

Recoveries of Little Penguins *Eudyptula minor* flipper-banded at colonies in western Victoria

F. I. Norman¹, P. Dann², P. Du Guesclin³, D. Drynan⁴ and D. Sutherland²

¹Lot 11 Cullen Crescent, Plenty, Victoria 3090.

²Research Department, Phillip Island Nature Parks, PO Box 97, Cowes, Victoria 3922.

Email: pdann@penguins.org.au

³29 William Street, Port Fairy, Victoria 3284.

⁴Australian Bird and Bat Banding Scheme, GPO Box 8, Canberra, ACT 2601.

Received: 18 May 2016

Between 1971 and 2008, 3773 Little Penguins *Eudyptula minor* were flipper-banded at 20 colonies (and other sites) in western Victoria from Lorne in the east to Portland in the west. Most of these (2351; 62.3%) were at Port Campbell, with a further 949 (25.1%) at Middle Island, near Warrnambool. In general, bandings were of nestlings (2037; 54% of total banded) rather than adults (1736; 46%). Of the penguins banded, 222 (5.9%) were recovered (found dead) either on land (166; 74.8% of recoveries), or as floating or beach-washed corpses (52; 23.4%). Of those found on land, 107 (64.5%) were considered to have been depredated, usually (91; 85%) by mammals (wild or domesticated dogs *Canis familiaris* or cats *Felis catus*, and foxes *Vulpes vulpes*). Only a few (31; 0.8% of those banded) recoveries were made at a substantial distance from their banding site. Such distant recoveries indicated that, on average, banded birds from the western Victorian colonies moved only about 38 km from the banding site, with a larger proportion (67%) being found to the west. These recoveries were made between Discovery Bay (147 km) to the west of the banding sites and Moonlight Head (78 km) to the east. There was no evidence that recoveries were related to mortalities of pilchards *Sardinops sagax* in either 1995 or 1997. It is thought that Little Penguins fledging and/or breeding in western Victoria may not have to move extensively, because local offshore waters there are relatively productive, with nutrients being provided via the nearby Bonney Upwelling and their subsequent transport by predominantly westerly currents. This is in marked contrast to penguins from other Victorian colonies that may make extensive movements between breeding seasons either as dispersing young or adults, often towards western Victoria.

INTRODUCTION

The use of radio and satellite transmitters on adult Little Penguins *Eudyptula minor* attending nests suggests that movements in the breeding period are relatively localised, with foraging trips when provisioning chicks usually taking one to two days (Weavers 1992; Collins *et al.* 1999; Preston *et al.* 2007; Hoskins *et al.* 2008). In the non-breeding period, adults may leave the colony for two to three months (e.g. McCutcheon *et al.* 2011) and remain offshore, apart from three weeks while moulting (Reilly and Cullen 1983). Movement of Little Penguins banded at nest sites or in colonies has been studied in eastern Australia. Results of banding at some sites in New South Wales, Tasmania and Victoria were presented by Reilly and Cullen (1982), Marchant and Higgins (1990) and Priddel *et al.* (2008), who collectively showed that movements, reflected by recoveries of marked birds found dead, varied amongst colonies. Birds dispersing from Phillip Island, for example, disperse widely and move particularly to the west (Reilly and Cullen 1982; Dann *et al.* 1992), whereas penguins from Gabo Island were recovered nearby or to the west, and those marked in New South Wales moved both north and south (Reilly and Cullen 1982). More recently, Norman *et al.* (2012) found that most recoveries of birds banded at sites off the east coast of Wilsons Promontory were to the west, although some birds were beach-washed in northern Tasmania and New South Wales. They considered that there was a tendency for birds from southern and western colonies in Victoria to move westward (to the western

Victorian and South Australian coasts), whereas birds from eastern Victorian colonies moved to the north or south.

Here we analyse recoveries (marked birds found dead) of Little Penguins (hereafter penguins) flipper-banded at breeding sites in western Victoria. The recoveries are examined in relation to causes of death reported by the finders, their timing and location. Unless otherwise noted, summaries refer to data from all breeding sites combined. Data for penguin colonies held by the Phillip Island Nature Parks (PINP) have been incorporated where appropriate.

METHODS

General study area

Colonies of penguins occur at various sites along the western Victorian coastline and have been described by, for example, Harris and Norman (1981), Dann *et al.* (2004) and Farnes (2007) (see Fig.1 for locations of banding sites).

Numbers of penguins banded

Between 1971 and 2008, penguins were flipper-banded (Dann *et al.* 2014) at 20 sites in western Victoria by numerous banders (many associated with the Penguin Study Group, PSG). A file summarising banding (marking) of penguins using flipper tags (provided by the Australian Bird and Bat Banding Scheme, ABBBS), generally when they were in burrows or ashore

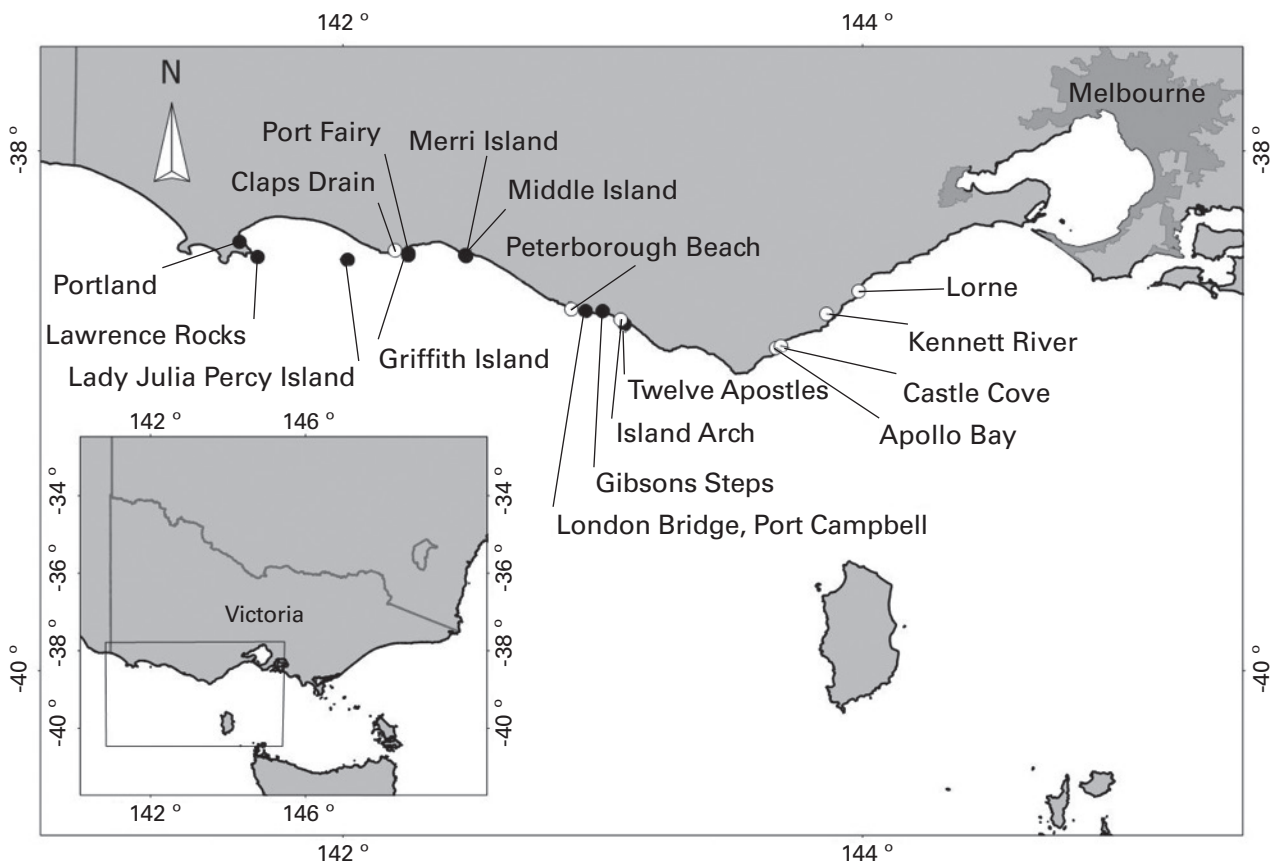


Figure 1. Locations of banding sites of Little Penguins in western Victoria. Past or present breeding sites shown as ●, other sites as ○.

above-ground within colonies, was prepared from material held by the ABBBS. This file was edited by removing duplicated records and reconciling ambiguities in banding sites (e.g. the interchangeability of the names of some sites used by some banders, particularly London Bridge and Port Campbell [and Port Campbell National Park]; all such bandings are here considered to have been made at London Bridge). Similarly, bandings listed as occurring at the ‘Twelve Apostles’ were actually made on the adjacent mainland and bandings at Princetown are considered here to have been made at Gibsons Steps. Whilst the sex of some adult birds was not determined when they were first marked, most were sexed using bill characteristics (Arnould *et al.* 2004).

Recoveries of marked penguins

We have examined recoveries (birds found dead) of penguins banded at western Victorian sites between 1971 and 2008 and reported to the ABBBS before 1 July 2013. The recovery file (from ABBBS) was edited to remove duplicates and to revise or standardise banding sites where necessary (hence modifying distances and directions of recoveries from banding sites). We have excluded re-trapped (= recaptured alive) birds, and local recoveries of birds banded at other sites (although these are extensive, D. Drynan pers. comm.). Further, apart from birds considered to have been killed by unknown or suggested predators, penguins recovered at the banding sites have not been considered in detail and they were excluded from analyses

Those reporting recoveries rarely provided details regarding possible causes of death. Distances and directions from the banding site, and the time between banding and recovery, are

automatically generated by ABBBS. Whilst breeding periods may vary depending on food resources (e.g. Cullen *et al.* 1992), in some analyses below it has been assumed that the breeding phenology at sites in western Victoria resembles that at Phillip Island. Thus, most egg-laying occurs between September and November, with chicks fledging some three months later (Dann *et al.* 2000). Here we have considered a breeding period to extend between August and February (although Overeem and Wallis 2003 considered egg-laying as starting in July, 1999).

RESULTS

Status of western Victorian colonies

Port Campbell National Park

Of the breeding population of western Victoria, some 2000 birds are thought to breed in the Port Campbell National Park (P. Du Guesclin pers. obs.); this figure includes birds occupying about 300 burrows (in two colonies) at Gibsons Steps (Harris and Norman 1981), where nests occur in sand or soil, under rocks at the base of cliffs or around cave walls, often below an overhang. The London Bridge colony apparently grew from 23 burrows in 1976 to 40–50 in 1978. There were some 50 burrows in the period from 1982 to 1984 and about 100 between 1990 and 1995 (PINP files; P. Du Guesclin pers. obs.).

Lady Julia Percy Island

On Lady Julia Percy Island, nests are most dense on talus slopes around Dingy Cove and McCoy Platform. There are more scattered nests in and above Seal Bay, where Short-

Table 1

Banding totals for Little Penguins at sites in western Victoria in the period 1971 to 1999.

Site	Banding period	Chicks	Adults			Not specified	Totals
			Male	Female	Unspecified		
London Bridge, Port Campbell	11/71 - 11/08	1477	333	358	182	1	2351
Middle Island	01/72 - 02/98	369	241	222	117		949
Portland	12/79 - 03/97	16	19	25	48		108
Lady Julia Percy Island	12/76 - 01/00	36	16	8	40		100
Gibsons Steps	12/72 - 02/77	85			77		162
Twelve Apostles	01/79 - 08/92	26	1	2			29
Apollo Bay	08/91 - 09/97		9	10	7	2	28
Lawrence Rocks	11/71 - 12/02	24	1				25
Other sites (11)	09/83 - 03/99	4	1	10	5	1	21
Totals		2037	621	635	476	4	3773

tailed Shearwaters *Ardenna tenuirostris* also breed in an area of grassland (of various grass species) and succulent herbfield (details in Norman *et al.* 1980, Dann *et al.* 2004). Approximately 2000 penguin burrows were estimated to be present in 1978/79 (Norman *et al.* 1980; Harris and Norman 1981), but only 317 active burrows were found in 2000 (Dann *et al.* 2004). Earlier reports (Wood Jones and Tubb 1937; Tarr 1954; Pescott 1965) suggested that breeding areas were more extensive and McKean (1962) considered that there were 5000–10 000 pairs breeding on the island (see also Pescott 1976). Reilly (1977) considered that there were ~ 1260 burrows in Dingy Cove and Seal Bay in 1976–77.

Middle Island

In December 1978, it was thought that there were 199 Little Penguin burrows on Middle Island, near Warrnambool (Harris and Norman 1981). However, the PSG later suggested that there were 1000 pairs (before 2000, in Jessop and Du Guesclin 2000). By the 1999/2000 breeding period, there were only 292 active burrows in the vegetated area and another 50 on north- and east-facing cliffs (Overeem and Wallis 2003). The small island (1.5 ha) has a ground cover that includes saltbush *Rhagodia baccata*, Coastal Pigface *Carpobrotus glaucescens*, New Zealand Spinach *Tetragonia tetragonoides* and small numbers of African Boxthorn *Lycium ferocissimum* and Mirror Bush *Coprosma repens* plants. However, most (63%) of the 342 burrows found in the 1999/2000 period were under saltbush and spinach (Overeem and Wallis 2003). In September 2005, there were 52 active burrows (Overeem and Wallis 2007). This number had declined by 2013, when there was a count of 112 birds, a population estimate of 187 birds, and only nine active burrows (L. Kivisalu pers. comm.).

Portland

Small colonies also exist on Lawrence Rocks (109 burrows counted in December 1978, Harris and Norman 1981), at Merri Island (10 burrows in 1978, Harris and Norman 1981 and 5 burrows in 1993, Dann and Norman 2006) and near the Twelve Apostles. A small colony previously existed in Portland, originally in clay cliffs on Henty Beach below the Lee Breakwater Road (P. Du Guesclin pers. obs.), but this decreased due to disturbance (Farnes 2007), predation and road

kills. A number of birds also bred under the floor of *Shoreline Engineering*, which led to an artificial, fenced site being constructed on the foreshore nearby after the demolition of the engineering building. This site was used by penguins for some years, but eventually the birds were killed by Jack Russell terriers that could also fit through the penguin fence entrances. A few birds continue to breed on the breakwaters in the harbour (P. Dann pers. obs.). Penguins (usually adults, some single individuals, perhaps moulting) have also been banded at other sites indicated in Figure 1.

Banding

Banding totals at sites on the western Victorian coast are summarised in Table 1 and there has been some amalgamation of sites where low numbers (<5) were involved. In the study period, 3773 penguins were banded. Of these, 2037 (54%) were nestlings and 1736 were adults (including 1256 which were sexed when banded). Most penguins were banded at London Bridge (2351, 62.3% of total) and on Middle Island, near Warrnambool (949, 25.1%).

Recoveries

In the study period (1971 – 2008), 222 penguins were considered to have been recovered (i.e. found dead or, in one case, mercy killed). In many cases, specific causes of death were not identified. Whilst 19 birds (8.5%) were found dead (no other details provided by the finder) and bands or a wing with a band were found in six instances, many birds (52; 23.4%) were beach-washed or found dead at or near burrows (35, 15.8%). Others were found dead on a road or were killed by a car (2 and 1, respectively; at Portland), oiled (3), killed by a rock fall (1; at London Bridge) or injured/killed by a human (1). Of the 166 birds known to have been recovered on land and with an apparent cause of death being reported, 107 (64.5%) were reported to have been killed by a predator. For those considered to have been depredated (48.2% of all recoveries), the predator was unknown in 14 cases, or was considered to have been a wild bird (1) or domestic animal (1), but 91 (85.0% of depredated penguins) were thought to have been taken by an unknown mammal (67), dog (16) or cat (8). Of those depredated, nine were in the Portland area, 46 at the London Bridge colony and 49 on Middle Island.

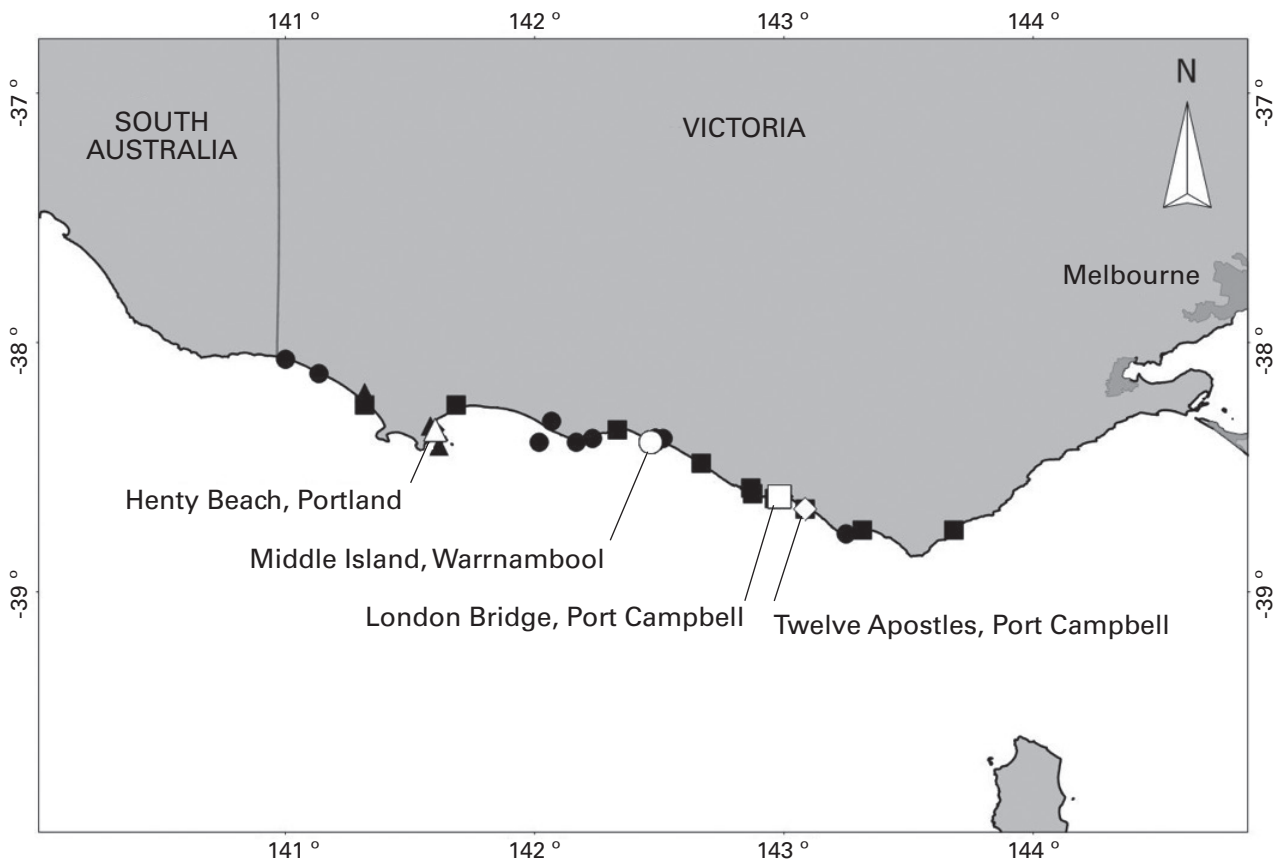


Figure 2. Locations of recoveries of Little Penguins from four breeding sites in western Victoria. White filled symbols = breeding site, black filled symbol = recovery site. Symbols used: Henty Beach, Portland ▲; Middle Island, Warrnambool ●; London Bridge, Port Campbell ■; Twelve Apostles, Port Campbell ◆.

The predation events, as reflected by recoveries of banded penguins, appeared to occur infrequently. For example, at London Bridge in Port Campbell National Park where flipper banding began in 1971, the first depredated recovery was in December 1985. At this site there were 33 banded penguins (of 42 found) recorded as being depredated between March and April 1989, all of which had been banded as adults up to eight years previously. However, six of 12 recoveries made in January 2004 had been banded as chicks in the ongoing breeding period. On Middle Island, the first depredated, banded bird was recorded in June 1979 (probably killed by a dog) and about 50 were reported as being killed by dogs or foxes in 1980 (PINP files). However, only small numbers of depredated birds were then recorded until November 2001, when nine were killed (including penguins banded some eight years earlier). More penguins were depredated in subsequent years, including previously marked individuals; for example, five dead banded penguins were found in October and November 2004 (thought to have been “predated by a mammal”), including individuals marked 10 years earlier.

The movements of 31 penguins from their banding sites to the locations of recovery are summarised in Figure 2. Distances between banding and recovery sites averaged 37.9 km (\pm sd 47.1, range 1–147, $n=30$) and the mean time between banding and recovery was 46.6 months (± 51.5 , 0–143, 28). For those

banded as adults (11), the mean distance travelled to the recovery site was 33.4 km (± 51.1 , 2–147), with an elapsed time of 70.5 months (± 45.6 , 9–132), whereas the mean distance for 19 birds banded as chicks was 40.5 km (± 44.5 , 1–138) and the time elapsed was 34.2 months (± 50.5 , 0–143). There were no significant differences in distances moved ($t=0.397$, df 28, $p=0.69$) or elapsed time ($t=0.165$, df 25, $p=0.11$) between birds banded as adults and as chicks. Whilst 10 birds were recovered to the east (0–180° bearing) of their banding sites, with movement by a nestling from Middle Island to Moonlight Head (78 km) being the farthest, 20 were to the west (181–360°), the longest being an adult from London Bridge to near the east end of Discovery Bay, a distance of 147 km. These records showed that no major mortalities were associated with sardine *Sardinops sagax* ‘die-offs’ (i.e. no increases in June–September 1995 or November–December 1998), and distances to recovery sites did not increase with elapsed time for the 11 birds banded as nestlings ($r = -0.2$, $p=0.555$) or the 18 banded as adults ($r = -0.35$, $p=0.068$).

Examination of beach-washed recoveries (52) shows that 13 birds banded as nestlings were recovered during or just after the breeding period (i.e. January to March). Penguins banded as adults (39) were recovered throughout the year, but many (14, 35.9%) were found in April after the moulting period.

DISCUSSION

Between 1971 and 2008, 3773 Little Penguins were banded as adults (1736, 46%) or nestlings (2037, 54%) at 20 sites in western Victoria, mainly at London Bridge (2351, 62.3%) and Middle Island (949, 25.1%). In the study period, some 222 (5.9% of penguins banded) recoveries (birds found dead) were made. Recoveries were made at banding sites, on the nearby Victorian coast, and as far west as Discovery Bay and east to Moonlight Head; however, distances involved (from banding to recovery sites) were usually short. Whilst distant recoveries (i.e. away from banding sites) occurred both to the east (33.3%) and particularly to the west (66.7%), no substantial movements away from banding sites were indicated by recoveries. Indeed, unlike the case of birds banded at Phillip Island (Dann *et al.* 2000) and Rabbit Island (Norman *et al.* 2012), there were no recoveries in Port Phillip Bay.

Most of the birds recovered on land were considered by the persons reporting the carcasses to have been depredated (64.5% of those where cause of death was given), mostly (85.0%) by a wild or domestic mammal, including dogs and foxes. In the present study, recovery rates (i.e. the percentage of banded birds subsequently found dead) away from banding sites were lower (0.8% for all birds banded) than those recorded for Phillip Island (about 3%, almost all beach-washed; Dann *et al.* 1992) and Rabbit Island (c. 2%; Norman *et al.* 2012). There was no evidence from the recoveries of any increase in mortality associated with sardine 'die-offs' (cf. Dann *et al.* 2000, Norman *et al.* 2012).

Reilly and Cullen (1982) indicated that recoveries showed a varying pattern of movement of penguins banded as nestlings, with most being made to the west from Phillip Island (see also Dann *et al.* 1992), west and north west from Chalky and Bruny Islands, Tasmania, east and west from Port Campbell, nearby or to the west from Gabo Island and north and south from colonies in New South Wales (see also Marchant and Higgins 1990). Norman *et al.* (2012) considered that reported directions travelled from Rabbit Island and the Seal Island Group off Wilsons Promontory tended to agree with those recorded in these previous studies, with penguins showing a predominantly north-westerly movement, although some recoveries were to the east and south. In the present study, penguins banded in western Victoria were recovered to the west and east, but, unusually, recoveries were normally made close to the banding sites.

Norman *et al.* (2012) suggested that movements of banded penguins subsequently recovered may be to areas of increased productivity. For Victorian penguins breeding around the nutrient-poor Bass Strait (Gibbs 1992), this movement is towards the Bonney Upwelling in the west of Bass Strait or towards the east, where there are summer upwellings (e.g. Newell 1961, Prince 2001). Gibbs *et al.* (1986) had previously commented on nutrient inputs from deeper waters, which were cooler and had an elevated chlorophyll level in the November to April period (Butler *et al.* 2002). The Bonney Upwelling, which extends towards Portland, involves the upwelling of cold, nutrient-rich water (e.g. Middleton and Bye 2007) below the surface of offshore waters. This enhances productivity and results in increased zooplankton and fish populations.

Bonney Upwellings generally occur between November and May, being strongest in late summer (February to March; Kirkwood and Goldsworthy 2013). Certainly Gill (2002) considered that there was an increase in ocean productivity in the summer-autumn period, resulting in increased krill *Nyctiphanes australis* aggregations. For penguins from colonies in western Victoria, there is a relatively short distance to travel to increased resources around the nutrient-rich Bonney Upwelling which may, in any case, occur locally with currents tending eastwards, particularly in winter (e.g. Gibbs 1992). However, the present study has not indicated such winter movements of penguins. Rather, that birds were recovered near to their banding sites suggests that the improved productivity extends to waters east of Portland, with birds consequently not having to make extensive movements. Indeed, Leggett (1994) found that foraging distance and time of radio-tracked penguins from the London Bridge colony were restricted when compared with those of birds at Phillip Island. Further, at least in some breeding periods, chicks at Port Campbell were heavier than those at Phillip Island (Cullen *et al.* 1992). Nevertheless, penguins from Phillip Island appear obliged to move extensively to the western Victorian coast (and beyond). Thus Dann *et al.* (1992) found that many penguins in their first and second years were recovered in western Victorian waters and Norman *et al.* (1992) reported that 28 of 30 banded penguins found in the 1986 'wreck' were from Phillip Island.

Dann (1992) noted that, whilst most recoveries of first and second year penguins banded at Phillip Island were made away from the island, predation (mainly by foxes) was the main cause of death of adults on land, a result also found in this study (although foxes were not necessarily specifically identified when the recovery occurred). Predation by mammals has been reported at various western penguin colonies. For example, P. Reilly (PINP files) recorded 300 dead penguins at Gibson's Steps in November 1977 (baiting removed the fox presumed to be responsible, P. Du Guesclin pers. obs.) and Harris and Norman (1981) mentioned problems with feral or pet dogs at Middle and Merri Islands. In the present study, predation (usually by mammals) was recorded at several sites, particularly Middle Island and London Bridge, where application of fox bait seemed to prevent further kills (P. Du Guesclin pers. obs.). However, predation at the latter site has not had any apparent effect on population size, which has remained at around 200 birds.

In contrast, at Middle Island, where the colony apparently grew from ~199 burrows in 1978 (Harris and Norman 1981) to about 1000 pairs before 2000 (PSG, reported in Jessop and Du Guesclin 2000), numbers of breeding penguins have decreased substantially. Thus by 2000 there were only 342 active burrows, a total which decreased to 52 in 2005 (Overeem and Wallis 2003, 2007). Overeem and Wallis (2003, 2007) reported 50 penguins being killed in October 1993, 72 between March and April 1995, and a further 13 in 1999-2000. They also reported 268 carcasses on one visit to the island, and noted that 'just under' 500 had been found in the past six years (between 1999 and 2003) (Overeem and Wallis 2007).

However, improved access to Middle Island also resulted in disturbance to burrows by visitors who trampled on them and caused substantial egg and chick losses (Overeem and

Table 2

Annual banding totals for Little Penguins at Middle Island, Victoria in the period 1971 to 1998.

Breeding period	Chicks	Adults			Totals
		Male	Female	Unspecified	
1971 - 1972	47				47
1972 - 1973	63				63
1973 - 1974	13			65	78
1975 - 1976	85				85
1976 - 1977	37			42	79
1979 - 1980	67				67
1980 - 1981	43				43
1982 - 1983		3	5	3	11
1983 - 1984				1	1
1993 - 1994	5	224	194	6	429
1997 - 1998	9	14	23		46
Totals	369	241	222	117	949

Wallis 2007). Between the 1971–1972 and 1997–1998 breeding periods, approximately 949 penguins were banded at Middle Island (Table 2). It is of note that, whilst substantial numbers of nestlings were banded before 1982–1983, relatively few have been banded there since. The population was considered to have decreased to four breeding adults by 2005, but the subsequent use of Maremma guardian dogs appears to have reversed the trend and penguin numbers have steadily increased (King *et al.* 2016).

In contrast, Dann (1992) considered that some colonies on Phillip Island had disappeared and the population remaining on Summerland Peninsula was decreasing as a result of reduced survival of adults and chicks. Predation, particularly by foxes and dogs, was the major mortality agent. Again, with management oriented towards removal of foxes, the population has increased (Sutherland and Dann 2014).

During the study period, other Victorian penguin colonies have also decreased or become extinct. The colony at the Portland foreshore has disappeared despite efforts to maintain it in artificial burrows. It is possible that predators were involved in its demise, although road fatalities may also have been of some importance because in 1980 road casualties were considered to occur frequently (PINP files). The breeding population of penguins on Lady Julia Island has decreased substantially from early estimates and survey results in 1978/79. Whilst this colony may have been influenced by pilchard ‘die-offs’ (in 1995 and 1998) and by breeding failure and increased mortality (e.g. Dann *et al.* 2000), the large increase in numbers of Australian fur seals *Arctocephalus pusillus doriferus* may also have reduced available habitat or indeed penguin survival on land (Dann *et al.* 2004). Whilst Australian fur seals do not eat penguins (Kirkwood *et al.* 2008), they do compact penguin breeding habitat severely and they may crush adult penguins traversing the main seal colony in Seal Bay (Dann *et al.* 2004).

The pattern of recoveries of penguins banded at sites in western Victoria is unlike those shown at other colonies. In contrast to birds banded at Phillip Island, or indeed Rabbit

Island off Wilsons Promontory and elsewhere (Reilly and Cullen 1982; Dann *et al.* 1992; Norman *et al.* 2012), movements from banding to recovery sites did not involve substantial distances. It appears that there is no need for breeding penguins in western Victoria to move away from waters near to their breeding colonies, perhaps because of enhanced productivity in this area resulting from the nutrient-rich Bonney Upwelling to the west.

ACKNOWLEDGEMENTS

We are, as ever, indebted to those (particularly members of the PSG) who have banded Little Penguins around the coast of western Victoria. We also acknowledge the trouble taken by those finding marked penguins and reporting their death to the ABBBS.

REFERENCES

- Arnould, J. P. Y., Dann, P. and Cullen, J. M. (2004). Determining the sex of little penguins (*Eudyptula minor*) in northern Bass Strait using morphometric measurements. *Emu* **104**: 261–265.
- Butler, A., Althaus, F., Furnali, D. and Ridgeway, K. (2002). Assessment of the conservation values of the Bonney upwelling area: a component of the Commonwealth Marine Conservation Assessment Program 2002–2004. Report to Environment Australia, Canberra.
- Collins, M., Cullen, J. M. and Dann, P. (1999). Seasonal and annual foraging movements of little penguins from Phillip Island, Victoria. *Wildlife Research* **26**: 705–721.
- Cullen, J. M., Montague, T. L. and Hull, C. (1992). Food of little penguins *Eudyptula minor* in Victoria: comparison of three localities between 1985 and 1988. *Emu* **91**: 381–341.
- Dann, P. (1992). Distribution, population trends and factors influencing the population size of little penguins *Eudyptula minor* on Phillip Island. *Emu* **91**: 263–272.
- Dann, P. and Norman, F. I. (2006). Population regulation in little penguins *Eudyptula minor*: the role of intraspecific competition for nesting sites and food during breeding. *Emu* **106**: 289–296.
- Dann, P., Cullen, J. M., Thoday, R. and Jessop, R. (1992). Movements and patterns of mortality at sea of little penguins *Eudyptula minor* from Phillip Island, Victoria. *Emu* **91**: 278–286.
- Dann, P., Mackay, M., Kirkwood, R. and Menkhorst, P. (2004). Notes on the birds of Lady Julia Percy Island, western Victoria. *Victorian Naturalist* **121**: 59–66.
- Dann, P., Norman, F. I., Cullen, J. M., Neira, F. and Chiaradia, A. (2000). Mortality and breeding failure of little penguins in 1995 following a widespread mortality of pilchard *Sardinops sagax*. *Marine and Freshwater Research* **51**: 355–362.
- Dann, P., Sidhu, L., Jessop, R., Renwick, L., Healy, M., Dettmann, B., Baker, G. B. and Catchpole, T. (2014). The effects of flipper bands and injected transponders on the survival of adult Little Penguins *Eudyptula minor*. *Ibis* **156**: 73–83.
- Farnes, R. F. (2007). ‘Birds of the Portland district’. (Portland Field Naturalists’ Club: Portland.)
- Gibbs, C. F. (1992). Oceanography of Bass Strait: implications for the food supply of little penguins *Eudyptula minor*. *Emu* **91**: 395–401.
- Gibbs, C. F., Tomczak, M. and Longmore, A. R. (1986). The nutrient regime of Bass Strait. *Australian Journal of Marine and Freshwater Research* **37**: 451–446.
- Gill, P. C. (2002). A blue whale *Balaenoptera musculus* feeding ground in a southern Australian coastal upwelling zone. *Journal of Cetacean Research and Management* **4**: 179–184.
- Harris, M. P. and Norman, F. I. (1981). Distribution and status of coastal colonies of seabirds in Victoria. *Memoirs of the National Museum of Victoria* **42**: 89–106.

- Hoskins, A. J., Dann, P., Ropert-Coudert, Y., Kato, A., Chiaradia, A., Costa, D. P. and Arnould, J. P. Y. (2008). Foraging behaviour and habitat selection of the little penguin *Eudyptula minor* during early chick rearing in Bass Strait. *Marine Ecology Progress Series* **366**: 293-303.
- Jessop, R. and Du Guesclin, P. (2000). The effects of an oil spill at Apollo Bay, Victoria, on little penguins *Eudyptula minor* in May 1990. *Australian Bird Watcher* **18**: 192-198.
- King, K., Wallis, R., Wallis, A., Peucker, A. and Williams, D. (2016). Successful protection against canid predation on little penguins (*Eudyptula minor*) in Australia using maremma guardian dogs: "The Warrnambool Method." *International Journal of Arts and Sciences* **8** (5): 139-150.
- Kirkwood R., Hume F. and Hindell M. (2008). Sea temperature variations mediate annual changes in the diet of Australian fur seals in Bass Strait. *Marine Ecology Progress Series* **369**: 297-309.
- Kirkwood, R. and Goldsworthy, S. (2013). 'Fur seals and sea lions'. (CSIRO Publishing: Collingwood.)
- Leggett, J. (1994). Foraging range and the burrow selection of little penguins, *Eudyptula minor*, during the 1993/1994 breeding season at London Bridge (Port Campbell National Park, Victoria), Unpublished report to Biological and Chemical Sciences Department, University of Ballarat.
- Marchant, S. and Higgins, P. J. (Eds.) (1990). 'Handbook of Australian, New Zealand and Antarctic birds. Volume 1'. (Oxford University Press: Melbourne.)
- McCutcheon, C., Dann, P., Salton, M., Renwick, L., Gormley, A. and Arnould, J. (2011). Foraging range of little penguins during winter. *Emu* **111**: 321-329.
- McKean, J. (1962). Unpublished letter. (Victorian) Fisheries and Wildlife Division file 154/1/1.
- Middleton, J. F. and Bye, J. A. T. (2007). A review of shelf-slope circulation along Australia's southern shelves: Cape Leeuwin to Portland. *Progress in Oceanography* **75**: 1-41.
- Newell, B. S. (1961). Hydrology of south-east Australian waters. CSIRO Australia, Division of Fisheries and Oceanography: Technical Paper No. 10.
- Norman, F. I., Du Guesclin, P. B. and Dann, P. (1992). The 1986 'wreck' of little penguins *Eudyptula minor* in western Victoria. *Emu* **91**: 369-376.
- Norman, F. I., Dann, P., Unthank, S. and Montague, T. L. (2012). Movements of little penguins *Eudyptula minor* banded at Rabbit Island and the Seal Island Group, Wilsons Promontory, Victoria. *Corella* **36**: 57-62.
- Norman, F. I., Harris, M. P., Corrick, A. H. and Carr, G. W. (1980). The flora and fauna of Lady Julia Percy Island, Victoria, Australia. *Proceedings of the Royal Society of Victoria* **91**: 135-154.
- Overeem, R. L. and Wallis, R. L. (2003). Little penguin *Eudyptula minor* at Middle Island, western Victoria: current status. *Victorian Naturalist* **120**: 76-83.
- Overeem, R.(L.) and Wallis, R.(L.) (2007). Decline in numbers of little penguin *Eudyptula minor* at Middle Island, Warrnambool, Victoria. *Victorian Naturalist* **124**: 19-22.
- Pescott, T. [W]. (1965). A visit to Lady Julia Percy Island, Victoria. *Victorian Naturalist* **81**: 290-301.
- Pescott, T. W. (1976). Seabird Islands No. 27 Lady Julia Percy Island, Victoria. *Australian Bird Bander* **14**: 29-31.
- Preston, T. J., Ropert-Coudert, Y., Kato, A., Chiaradia, A., Kirkwood, R., Dann, P. and Reina, R. D. (2007). Foraging behaviour of little penguins *Eudyptula minor* in an artificially modified environment. *Endangered Species Research* **3**: 1-9.
- Priddel, D., Carlile, N. and Wheeler, R. (2008). Population size, breeding success and provenance of a mainland colony of little penguins (*Eudyptula minor*). *Emu* **108**: 35-41.
- Prince, J. D. (2001). Ecosystem of the south east fishery (Australia), and fisher lore. *Marine and Freshwater Research* **52**: 431-449.
- Reilly, P. (1977). Decreases in breeding success of the little penguin *Eudyptula minor* in 1976/77 on Phillip Island, Victoria. *Victorian Ornithological Research Group Notes* **13**: 3-9.
- Reilly, P. and Cullen, J. M. (1982). The little penguin *Eudyptula minor* in Victoria III. Dispersal of chicks and survival after banding. *Emu* **82**: 137-142.
- Reilly, P. and Cullen, J. M. (1983). The little penguin *Eudyptula minor* in Victoria IV. Moulting. *Emu* **83**: 94-98.
- Sutherland, D and Dann, P. (2014). Population trends in a substantial colony of little penguins: three independent measures over three decades. *Biodiversity and Conservation* **23**: 241-250.
- Tarr, H. E. (1954). Diary notes from Lady Julia Percy Island (Victoria) – November-December 1949. Part One. *Bird Observer* (Nov.).
- Weavers, B. W. (1992). Seasonal foraging ranges and travels at sea of little penguins *Eudyptula minor* determined by radiotracking. *Emu* **91**: 302-317.
- Wood Jones, F. and Tubb, J. A. (1937). Reports of the McCoy Society 23. Aves. *Proceedings of the Royal Society of Victoria* **49**: 426-431.