. data).

Numbers of many species of migratory shorebirds have decreased since the earliest counts in the 1960s, with significant decreases of Curlew Sandpipers *Calidris ferruginea* and Eastern Curlews *Numenius madagascariensis* both in the Reserve and elsewhere in Tasmania (BirdLife Tasmania unpubl. data). Current populations of Double-banded Plover *Charadrius bicinctus*, Red-necked Stint *C. ruficollis* Eastern Curlew and Common Greenshank *Tringa nebularia* in the Reserve all exceed 0.1% of their global population estimates (Woehler and Park 2006).

To date, dedicated and broad-scale surveys of nesting sites of resident shorebirds have not been undertaken within the Reserve due to limited access (the nesting sites need to be accessed either via boat or through private land) and the emphasis on migratory shorebirds for national monitoring efforts. Preliminary analyses of selected shorebird count data were undertaken for a recent community report card (NRM South 2012).

The aims of the current project are to:

- address the major data gap on the presence of nesting sites of resident shorebirds in the PWOL Nature Reserve and Ramsar Site by the provision of fine-scale GPS data for nesting territories,
- assess and identify the significance of values associated with these breeding populations,
- identify observed threats to the resident shorebirds and seabirds,
- provide baselines to monitor changes in conditions and values, and the efficacy of any management actions targeted at coastal habitats and bird values, and
- provide lists of all birds species previously reported from Barren and Woody Islands, and from Suzie Islet.

The establishment of baseline data on resident shorebirds (and other bird values) will increase the knowledge available on the values of the Ramsar Site and the Nature Reserve, and provide critical information for future management actions. For the purposes of this report, the PWOL Ramsar Site and PWOL Nature Reserve will be referred to as PWOL, in recognition of their extensive spatial overlap. The primary focus of the present survey is on



nesting shorebirds and seabirds, but data on migratory shorebirds, waterbirds and woodland birds are included where they add to the existing state of knowledge for PWOL.

Box 1. Summary of Pitt Water Orielton Lagoon Ramsar Site

“Pittwater-Orielton Lagoon. 16/11/82; Tasmania; 3,175 ha; 42°47'S 147°30'E. A tidal salt water lagoon with a narrow entrance to the sea, the site includes the estuaries of four rivers. Most of the wetland is fringed by saltmarsh vegetation and rocky shores. The site is of international importance as a summer feeding area for migratory shorebirds, and supports large numbers of the endemic sea-star (*Patiriella vivipara*) and several scarce or endangered plant species. Ramsar site no. 254. Most recent RIS information: 1998.”

Source: http://www.ramsar.org/cda/en/ramsar-documents-list-anno-australia/main/ramsar/1-31-218%5E16713_4000_0

Methods

All mapping data were collected using a Garmin GPSmap 76CSx 12-channel hand-held unit based on the WGS-84 datum and recorded as UTM coordinates. During the boat surveys, the locations of nesting birds and breeding territories were marked on small-scale (approximately 1:20,000) maps while in the field. The UTM coordinates of these locations were derived from Google Earth. The bird surveys report both the number of breeding pairs for each species, and the total number of individuals observed for each species.

Resident shorebirds (boat and ground-based surveys)

Extensive foreshore areas of the PWOL foreshore are inaccessible on foot due to extensive areas of fine silts and muds, and deep sediments. These areas were surveyed from a small dinghy using 10x40 binoculars to scan the foreshore and identify nesting shorebirds on their breeding territories. The shallow depths of PWOL frequently ensured approaches were no closer than 50m or so offshore. Resident shorebirds were typically observed as pairs, and the survey assumed that these pairs occupied a breeding territory. In some cases, chicks were observed during the boat surveys that validated this assumption.

Ground-based surveys were undertaken where access to the foreshore was possible and where the silt sediments allowed on-foot travel. These surveys were conducted in a manner identical to shorebird mapping surveys elsewhere in Tasmania (BirdLife Tasmania, unpubl. data) to provide comparable GPS and population data. Many shorebird nests with eggs or chicks were encountered during these surveys.

Resident seabirds (gulls and terns)

The Silver Gull (*Chroicocephalus novaehollandiae*) colony on the south-eastern foreshore on the Sorell Causeway was surveyed using the methods described in Woehler (2012), consistent with past efforts to survey gull colonies in southeast Tasmania since the



1980s. Briefly, this involved walking along the water line and along the roadside to count nests, eggs and adults present. The data from this survey will be included in monitoring of the colony during the 2012/13 season, as further visits will be made. See Woehler (2012) for further details of the survey method and a review of past surveys of the colony. A limited number of comparisons with the monitoring data from this colony in recent years was undertaken for this study, reflecting the concerns raised in Woehler (2012).

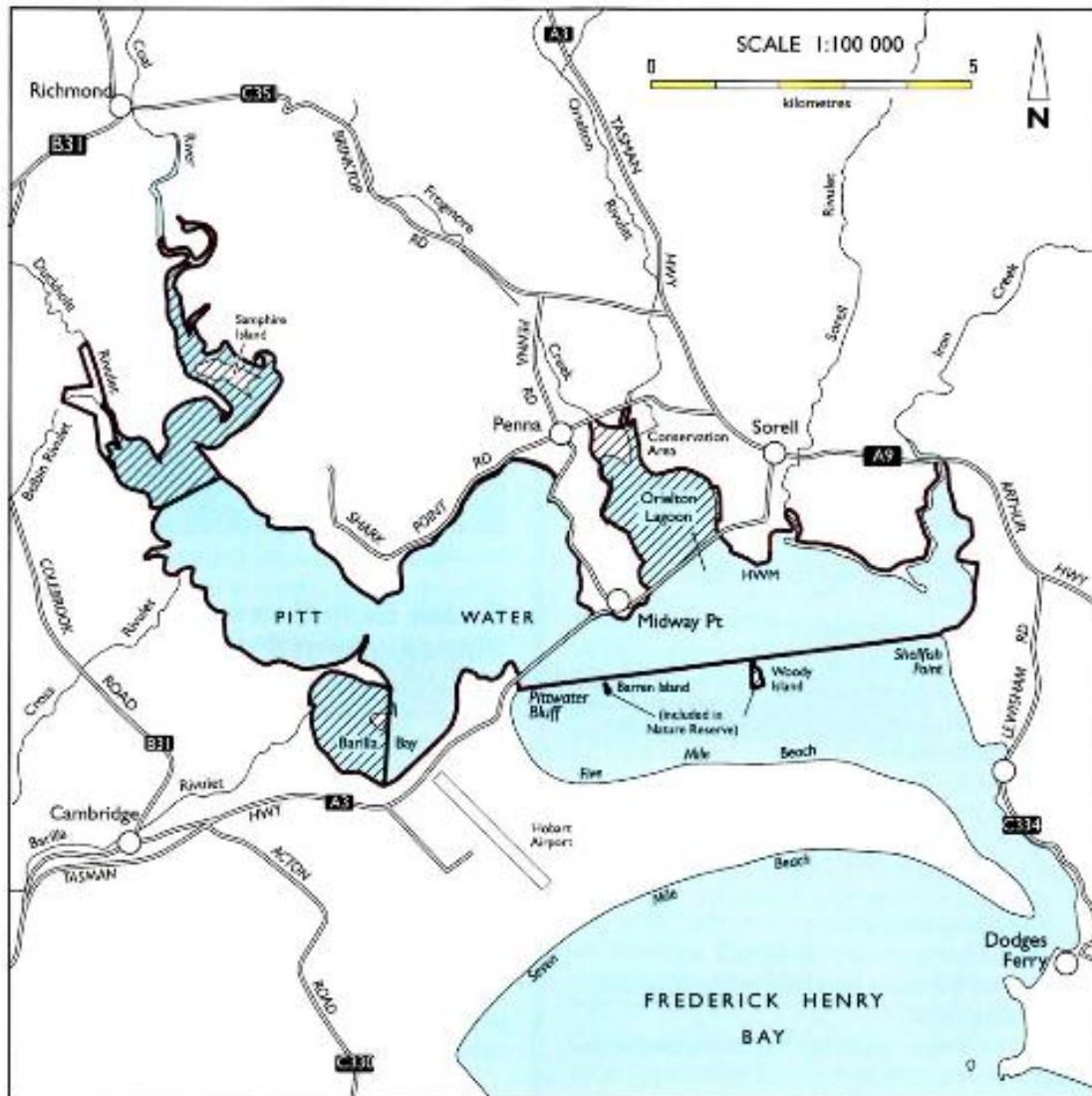


Figure 1. Map of the Pitt Water Orielton Lagoon Ramsar Site and Nature Reserve (adapted from State of Tasmania 2008). The Nature Reserve (NR) is shown with diagonal stripes and the Ramsar Site is enclosed by the heavy black line.

The colony of Kelp Gulls (*Larus dominicanus*) on the northern mud-flats and foreshores of Orielton Lagoon was surveyed on foot. Due to the dispersed nature of the colony, the survey was undertaken from the perimeter of the colony, as not all nests were visible from a single viewing position. Nesting by Caspian Terns (*Sterna caspia*), breeding Kelp, Silver and Pacific Gulls (*Larus pacificus*) was observed elsewhere in PWOL, and were documented



using the methods for resident shorebirds, with observations of nests, alarm calls and of birds returning to nests as indicative of nesting.

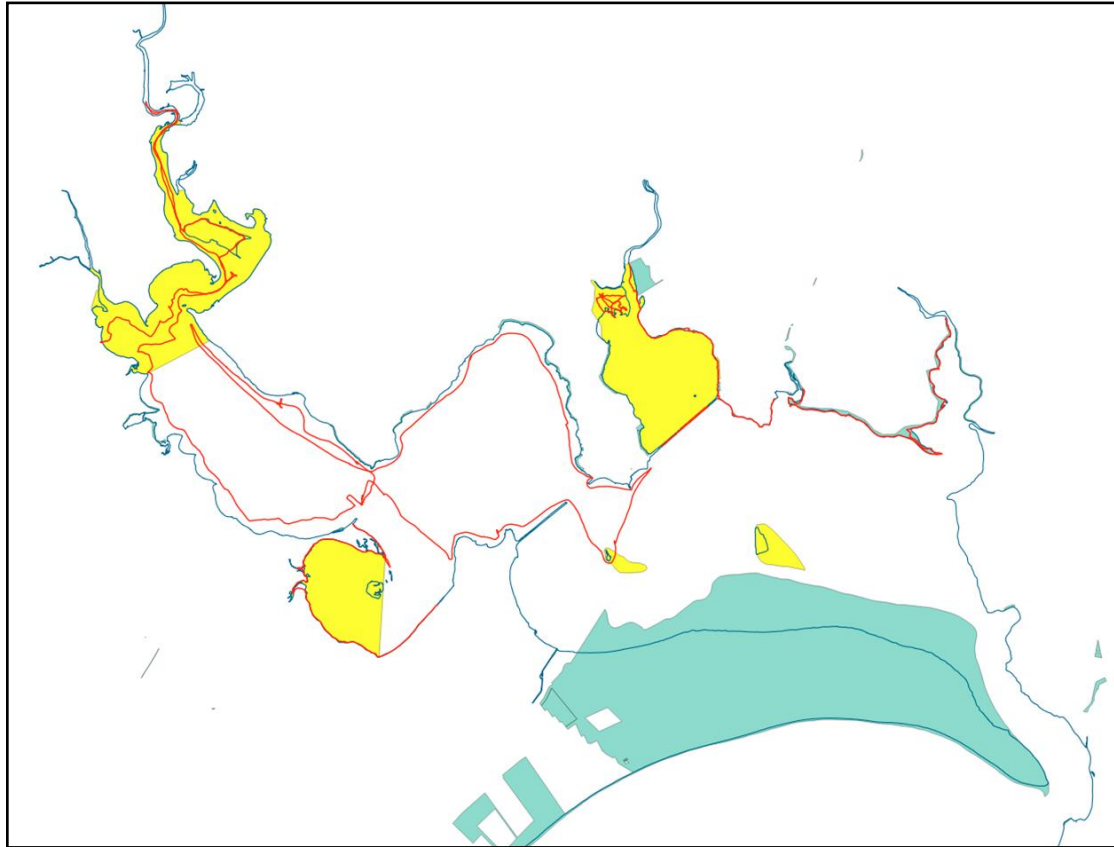


Figure 2. Survey effort in the Pitt Water Orielton Lagoon Ramsar Site and Nature Reserve, November - December 2012. The PWOL NR is shown in yellow, and adjacent reserves are shown in pale green; the Seven Mile Beach Protected Area covers most of the Llanherne Peninsula. The survey tracks (water and foreshore) are shown in red (see Table 1 for details).

Woodland birds on Barren and Woody Islands, and on Suzie Islet

The lists of bird species previously recorded on Barren and Woody Islands and on Suzie Islet were obtained by a search and extraction of the BirdLife Tasmania observations database. No ground-based surveys of birds on these islands were undertaken for the present study.

Waterbirds and other observations

General observations of birds were made during all survey days. The list of bird species observed, and where appropriate, estimates of numbers, are detailed. Observations and/or evidence of threats to shorebird and seabird values made during the surveys were



collated and mapped where useful or relevant. This included, but was not limited to observations of feral cat prints and unsupervised dogs, the presence of marine debris etc.

Estimations of populations' significance

There are presently no official guidelines for assessing the level of significance of resident (ie non-migratory) shorebird populations in Australia beyond their inclusion for sites through the application of Ramsar criteria. These criteria use a mixture of percentages of populations and absolute numbers to identify sites of international significance holding populations that meet the criteria. Species whose estimated resident populations exceed the 1% threshold are highlighted

Results

Surveys were conducted on six days and comprised boat-and ground-based surveys. A total of approximately 67.4km of foreshore was surveyed, approximately 44.1km by boat and 23.3km on foot (Figure 2, Table 1). A total of seven species was observed breeding (nests and/or chicks), or evidence of breeding observed (nests under construction, swooping flights to defend nests etc), Table 2. Detailed accounts for each of the seven breeding species follow.

Table 1. Survey effort, PWOL 2012/13.

Date	Foreshore area(s) surveyed, km	Survey method
20 Nov 2012	Upper Pitt Water, Coal River (20.2 km)	Boat survey, on-foot survey of Samphire Island and small beach
25 Nov 2012	Sorell Causeway Silver Gull colony (0.97 km)	On foot. Further visits to colony made
27 Nov 2012	Barilla Bay (6.8 km)	On foot
28 Nov 2012	Pitt Water, Barren I (23.9 km)	Boat survey
2 Dec 2012	Orielton Lagoon, Sorell Causeway to Iron Ck (12.3km)	On foot
5 Dec 2012	Orielton Lagoon (3.2 km)	On foot



Table 2. Estimated total breeding populations, shorebirds and seabirds, PWOL 2012/13.

Common name	Scientific name	#breeding pairs	#birds	Comments	EPBC Act 1999
Australian Pied Oystercatcher	<i>Haematopus longirostris</i>	62	124		-
Sooty Oystercatcher	<i>Haematopus fuliginosis</i>	4	5		-
Hooded Plover	<i>Thinornis rubricollis</i>	Nil	Nil	Nesting habitat absent from survey area, nesting occurs on Sandy Point, <i>Seven Mile Beach Protected Area</i>	Marine
Red-capped Plover	<i>Charadrius ruficapillus</i>	10	52		Marine
Black-fronted Plover	<i>Euseyornis melanops</i>	Nil	Nil	Breeding habitat present, occasional breeding previously reported.	-
Caspian Tern	<i>Sterna caspia</i>	3	6		Marine, migratory
Silver Gull	<i>Chroicocephalus novaehollandiae</i>	425 nests		Nesting effort on Sorell Causeway appears to be lower than the 2011/12 season, with no chicks observed on 25 November following egg oiling, but note also extensive concerns in Woehler (2012)	Marine
Kelp Gull	<i>Larus dominicanus</i>	300 nests		Colony increasing, <u>may</u> pose threat to migratory shorebirds by alienating feeding habitat in Orielton Lagoon, disturbance	Marine
Pacific Gull	<i>Larus pacificus</i>	1	2	Sole nesting pair observed on Barren Island	Marine

Breeding species accounts

Australian Pied Oystercatcher

A total of 62 nests and breeding territories was observed during the surveys (Figure 3, Appendix 1). The highest concentration of breeding territories was in Barilla Bay, with 5 nests with eggs, 5 territories with nest scraps and a further 4 territories. Breeding territories were also present in the lower reaches of the Coal River and between Sorell and Iron Creek. Australian Pied Oystercatcher territories were absent between Horatio Point and the Midway Point Causeway, largely due to the presence of cliffs and unsuitable habitat. The western foreshore northwest of Railway Point was similar, with low cliffs and an absence of suitable nesting habitat.

Patterson (1982) reported “4 or 5” breeding pairs in Barilla Bay, and Park (1983) reported one breeding pair in Orielton Lagoon, and “at least” three pairs nesting at “Sorell”. Newman and Patterson (1986) and Newman and Park (1992) reported up to 48 pairs on Seven and Five Mile Beaches and Milford. Four pairs were reported nesting in Orielton Lagoon (Newman and Park 1992).

Pied Oystercatchers nest on Little Spectacle and Spectacle Islands outside the PWOL (Brothers et al. 2001, Woehler 2010, OMG Newman, pers. comm.).



A survey in January 2012 of the Milford, Five Mile Beach and Seven Mile Beach foreshores located just 32 nests (BirdLife Tasmania 2012). In conjunction with the present survey, the Pitt Water Orielton Lagoon Nature Reserve, Ramsar Site and adjacent Seven Mile Beach Protected Area conservatively holds at least 94 nests, or at least 188 breeding adults. This is approximately 1.3 to 1.7% of the estimated global population of the Australian Pied Oystercatcher, and immediately identifies the area of national and international significance for the species.

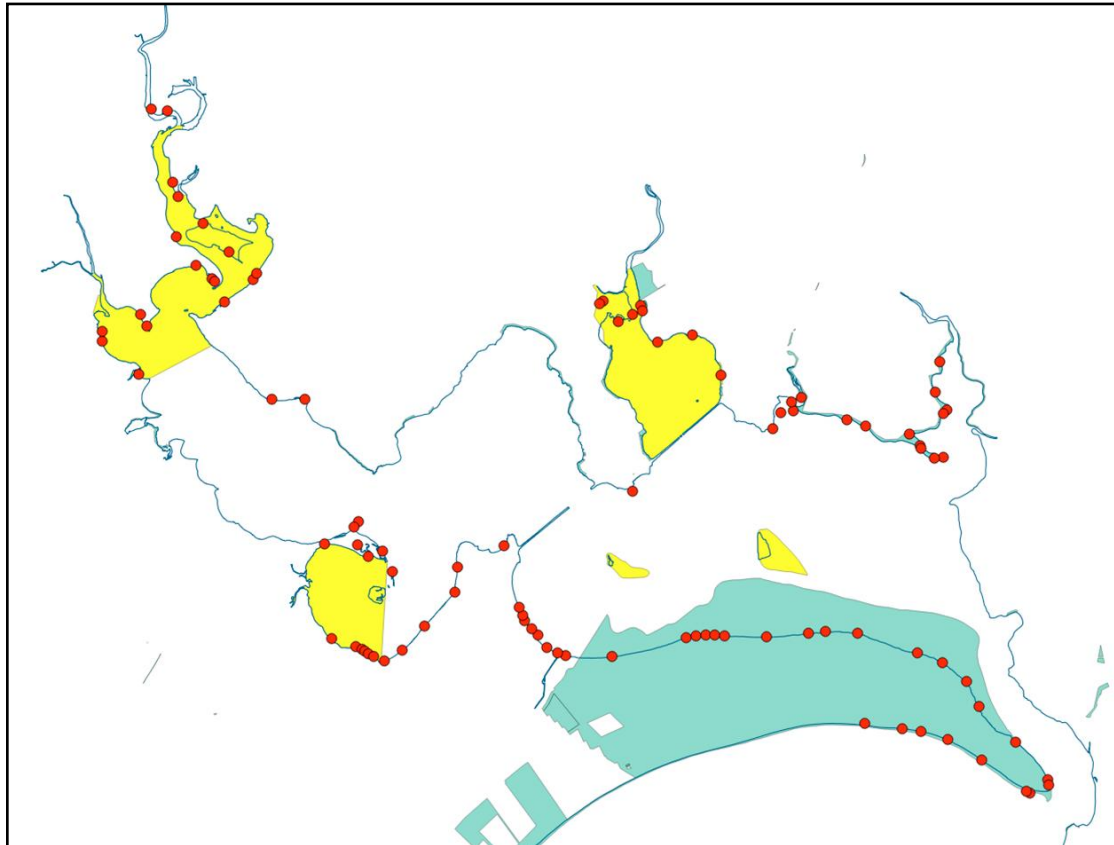


Figure 3. Breeding territories of Australian Pied Oystercatchers (n = 62), 2012/13. Each red dot indicates a nest site, nest scrapes or a breeding pair on their territory. The 32 nests located during surveys in January 2012 on the Milford, Five Mile and Seven Mile Beach foreshores are included to indicate the high density breeding population of Australian Pied Oystercatchers in the area (see text above and Discussion). The PWOL NR is shown in yellow, and adjacent reserves are shown in pale green; the Seven Mile Beach Protected Area covers most of the Llanherne Peninsula.

Sooty Oystercatcher

Only four breeding territories were located during the survey (Figure 4). Evidence of nesting was present on Barren Island and on the Oaks Point foreshore; the other two observations were of breeding adults only. In total, five Sooty Oystercatchers were observed during the present survey. A single pair was observed on the Five Mile Beach foreshore in January 2012.



Nesting by Sooty Oystercatchers on sandy substrates is extremely rare (Lauro and Nol 1995) and may signify either an increasing population and/or unsuitable nesting habitat on adjacent islands which are the typical nesting sites for the species (Brothers et al. 2001). Sooty Oystercatchers nest on Little Spectacle and Spectacle Islands outside the PWOL (Brothers et al. 2001, Woehler 2010, OMG Newman, pers. comm.).

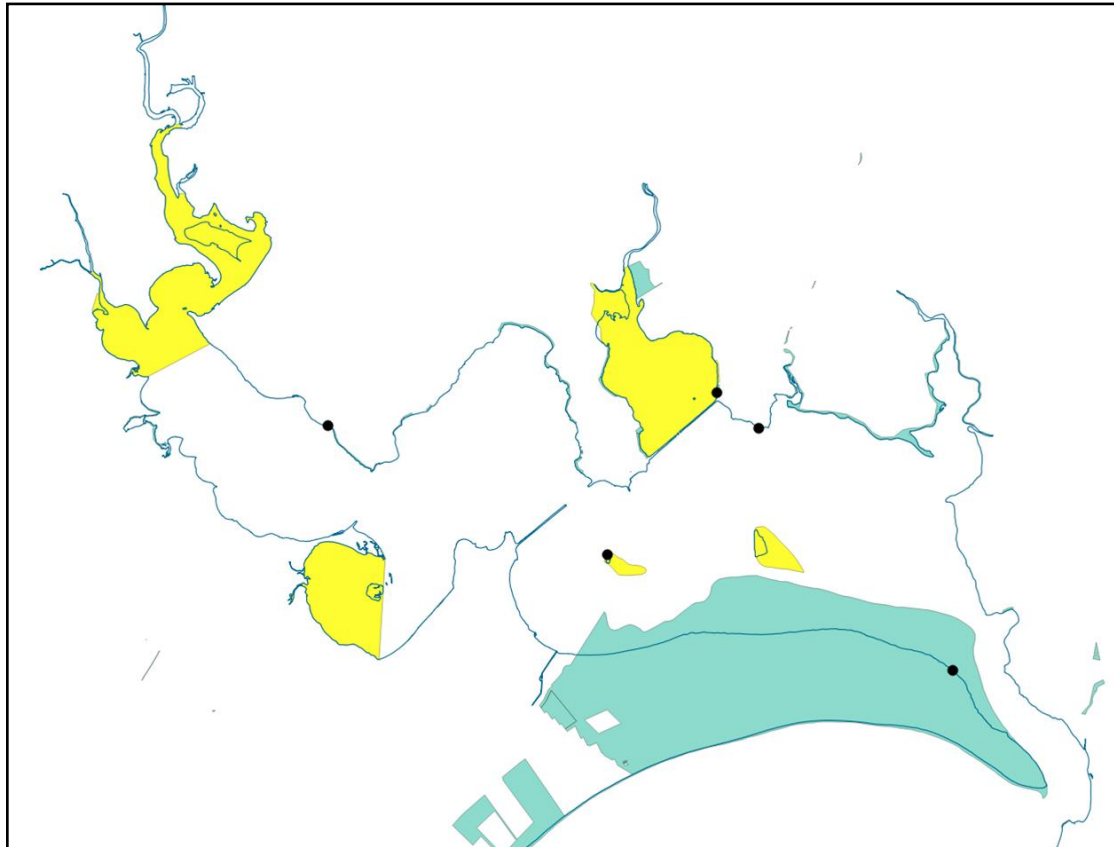


Figure 4. Breeding territories of Sooty Oystercatchers, 2012/13 (n = 4). Each black dot indicates a nest site, nest scrapes or a breeding pair on their territory. The nest located during surveys in January 2012 on the Five Mile Beach foreshore is also shown. The PWOL NR is shown in yellow, and adjacent reserves are shown in pale green; the Seven Mile Beach Protected Area covers most of the Llanherne Peninsula.

Hooded Plover

There were no breeding Hooded Plovers within the PWOL NR and Ramsar Site during the 2012/13 survey (Figure 5). This is largely due to the absence of suitable habitat (oceanic sandy beaches).

One pair was reported to attempt breeding on Five Mile Beach in the 1980s (Newman and Patterson 1986). Two pairs of Hooded Plovers nest on the foreshore and the open sandy areas at Sandy Point and on Seven Mile Beach during the summer months (September to March) and typically remain in the area year round when not breeding (subject to disturbance).

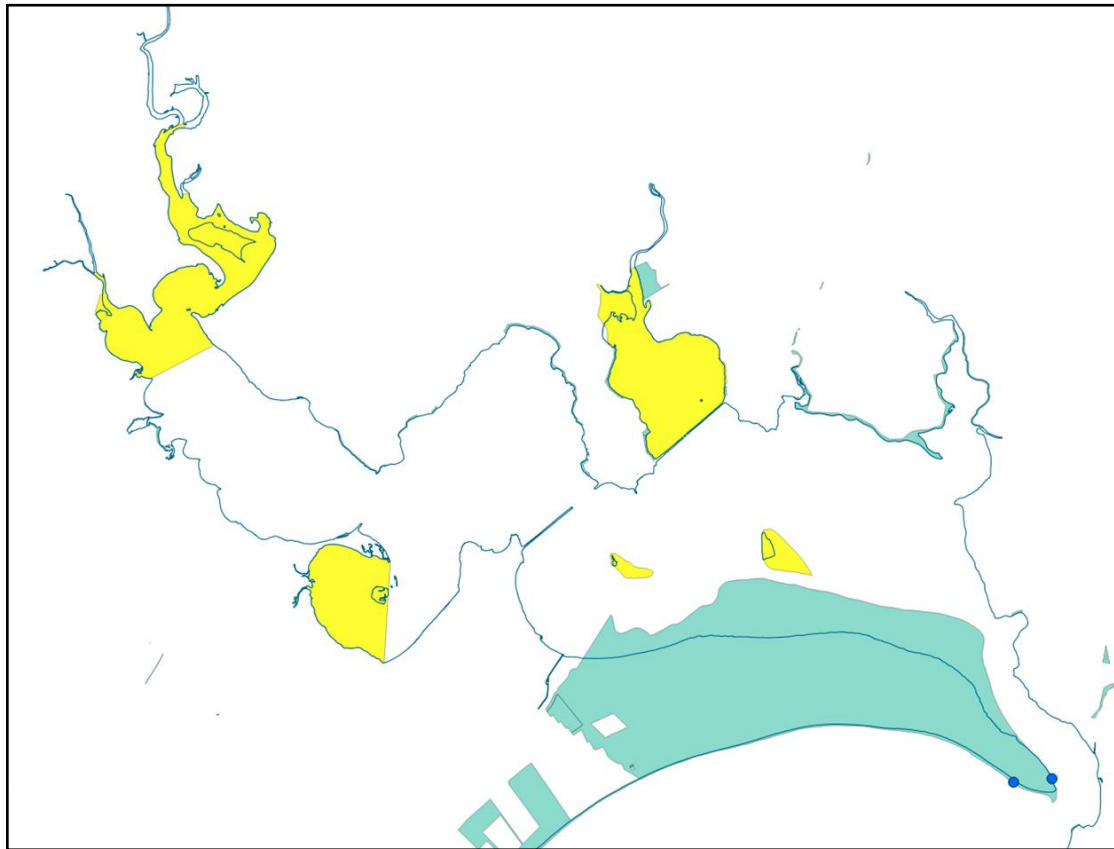


Figure 5. Breeding territories of Hooded Plovers, 2012/13 ($n = 0$). The 2 nests located during surveys in January 2012 on the Sandy Point and Seven Mile Beach foreshores are shown. The PWOL NR is shown in yellow, and adjacent reserves are shown in pale green; the Seven Mile Beach Protected Area covers most of the Llanherne Peninsula.

Red-capped Plover

A low number of Red-capped Plover nesting sites were located during the surveys (Figure 6). Of significance were two concentrations of Red-capped Plovers, one on the northern Orielton Lagoon salt flats ($n = 8$) close to Shark Point Road, and the other on the Iron Creek sand spit ($n \geq 32$). Red-capped Plovers are known to nest semi-colonially, and it is possible these two sites hold semi-colonial populations of the species. The ‘colony’ on Iron Creek sand spit is a welcome discovery in light of reported decreases for the species elsewhere in southeast Tasmania (BirdLife Tasmania unpubl. data). In total, more than 50 Red-capped Plovers were observed during the present survey. Park (1983) reported more than 100 Red-capped Plovers in the (January) 1975 Summer Wader Count for Orielton/Sorell.

Park (1983) and Fletcher (pers. comm.) reported breeding by Red-capped Plovers on, “the east side of Orielton Rivulet to the south of the bridge, in the saltmarsh at the northern end of Orielton Lagoon”, and in, “the drier saltmarsh areas of Iron Creek”. Counts of 10 or more pairs adjacent to Orielton Creek were obtained in the 1970s and 1980s (A Fletcher pers. comm.). Patterson (1982) reported Red-capped Plovers roosting and breeding in Barilla Bay during 1980 - 1982, including Railway Spit, where one pair was observed in this study.



Red-capped Plovers formerly nested on the open sandy areas at Sandy Point (Newman and Patterson 1986) but the January 2012 survey failed to locate any breeding birds in the area (BirdLife Tasmania, unpublished data). It is likely the high levels of disturbance from ongoing, season human recreational activities and dogs at Sandy point may have contributed to this absence.

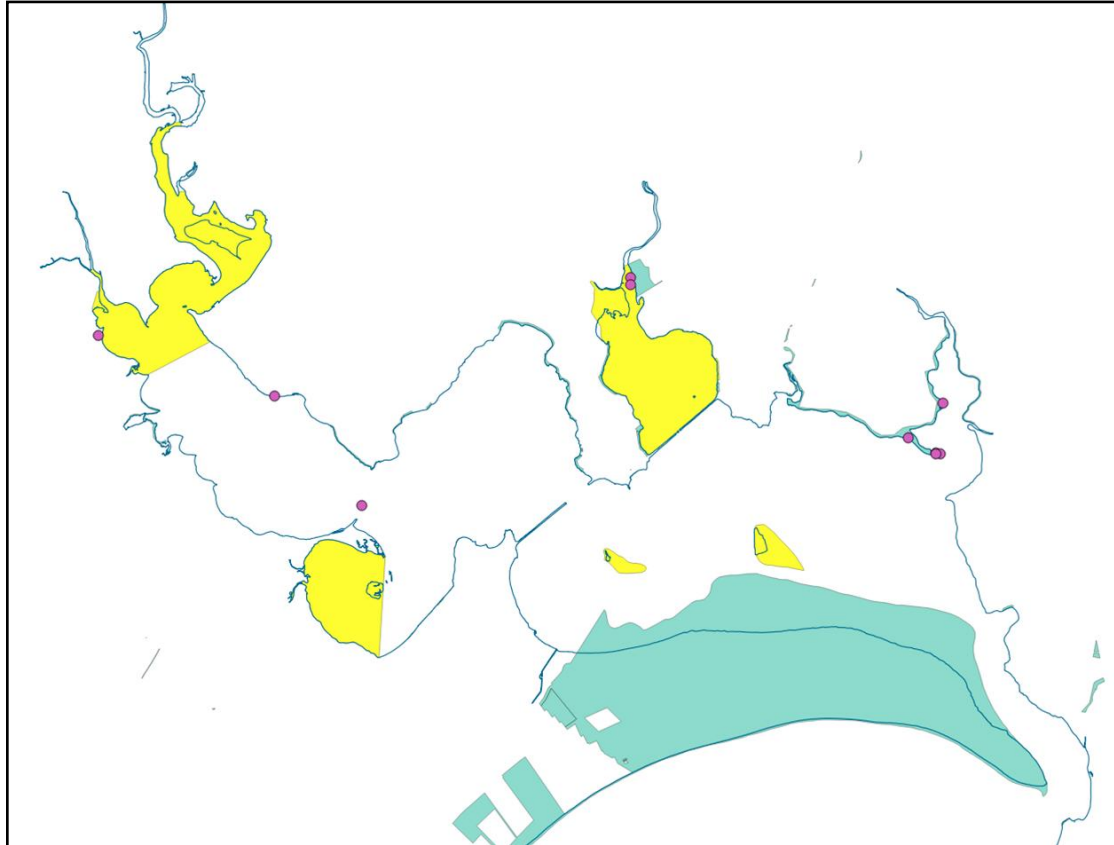


Figure 6. Breeding territories of Red-capped Plovers, 2012/13 (n = 10). The PWOL NR is shown in yellow, and adjacent reserves are shown in pale green; the Seven Mile Beach Protected Area covers most of the Llanherne Peninsula.

Black-fronted Plover

No Black-fronted Plovers were observed during the present survey. They have been recorded as often present on the drier salt flats of Orielton Lagoon close to Shark Point Road, and have been recorded breeding in the area in the past (A Fletcher pers. comm.). Patterson (1982) reported a single breeding pair in Barilla Bay in 1981, and a winter maximum of 39 birds in Barilla Bay.

Caspian Tern

Three nests were located during the survey: one close to the Kelp Gull colony on the northern Orielton Lagoon salt flats, one on the Iron Creek sand spit and the third was on Barren Island. Barren Island was the only previously known nesting site for the species in the survey area (BirdLife Tasmania, unpublished data).



Caspian Terns nest on Spectacle Island outside the PWOL (Brothers et al. 2001, Woehler 2010). There is no current estimate of the breeding population of Caspian Terns in southeast Tasmania, but it is believed to be relatively small as pairs are typically solitary nesters on offshore islands.

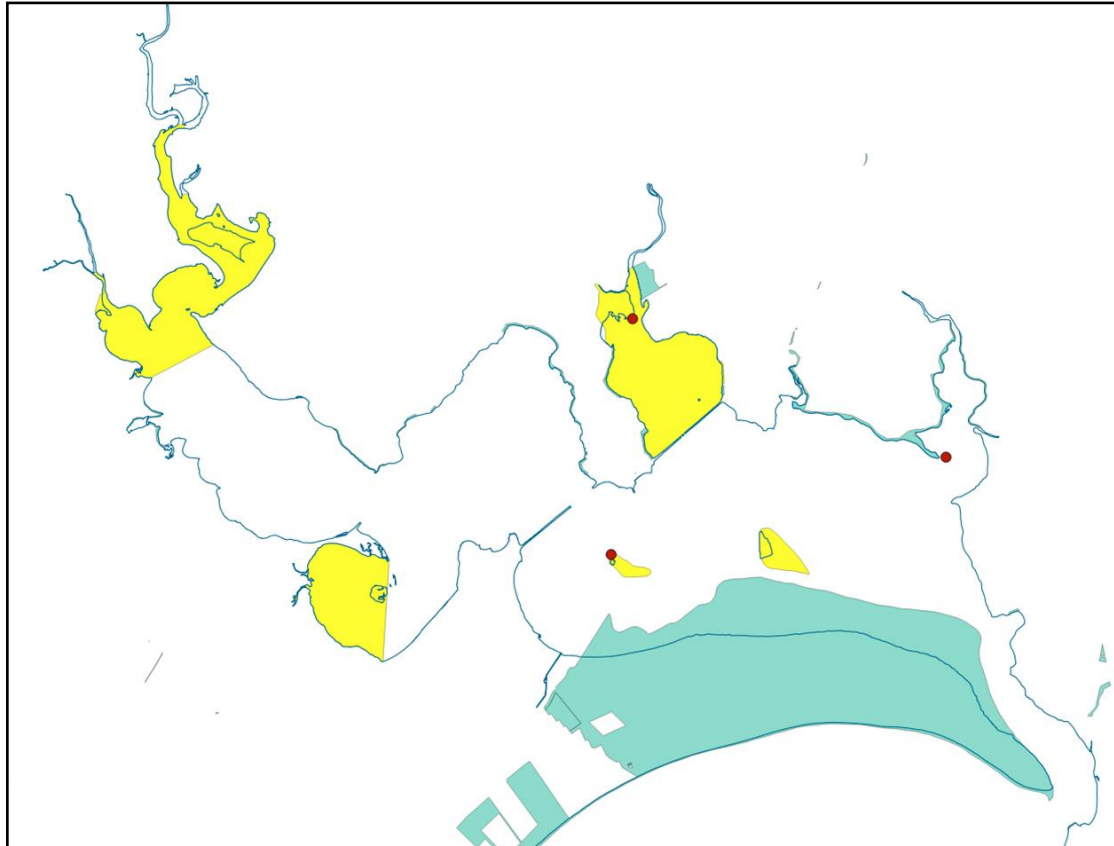


Figure 7. Nest sites of Caspian Terns, 2012/13 (n= 3). The PWOL NR is shown in yellow, and adjacent reserves are shown in pale green; the Seven Mile Beach Protected Area covers most of the Llanherne Peninsula.

Silver Gull

Two colonies of Silver Gulls were present during the 2012/13 surveys. One was on the Sorell Causeway and the other was on the northwest slopes of Barren Island.

A ground survey of the Sorell Causeway colony on 25 November located approximately 400 nests, including some still under active construction. This breeding effort appeared to be smaller than in 2011/12 when more than 510 nests were present (Woehler 2012). Oiling of eggs had been undertaken before this survey (C Markby, pers. comm.) as part of ongoing annual efforts to manage the colony by DIER. The impact of the oiling activities remains indeterminate beyond the immediate mortality of the embryos (Woehler 2012). The colony vertices are listed in Appendix 1a.



The Barren Island colony was observed during the boat survey on 28 November, when fewer than 25 nests were estimated to be present. No landing was made on Barren Island for the purpose of surveying the colony, but the nesting birds were clearly visible among the vegetation and rocks close to the shore.

The total breeding population of Silver Gulls in the PWOL in 2012/13 was estimated at 425 nests, noting that the species is asynchronous in its laying, and the unknown effect of egg oiling on laying and nest abandonment.

In past seasons, Little Spectacle Island (outside PWOL) has been used for nesting by Silver Gulls (Brothers et al. 2001, Woehler 2010). No visit was made to Little Spectacle Island for the current survey, and as the colony is on the western slopes of the island and is not visible from the mainland, it is unknown whether Little Spectacle Island was used for breeding by Silver Gulls in 2012/13. The island receives considerable visitors and the nesting gulls and Crested Terns are frequently disturbed. Park (1983) reported “many” Silver Gulls nesting on Suzie Islet.

Kelp Gull

A moderate-sized colony of approximately 280 - 300 nests was located on the northern salt flats of Orielton Lagoon, close to Shark Point Road. The breeding population was estimated as there was no single vantage point from which all nests were visible, and the colony was only briefly entered as eggs and small chicks (< 1 week of age) were present. The nests were loosely spaced within the colony, and many nest sites were observed flooded or awash on a high tide (Figures 8a and b). The colony extended for approximately 360m NE-SW and approximately 400m N-S; the colony vertices are listed in Appendix 1b.



Figure 8 (a). Part of the Kelp Gull colony, Orielton Lagoon. © Eric J Woehler



Figure 8 (b). Kelp Gull nest awash at high tide, Orielton Lagoon. The nest would likely fail as a result of the egg cooling from the wet nest materials. © Eric J Woehler

Approximately 20 to 30 breeding pairs were observed on Barren Island, with nests dispersed among the vegetation on the island. No landing was made on Barren Island for the purpose of surveying the colony, but many of the nesting gulls were visible among the vegetation and rocks close to the shore. Approximately 300 - 320 breeding pairs of Kelp Gulls were present in PWOL during the 2012/13 breeding season.

The recent establishment and subsequent expansion of the Kelp Gull colony on the Orielton Lagoon salt flats is likely to pose a threat to feeding and roosting migratory shorebirds through two mechanisms: kleptoparasitism and disturbance. Gulls exhibit a form of parasitism where birds of other species are harassed and chased until they regurgitate their food, known as inter-specific kleptoparasitism.

When the nesting Kelp Gulls are disturbed, they typically rise from their nests and circle the colony before settling. When they rise, they disturb any roosting and feeding shorebirds, such as Endangered Eastern Curlews *Numenius madagascariensis* and Bar-tailed Godwits *Limosa lapponica*. Repeated disturbance will reduce the capacity of the curlews and godwits (and any other migratory shorebirds) to accumulate sufficient fat reserves for their return migratory flight to Siberia.

The extent of these two mechanisms is presently unknown and warrants further study to contribute to future management of the PWOL. It is likely that the Kelp Gull colony will continue to increase in numbers of nests, and the associated threats to migratory shorebirds will increase in parallel.

In past seasons, Spectacle Island (outside PWOL) has been used for nesting by Kelp Gulls (Brothers et al. 2001, Woehler 2010). No visit was made to Spectacle Island for the current survey, and as only some parts of the colony are visible from the mainland, it is unknown to what extent Spectacle Island was used for breeding by Kelp Gulls in 2012/13. Park (1983) reported "a few pairs" of Kelp Gulls nesting on Suzie Islet.



Pacific Gull

Only one breeding pair of Pacific Gulls was located during the survey on Barren Island (Appendix 1c). No landing was made on Barren Island for the purpose of confirming the presence of a nest, but the island is a known nesting site for the species. The species has a relatively small breeding population in southeast Tasmania, and may have been displaced by Kelp Gulls from some offshore islands. Pacific Gulls nest on Spectacle Island outside the PWOL (Brothers et al. 2001, Woehler 2010).

Anthropogenic threats to shorebird and seabird values

Various anthropogenic threats to nesting shorebirds and seabirds were observed during the surveys. These threats comprised (i) livestock on foreshores used by shorebirds for feeding and nesting, (ii) marine debris and waste materials on foreshores, (iii) domestic/feral cat prints and (iv) an unleashed and uncontrolled domestic dog.

Livestock on foreshores

Livestock were observed feeding and resting on the foreshore at three locations during the survey. Sheep were present immediately behind the foreshore close to a breeding territory of Australian Pied Oystercatchers on the upper reaches of the Coal River on 20 November (Figure 9a). Hoof prints in the mud clearly indicated their presence on the foreshore earlier. Cattle were present on the Iron Creek foreshore on 4 December (Figure 9b), and there was an extensive area of foreshore with cattle prints in the mud. An extensive length of broken fencing allowed cattle access onto the foreshore on the eastern foreshore of the Coal River opposite Samphire Island.

Livestock can trample nests, eggs and chicks, and result in immediate nesting failure for shorebirds and seabirds nesting on the foreshore.



Figure 9 (a). Sheep close to a breeding pair of Australian Pied Oystercatchers, Coal River. © Eric J Woehler



Figure 9 (b). Cattle resting on the foreshore, Iron Creek foreshore. © Eric J Woehler

Marine debris and waste materials

Considerable quantities of marine debris were present on much of the Barilla Bay foreshore between Railway Spit and Mile Beach, with much of the material sources from local aquaculture activities, with pieces of treated wood and plastic mesh being particularly abundant. A number of water material dump sites were observed immediately east of the Cambridge Aerodrome, much of the material is likely to be derived from previous construction activities, but a rusted car body was present, as was extensive broken glass and what appeared to be pieces of asbestos sheeting. A high number of old car tyres were present on the foreshore adjacent to the aquaculture facility in Barilla Bay.

Marine debris poses considerable threats to shorebirds and their chicks, primarily through entanglement resulting in starvation and death.

Domestic/feral cats

A number of cat foot prints were observed on the Barilla Bay foreshore. It is unknown whether the prints were made by a domestic cat associated with a local household or whether the prints were made by one or more feral cat(s).

Feral cats are efficient predators of shorebirds and seabirds, taking adults, chicks and eggs.

Domestic dog

An unleashed and poorly/uncontrolled domestic dog was observed chasing shorebirds and seabirds on Railway Spit in association with the launching of an aquaculture vessel. The dog failed to respond to voice controls for several minutes, and was observed to approach nesting Australian Pied Oystercatchers and roosting Silver Gulls, putting all to flight, before eventually returning to the aquaculture vessel.

Domestic dogs can readily disturb nesting birds, potentially resulting in nesting failure. Dogs are also efficient predators of shorebirds and seabirds, readily taking adults, chicks and eggs.



Human disturbance

Remarkably, no human disturbance to nesting shorebirds and seabirds was observed during the present survey; this absence is unusual. As the human population in the surrounding areas increases with the associated increases in development and recreational activities, the potential for significant human disturbance to nesting and roosting shorebirds and seabirds will increase. The present relatively low levels of human disturbance inside some areas of PWOL, is a significant contributing factor to the present international significance of the area for resident and migratory species.

Other notable observations

A number of other observations are worth briefly mentioning here. The lists of bird species previously recorded on Barren and Woody Islands, Suzie Islet are provided in Appendices 3-5 respectively. A list of all bird species observed is provided in Appendix 6.

Peregrine Falcon nest

A cliff face known as Barwick's Rocks on Butchers Hill showed evidence of Peregrine Falcon nesting (Figure 10), which was confirmed by Nick Mooney (N Mooney, pers. comm.). The pair were successful, raising a chick in 2012. Masked Owls are known to roost occasionally in the potholes at Barwick's Rocks (N Mooney, unpubl. obs.).



Figure 10. Peregrine Falcon nest site. © Eric J Woehler

Migratory shorebirds

More than 170 Red-necked Stints were observed in three flocks during the survey. A flock of 50 were roosting on a small sandy beach halfway between Horatio and Shark Points (Figure 11a), approximately 60 were feeding on the inter-tidal salt flats in northern Orielton Lagoon (Figure 11b), and 65 were roosting and feeding on the Iron Creek sand spit. A solitary Common Greenshank was observed on the saltmarsh in Barilla Bay and a flock of approximately 30 Pacific Golden Plover was observed in Orielton Lagoon (Figure 11c).



Figure 11b. Feeding Red-necked Stints, Orielton Lagoon. © Eric J Woehler



Figure 11c. Pacific Golden Plovers, Orielton Lagoon. © Eric J Woehler

Discussion

Comparison with historical data, significance of resident populations

There are very few historical breeding population data available for the resident shorebirds of Pitt Water Orielton Lagoon. The few published data are typically from the 1980s and 1990s (eg Patterson 1982, Park 1983 and Newman and Patterson 1986). The survey sought to address this major data gap by providing fine-scale GPS data for nesting territories of resident shorebirds in the Pitt Water Orielton Lagoon Nature Reserve and Ramsar Site. This survey has established a valuable baseline for future surveys and monitoring of the breeding shorebirds and seabirds in the Nature Reserve and Ramsar Site.

It is likely that some Red-capped Plovers may have been missed during the boat surveys due to their size and extensive coastal vegetation that may have hindered their being observed from the water. In the absence of ground-based surveys for the areas surveyed from the water, there is no mechanism to estimate the total breeding population of Red-capped Plovers in the survey area.



However, it is unlikely that the total breeding population will be substantially higher, given the limited availability of suitable habitat for the species in the survey area, and that breeding sites located during the survey closely matched those identified in the past.

It is also unlikely that many pairs of Australian Pied Oystercatchers were missed during the survey. Further, it must be acknowledged that not every pair of Australian Pied Oystercatchers recorded on their territory may have laid eggs by the time of the survey. While nests with eggs and chicks of various ages were observed on many occasions, some pairs may not yet have initiated breeding at the time of the survey.

The survey results are minimum estimates - there can be no fewer birds than were observed, but the total breeding populations are unlikely to be significantly higher. The population estimates for the survey are conservatively derived from the numbers observed, and no further increases or estimates have been included. The exclusion of non-breeding birds greatly simplifies the interpretation of the survey data and increases the confidence in estimating the current total breeding populations for each species for future comparisons.

Unfortunately, the historic data for Red-capped Plovers are limited in their detail (winter flocks of up to 70 birds in Barilla Bay, Patterson 1982 and 100 birds in the Summer 1975 Wader Count, Park 1983) and do not permit comparison with the current survey data beyond noting strong similarities in the breeding and roosting locations listed, and a potential decrease in the total numbers present. The species warrants further, dedicated studies in light of decreases in breeding populations elsewhere in Tasmania (BirdLife Tasmania, unpubl. data).

Southeast Tasmania (Triabunna/Maria I to south Bruny I) is believed to hold approximately 10% of the Australian population of Australian Pied Oystercatchers, and Seven Mile and Five Mile Beaches are the most important known breeding site for this species in southeast Tasmania (Fletcher and Newman 2010), with the highest density breeding population known – currently approximately 30 pairs nesting annually (a decrease from over 40 pairs). Large roosting flocks in excess of 1000 birds have been reported from nearby Ralphs Bay (Fletcher and Newman 2010, Birdlife Tasmania unpubl. data). Fletcher and Newman (2010) proposed the Australian Pied Oystercatcher population in Southeast Tasmania to be closed, with minimal immigration into or emigration out of the area based on preliminary analyses.

Australian Pied Oystercatchers are long-lived birds, with individuals in southeast Tasmania recorded to be more than 30 years of age (OMG Newman unpubl. data, BirdLife Tasmania unpubl. data). Characteristic of many long-lived species is delayed onset of breeding, with Australian Pied Oystercatchers typically not breeding until at least 4 or 5 years of age, and it has been estimated that as much as half the total Australian Pied Oystercatcher population is comprised of non-breeding individuals (OMG Newman, pers. comm.).

Based on the results of this survey, the Pitt Water Orielton Lagoon Nature Reserve and Ramsar Site hold an additional 62 breeding pairs of Australian Pied Oystercatchers, the vast majority of which were not previously included in earlier population estimates. In total, the Pitt



Water Orielton Lagoon Nature Reserve and Ramsar Site, Milford foreshore, Five Mile and Seven Mile Beaches hold more than 90 breeding pairs of Australian Pied Oystercatchers - the highest density of the specie known in Tasmania. This breeding population represents between 1.3% and 1.6% of the global population estimate for Australian Pied Oystercatchers (11,000 - 14,000 birds, Wetlands International 2006). Assuming a 50% non-breeding component in the total estimated population (see above) would double this estimate immediately. Exceeding the 1% population threshold indicates that this breeding population of Australian Pied Oystercatcher is of national and international significance.

Management and conservation considerations

It is critical that the management regime for the Pitt Water Orielton Lagoon Nature Reserve and Ramsar Site recognises and incorporates the nationally- and internationally-significant breeding population of Australian Pied Oystercatchers identified by this survey.

Proactive management and enforcement are critical to ensure the breeding population is maintained into the future. Newman and Park (1992) reported the presence of 48 breeding pairs from Milford, Five Mile and Seven Mile Beaches in 1991/92; the same areas held just 32 pairs in 2011/12 and 2012/13 (BirdLife Tasmania 2012, this study). This decrease of 33% in just 20 years is of great concern for a long-lived (25+ year) shorebird, and was predicted by Newman and Patterson (1986) in response to the ever-increasing human disturbance to nesting oystercatchers. Recent efforts (2012) by PWS to allow dog and horse access to breeding areas on Five Mile Beach will threaten this nationally- and internationally-significant breeding population immediately every summer breeding season (BirdLife Tasmania 2012).

The management framework must integrate the international significance of this breeding population with measures that recognise the population's closed nature, with minimal immigration and emigration of individuals (Fletcher and Newman 2010). Losses from human disturbance and predation by dogs can not be readily mitigated in a closed population; replacement of birds in this closed population lost to anthropogenic pressures will take longer than in open populations where immigration provides a source of additional individuals to the population.

The management framework must also recognise and manage the Pitt Water Orielton Lagoon Nature Reserve and Ramsar Site as one component of an inter-connected network of wetlands, coastal lagoons and foreshore areas used for breeding, feeding and roosting by resident and migratory shorebirds. Based on extensive surveys and monitoring of colour-banded and marked shorebirds, the critical sites in this network are the Pitt Water Orielton Lagoon Nature Reserve and Ramsar Site, Ralph's Bay (Lauderdale and South Arm Neck), Pipeclay, Clear and Calvert's Lagoons, and Marion Bay. Threats to, and impacts on the Ramsar values can occur outside of the PWOL Ramsar Site (eg human disturbance to nesting and roosting shorebirds at Sandy Point). A regional management approach will reduce the impacts of such external pressures on the Ramsar values.



This network of sites was identified by BirdLife Tasmania (at the time Birds Tasmania) to the Tasmanian Planning Commission (TPC, at the time the *Resource Development and Planning Commission*, and the *Resource Management and Planning Appeals Tribunal*) for the *Bruny Bioregion Marine Protected Area Enquiry* and the Walker Corporation's Lauderdale Quay proposal. The TPC recognised the existence of the site network as proposed by BirdLife Tasmania. The existing approach of site-specific management will fail to manage the needs of this regional network of sites.

One approach that has addressed the need for the conservation at broader, regional scales (and contributing to national and international conservation needs) was the Important Bird Areas (IBAs) program of BirdLife International. IBA criteria are internationally agreed, standardised, quantitative and scientifically defensible; an IBA is an internationally agreed priority for conservation action. Further details of the program and IBA criteria are available at <http://www.birdlife.org/action/science/sites/index.html>

The Pitt Water Orielton Lagoon Ramsar Site is part of the South Arm IBA (details of the extent and species are at www.birddata.com.au/iba.vm), Figure 12. An explicit recognition of the existence of the site network, and a regional management framework for the sites and bird values will serve as a much-needed model for similar site networks elsewhere in Tasmania (eg Robbins Passage/Boullanger Bay wetlands).

It is critical that the nationally- and internationally-significant Australian Pied Oystercatcher population in the Pitt Water Orielton Lagoon Ramsar Site be included in the Ramsar Information Sheet (RIS) and Ecological Character Description (ECD). In addition, it is critical that the relevant areas of the Federal Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC) be advised of the results of the survey immediately.

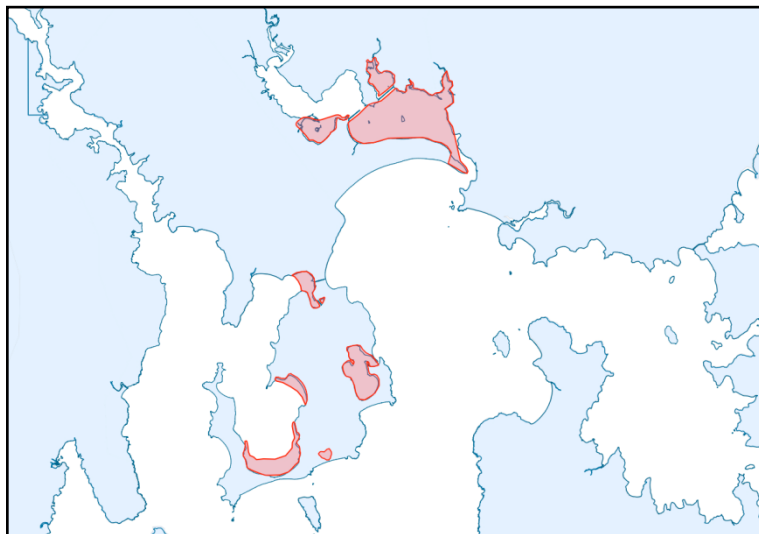


Figure 12. Map showing the South Arm Important Bird Area (IBA) network in red.



Additional comments

The Pitt Water Orielton Lagoon Nature Reserve and Ramsar Site is a remarkable wetland that is home to resident shorebirds and seabirds, and critical feeding and roosting habitat for migratory shorebirds every summer. The shorebird and seabird community tasks managers with the responsibility of conserving nationally- and internationally significant bird values at a time when human pressures on coastal areas is increasing. Appropriate management frameworks, recognising regional-scale network of sites and enforcing conservation measures are fundamental to the survival of these values into the future. Predicted sea-level rises will provide additional threats to the Nature Reserve and Ramsar Site. Long-term population trends will provide managers and the community the critical feedback on the efficacy of conservation and management efforts.

Recommendations

Based on the results obtained in this survey, and the discussion of those results, the following recommendations are provided:

- Incorporate the survey results into the management framework for Pitt Water Orielton Lagoon Nature Reserve and Ramsar Site, in particular the nationally- and internationally-significant breeding populations of Australian Pied Oystercatchers, noting the existing and increasing threats to the Pitt Water Orielton Lagoon and regional (ie southeastern Tasmania) populations,
- Incorporate the survey results into the Pitt Water Orielton Lagoon Ramsar Site Ramsar Information Sheet (RIS) and Ecological Character Description (ECD) at the earliest opportunities.
See <http://www.ramsar.wetlands.org/Database/Searchforsites/tabid/765/Default.aspx> for further details,
- Advise the relevant areas of SEWPAC of these survey results at the earliest opportunity,
- Undertake dedicated ground-based surveys of Red-capped Plovers to improve our currently limited understanding of their breeding ecology and habitat preferences in PWOL and elsewhere in Tasmania,
- Establish a regular survey of breeding shorebirds and seabirds in the Pitt Water Orielton Lagoon Nature Reserve and Ramsar Site, nominally at 3 - 5 year intervals to monitor their populations, to provide data for future reviews of the area's Management Plan, and to provide feedback on the efficacy of management efforts. Investigate the potential of BirdLife Tasmania to undertake these surveys in conjunction with PWS,
- Investigate the options for the monitoring of Pied Oystercatcher breeding productivity (chicks fledged per breeding pair) in various areas of PWOL to obtain fine-scale data on potential impacts associated with human disturbance from recreational activities; these surveys to be undertaken around mid-January,



- Continue efforts to restore Barren and Little Spectacle Islands as Silver Gull breeding sites as viable alternatives to nesting on the Sorell Causeway,
- Establish annual population monitoring of the Kelp Gull colony in Orielton Lagoon and assess the potential impacts by the gulls on roosting and feeding shorebirds (resident and migratory species), and investigate potential management options to discourage nesting by the gulls at the site if shorebird impacts identified,
- Investigate options for feral cat trapping in the Nature Reserve and Ramsar Site,
- Investigate options for fencing properties adjacent to the Nature Reserve and Ramsar Site where livestock can access foreshore areas,
- Investigate the potential for winter cleanups of marine debris from foreshores, possibly in conjunction with the aquaculture industry.

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References

- BirdLife Tasmania (formerly Birds Tasmania) 2012. *Submission on proposed rezoning of Five and Seven Mile Beaches re horse and dogs*. Submission to PWS 20 January 2012, Hobart 9pp.
- Brothers ND, Pemberton D, Pryor H, Halley V 2001. *Tasmania's offshore islands: seabirds and other natural features*. Hobart, Tasmanian Museum and Art Gallery.
- Commonwealth of Australia 2009. Significant impact guidelines for 36 migratory shorebird species. EPBC Act Policy Statement 3.21. Canberra 17pp.
- Fletcher A, Newman M 2010. *Studies of the Australian Pied Oystercatcher in south-east Tasmania 1964 - 2009*. Stilt 58, 24-33.
- Lauro B, Nol E 1995 *Patterns of habitat use for Pied and Sooty Oystercatchers nesting at the Furneaux Islands, Australia*. Condor 97, 920-934
- Newman OMG, Park P 1992. *Pied Oystercatcher breeding success in the 1991/92 summer*. Tasmanian Bird Report 21, 13-22.
- Newman OMG, Patterson RM 1986. *Seven Mile and Five Mile Beaches*. Tasmanian Bird Report 15, 21-25.
- NRM South 2012. *Pitt Water and Orielton Lagoon, A report to the community*. NRM South, 12pp.
- Park P 1983. *Orielton Lagoon and Sorell wader areas*. An Occasional Stint 2, 15-33.
- Parks and Wildlife Service 2010. *Pitt Water Nature Reserve Draft Management Plan*. DPIPWE, Hobart, 83pp.
- Patterson RM 1982. *A survey of the wader population of Barilla Bay*. An Occasional Stint 1, 21-28.
- Wetlands International 2006. *Waterbird population estimates*. 4th Edition, Wetlands International, Wageningen, The Netherlands.
- Woehler EJ 2010. *Seabirds and shorebirds on Spectacle Island*, 17 November 2009. Birds Tasmania report to Southern Beaches Inc., March 2010
- Woehler EJ 2012. *Silver Gulls in southeast Tasmania – Analyses of colony monitoring September – November 2011, and proposals for future research and management*. Tasmanian Bird Report (in press).
- Woehler E & Park P 2006. Inventory of nationally important shorebird sites in Tasmania. Unpublished Birds Tasmania report to Birds Australia and the Department of the Environment & Heritage, 3pp.



Appendices

Appendix 1. GPS data (UTM WGS-84 coordinates, see Methods) for nesting gulls, PWOL 2012/13.

a) Bounds of Silver Gull colony, Sorell Causeway. The colony occupied the foreshore between the roadway and the high water mark for much of this area, depending on the grade and substrate. The colony was typically between 1m and 4m in width.

Date	Vertex	Easting	Northing
25-Nov-12	northeast	0544969	5261847
25-Nov-12	southwest	0544280	5261267

b) Polygon vertices of Kelp Gull colony, Orielton Lagoon, PWOL.

Vertex	Easting	Northing
1	0543736	5263542
2	0543559	5263448
3	0543513	5263392
4	0543527	5263243
5	0543713	5263131
6	0543800	5263330
7	0543774	5263462
8	0543736	5263542

c) GPS data for other gull nests and colonies observed, PWOL 2012/13.

Date	Species	Easting	Northing	Comment/description
27-Nov-12	Kelp Gull	0548767	5259734	Nesting on salt marsh, Barilla Bay
28-Nov-12	Kelp Gull	0543560	5260695	Nesting on boulder, Midway Point
28-Nov-12	Pacific Gull	0543785	5260625	Adult on top of small un-named island
28-Nov-12	Pacific Gull	0543434	5259597	One pair observed on Barren Island
28-Nov-12	Kelp Gull	0543444	5259550	Estimated 20-30 pairs nesting on Barren Island, nests dispersed among vegetation
28-Nov-12	Silver Gull	0543414	5259653	Estimated 15 - 25 pairs nesting on Barren Island, small colony
28-Nov-12	Kelp Gull	0541617	5259737	Nest at base of cliffs below golf course
28-Nov-12	Kelp Gull	0541609	5259744	Nest at base of cliffs below golf course



Appendix 2. Bird list, Barren Island (BirdLife Tasmania unpublished records).

Common name	Scientific name
Australasian Gannet	<i>Morus serrator</i>
Australasian Grebe	<i>Tachybaptus novaehollandiae</i>
Australian Pelican	<i>Pelecanus conspicillatus</i>
Bar-tailed Godwit	<i>Limosa lapponica</i>
Black-faced Cormorant	<i>Phalacrocorax fuscescens</i>
Caspian Tern	<i>Sterna caspia</i>
Chestnut Teal	<i>Anas castanea</i>
Common Greenshank	<i>Tringa nebularia</i>
Crested Tern	<i>Sterna bergii</i>
Eastern Curlew	<i>Numenius madagascariensis</i>
European Goldfinch	<i>Carduelis carduelis</i>
Forest Raven	<i>Corvus tasmanicus</i>
Great Cormorant	<i>Phalacrocorax carbo</i>
Common Greenshank	<i>Tringa nebularia</i>
House Sparrow	<i>Passer domesticus</i>
Kelp Gull	<i>Larus dominicanus</i>
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>
Masked Lapwing	<i>Vanellus miles</i>
Pacific Gull	<i>Larus pacificus</i>
Peregrine Falcon	<i>Falco peregrinus</i>
Australian Pied Oystercatcher	<i>Haematopus longirostris</i>
Short-tailed Shearwater	<i>Puffinus tenuirostris</i>
Silver Gull	<i>Chroicocephalus novaehollandiae</i>
Skylark	<i>Alauda arvensis</i>
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>
Swamp Harrier	<i>Circus approximans</i>
Welcome Swallow	<i>Hirundo neoxena</i>
White-faced Heron	<i>Egretta novaehollandiae</i>

**Appendix 3.** Bird list, Suzie Islet (BirdLife Tasmania unpublished records).

Common name	Scientific name
Australasian Shelduck	<i>Tadorna tadornoides</i>
Australian Pelican	<i>Pelecanus conspicillatus</i>
Australian Shelduck	<i>Tadorna tadornoides</i>
Bar-tailed Godwit	<i>Limosa lapponica</i>
Black Swan	<i>Cygnus atratus</i>
Black-faced Cormorant	<i>Phalacrocorax fuscescens</i>
Caspian Tern	<i>Sterna caspia</i>
Chestnut Teal	<i>Anas castanea</i>
Common Greenshank	<i>Tringa nebularia</i>
Common Starling	<i>Sturnus vulgaris</i>
Crested Tern	<i>Sterna bergii</i>
Curlew Sandpiper	<i>Calidris ferruginea</i>
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>
European Goldfinch	<i>Carduelis carduelis</i>
Great Crested Grebe	<i>Podiceps cristatus</i>
Grey-tailed Tattler	<i>Heteroscelus brevipes</i>
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>
House Sparrow	<i>Passer domesticus</i>
Kelp Gull	<i>Larus dominicanus</i>
Large Black Cormorant	<i>Phalacrocorax carbo</i>
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>
Little Egret	<i>Egretta garzetta</i>
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>
Masked Lapwing	<i>Vanellus miles</i>
Musk Duck	<i>Biziura lobata</i>
Pacific Black Duck	<i>Anas superciliosa</i>
Pacific Golden Plover	<i>Pluvialis fulva</i>
Pacific Gull	<i>Larus pacificus</i>
Peregrine Falcon	<i>Falco peregrinus</i>
Australian Pied Oystercatcher	<i>Haematopus longirostris</i>
Red Knot	<i>Calidris canutus</i>
Royal Spoonbill	<i>Platylea regia</i>
Silver Gull	<i>Chroicocephalus novaehollandiae</i>
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>
Swamp Harrier	<i>Circus approximans</i>
White-faced Heron	<i>Egretta novaehollandiae</i>

**Appendix 4.** Bird list, Woody Island (BirdLife Tasmania unpublished records).

Common name	Scientific name
Black-faced Cormorant	<i>Phalacrocorax fuscescens</i>
Brown Falcon	<i>Falco berigora</i>
Brown Quail	<i>Coturnix ypsilophora</i>
Caspian Tern	<i>Sterna caspia</i>
Chestnut Teal	<i>Anas castanea</i>
Common Starling	<i>Sturnus vulgaris</i>
Crested Tern	<i>Sterna bergii</i>
Eastern Curlew	<i>Numenius madagascariensis</i>
European Goldfinch	<i>Carduelis carduelis</i>
Forest Raven	<i>Corvus tasmanicus</i>
Galah	<i>Cacatua roseicapilla</i>
Great Cormorant	<i>Phalacrocorax carbo</i>
Greenfinch	<i>Carduelis chloris</i>
Grey Butcherbird	<i>Cracticus torquatus</i>
Grey Fantail	<i>Rhipidura fuliginosa</i>
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>
Kelp Gull	<i>Larus dominicanus</i>
Little Penguin	<i>Eudyptula minor</i>
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>
Masked Lapwing	<i>Vanellus miles</i>
Pacific Gull	<i>Larus pacificus</i>
Peregrine Falcon	<i>Falco peregrinus</i>
Australian Pied Oystercatcher	<i>Haematopus longirostris</i>
Scarlet Robin	<i>Petroica multicolor</i>
Short-tailed Shearwater	<i>Puffinus tenuirostris</i>
Silver Gull	<i>Chroicocephalus novaehollandiae</i>
Silvereye	<i>Zosterops lateralis</i>
Spotted Pardalote	<i>Pardalotus punctatus</i>
Striated Pardalote	<i>Pardalotus striatus</i>
Swamp Harrier	<i>Circus approximans</i>
Tree Martin	<i>Hirundo nigricans</i>
Welcome Swallow	<i>Hirundo neoxena</i>
Whimbrel	<i>Numenius phaeopus</i>
White-bellied Sea Eagle	<i>Haliaeetus leucogaster</i>



Appendix 5. Species list of birds observed during surveys, with estimates of numbers where appropriate (observers: EJ Woehler and C Markby).

Common name	Scientific name	#s	Comments
Black Swan	<i>Cygnus atratus</i>	132	Observed on all survey days
Black-faced Cormorant	<i>Phalacrocorax fuscescens</i>	70	
Chestnut Teal	<i>Anas castanea</i>	363	Large roosting flocks observed on mudflats in Coal River
Common Greenshank	<i>Tringa nebularia</i>	1	One seen in Barilla Bay
Crested Tern	<i>Sterna bergii</i>	10s	
Great Crested Grebe	<i>Podiceps cristatus</i>	13	Includes one flock of 10 birds
Hoary-headed Grebe	<i>Poliiocephalus poliocephalus</i>	24	Widely distributed
Great Cormorant	<i>Phalacrocorax carbo</i>	8	
Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>		
Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>	4	
Masked Lapwing	<i>Vanellus miles</i>		Widely distributed on foreshores and in pastures
Australasian Shelduck	<i>Tadorna tadornoides</i>	108	Single large flock roosting on low tide mudflats in Barilla Bay
Musk Duck	<i>Biziura lobata</i>	10s	Observed well upstream into Coal River
Pacific Golden Plover	<i>Pluvialis fulva</i>	30+	One seen in Barilla Bay near processing facilities, A flock of ~30 on mudflats in Orielton Lagoon
Peregrine Falcon	<i>Falco peregrinus</i>		Nest site observed
Red-necked Stint	<i>Calidris ruficollis</i>	175	50 seen in Pitt Water, 60 feeding in Orielton Lagoon, 65 on sandbar at mouth of Iron Creek
Swamp Harrier	<i>Circus approximans</i>	6	
Wedge-tailed Eagle	<i>Aquila audax</i>	1	
White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>	3	Pair seen on banks of Coal River, 1 over Iron Creek
White-faced Heron	<i>Egretta novaehollandiae</i>	33	Widely distributed