

## TOURISTS AND LITTLE PENGUINS *Eudyptula minor* AT MONTAGUE ISLAND, NEW SOUTH WALES

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Little Penguins *Eudyptula minor* have been viewed by tourists at a penguin landing site (Jetty Bay) on Montague Island since 1991. Numbers of penguins coming ashore at Jetty Bay during November in the evening decreased significantly between 1994 and 1998 from approximately 250 to 66 per night, compared with no reduction in numbers coming ashore at a control site 600 m south (~270 to 284 per night). After watching penguins coming ashore at Jetty Bay, tourists walked to their boat along a roadway that was also used by penguins. The decrease in penguin numbers landing at Jetty Bay may be partly attributable to disturbance from tourists, because numbers at the control site and numbers of breeding pairs on the island showed little change. High and dense Kikuyu Grass *Pennisetum clandestinum* near Jetty Bay may also have caused penguin numbers to decrease during this period. In March 2001 a viewing platform and walkway were constructed at Jetty Bay, which enabled visitors to depart from the viewing platform to the tour boat without disturbing penguins. In November 2002, 37 penguins came ashore per night at Jetty Bay compared with 194 at the control site. There was a non-significant increase in numbers of penguins coming ashore at Jetty Bay between 2002 and 2006. The lack of recovery in numbers of penguins coming ashore at Jetty Bay after 2001 may be caused by the lag time for recovery as nesting penguins slowly return to the Jetty Bay area following cessation of disturbance from tourists and/or by the high, dense Kikuyu Grass in the Jetty Bay area. Work is underway to remove kikuyu in this area and replace it with native vegetation. Monitoring numbers of Little Penguins coming ashore in November at both sites should continue in order to determine responses to management actions.

### INTRODUCTION

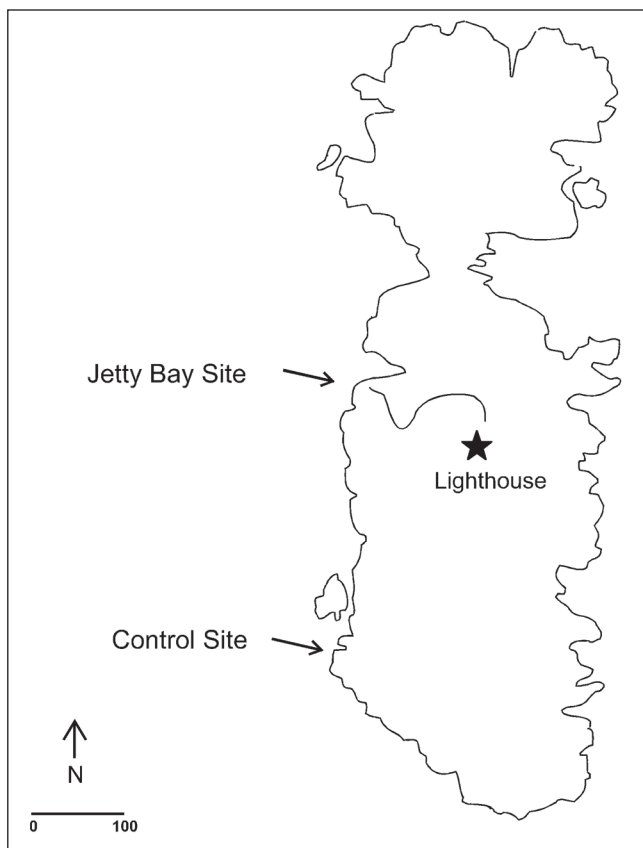
In recent decades, interest has grown in nature-based tourism and nature travel (Reynolds and Braithwaite 2001). The viewing of marine wildlife is a component of these activities. Negative effects associated with such activities have been documented, including some on penguins (Culik and Wilson 1995; Giese 1996). Studies of Adélie Penguins *Pygoscelis adeliae* and Gentoo Penguins *P. papua* on the other hand, found no discernible effects of tourist visitation on population size or breeding success of the birds (Fraser and Patterson 1997; Cobby and Shears 1999; Carlini *et al.* 2007). Although Little Penguins avoid areas with high levels of human disturbance (Klomp *et al.* 1991), breeding success, survival and movements of Little Penguins in and out of breeding areas at the popular penguin viewing site on Phillip Island, Victoria where visitation has been managed were not affected by tourists (Dann 1992).

At a site on the west coast of Montague Island (Jetty Bay) penguins have been viewed while coming ashore after dusk by tourists since April 1991 (Ross Constable, pers. comm.). Tours depend on good sea conditions and hence operate on about 50 per cent of evenings. Each tour boat is accompanied by a trained guide of the NSW Parks and Wildlife Group of the Department of Environment and Climate Change (formerly the National Parks and Wildlife Service) of New South Wales (NSW). The population of Little Penguins on Montague Island is one of the largest in New South Wales (Lane 1979; Marchant and Higgins 1990). The most recent estimate of the population was 5000 breeding pairs in October 2000 (Weerheim *et al.* 2003). Weerheim *et al.* (2003) considered this figure to be an underestimate because their repeat surveys in November and

December showed that single counts underestimated population size. Penguins come ashore at many places on Montague Island; in November 1992 and 1994 respectively, 60 and 85 landing sites were recorded (Fullagar and Heyligers 1992; Heyligers and Fullagar 1995).

We investigated possible impacts of tourists and their activities on Little Penguins landing at the penguin-viewing site (Jetty Bay) on Montague Island in November 1998 and 2002. During the first study period (1998), tourists congregated before dusk behind a roped-off area above the wharf at Jetty Bay (Fig. 1) to watch the penguins that came ashore over rocks and then climbed up to the roadway from the wharf. The penguins walked up the roadway for 20 to 30 metres and then dispersed along runways to nesting areas or continued up a mown grass track to other runways. After viewing the penguins for 30 minutes, tourists boarded a boat for the return trip to Narooma. This required them to access the wharf at Jetty Bay by walking down the roadway that the penguins also used. Although the guides tried to move the tourists when there was a lull in penguin movements, it was inevitable that penguins were disturbed.

After the 1998 study, the National Parks and Wildlife Service built a viewing platform at Jetty Bay and constructed an alternative route for visitors to access the wharf area and tour boat. This included stairs and a curved, sloping walkway overhanging the waters of Jetty Bay (Figs 2 and 3). The walkway led down to the wharf so that departing visitors walked from the rear of the viewing area down to the tour boat and departed without disturbing penguins arriving ashore. The viewing platform and walkway were constructed between January and March 2001.



**Figure 1.** Map of Montague Island showing Jetty Bay and the control site where Little Penguins were counted when they came ashore in the evening.

We conducted a follow-up survey of numbers of penguins landing at Jetty Bay and at a control site in November 2002, after construction of the viewing platform and new walkway at Jetty Bay for departing visitors. We report on our study and discuss the outcomes and implications for managing penguin viewing on Montague Island in this paper.

## METHODS

### Study site

Montague Island is situated nine kilometres south-east of Narooma on the south coast of New South Wales. The island has an area of 82 hectares and is close to the edge of the continental shelf. It is managed as a Nature Reserve by the NSW Parks and Wildlife Group. The island supports two species of fur seal *Arctocephalus* spp., three species of shearwater *Ardenna* spp., Little Penguins *Eudyptula minor* and other seabirds (National Parks and Wildlife Service 1994). Vegetation on the island has been altered since European occupation began in the 1880s and possibly earlier from the introduction of goats and rabbits. The typical coastal vegetation of shrubs and trees has been replaced by communities dominated by Mat-rush *Lomandra longifolia* and introduced Kikuyu Grass *Pennisetum clandestinum* (Heyligers 1993).



**Figure 2.** Aerial photograph of Jetty Bay at Montague Island showing the penguin landing site (right foreground, dark coloured rock), wharf where tour boats berthed, roadway leading up from the wharf, above which is a fenced-off viewing platform with bench seats, and the walkway for departing tourists (behind the crane). Photo: Jack Babidge



**Figure 2.** Construction of the walkway at Jetty Bay, Montague Island, that leads from the viewing platform (out of picture on left) to the wharf. Photo: Jack Babidge

### Protocol for counting

Little Penguins landing in the evening were counted in 1998 and 2002 at Jetty Bay and at a control site, both on the west coast of Montague Island. In 1998 the survey at Jetty Bay was conducted with tourists leaving the island via the roadway. In the presence of humans, some penguins on the roadway or near it retreated and some headed back towards the sea. Care was taken then not to double count birds. In 2002 the survey was conducted with the tourists leaving via the walkway, which did not appear to disturb the penguins. Penguins were counted with a hand-held tally counter under white light. At Jetty Bay tourists viewed penguins under low intensity electric lights, and these lights were used in this study, both in the presence and

absence of tourists in order to see the penguins and to avoid confounding effects. Counts at Jetty Bay in 1998 and 2002 were made on nights when tourists were present and on nights when they were absent. Weber (1994) found that the number of penguins that landed at Jetty Bay over 16 consecutive evenings did not differ with the presence or absence of tourists. At the control site, a gas lantern was placed on a rock 1.5 metres above ground level and 10 metres inland of the penguin landing site so that birds could be seen and counted, again to avoid confounding effects. After some initial hesitation, penguins showed little reaction to the light.

In 1998, counts were made over six evenings, from 10 to 15 November. In 2002, counts were also made over six evenings, from 8 to 13 November. The counts were conducted in November because data in that month from earlier surveys were available. Observations began 15 minutes before sunset in order to record the time the first penguin came ashore. Little Penguins typically come ashore at dusk, with most ashore within two hours of the onset of darkness (Montague 1982). Counting was continued for 1 hour 15 minutes after the first penguin landed and came ashore. If a penguin came ashore briefly and returned to the sea, that event was discounted. Counts at each site in 1998 and 2002 were compared using 2-tailed t-tests. Because the variances of the two sets of counts at the control site differed significantly ( $F=160$ ,  $df = 5,5$ ,  $P<0.001$ ), the t-test was adjusted accordingly (Bailey 1959).

#### Other data sources

Data on the number of penguins landing in November at Jetty Bay and at the control site were available for 1994, and for Jetty Bay for 1992 (Heyligers and Fullagar 1995; C. Davey, MI Partners database, pers. comm.). Based on the number of penguins that landed at dusk in November 1992 and 1994, Jetty Bay and the control site were recorded as 'prime sites' in both years by Heyligers and Fullagar (1995). The average number of penguins landing at prime sites (270) was used in our analyses for the control site in 1992. Differences in the number of penguins coming ashore at Jetty Bay and at the control site between 1993 and 1998 were analysed by Shaughnessy *et al.* (1999), using data supplied by Jamie Weber (pers. comm.).

From 2003 to 2006, counts were made at Jetty Bay by volunteers on tours to Montague Island on 3–10 nights each November using the same protocol as we used in 1998 and 2002 (M. Westwood pers. comm.). Counts for these four years were analysed by linear regression of the natural logarithm of mean counts against year. This provides an estimate of the exponential rate of increase (Caughley 1980). The statistical significance of the regression was examined using analysis of variance (Bailey 1959).

## RESULTS

The number of Little Penguins landing at Jetty Bay in November was similar in 1992 and 1994, decreased considerably from 1994 to 1998, and was lower again in 2002 (Table 1). The number of penguins landing at the control site was similar in 1992, 1994 and 1998, and slightly lower in 2002

(Table 1). The decrease from over 200 penguins per night in November 1992 and 1994 at Jetty Bay to well below 100 in November 1998 and 2002 did not occur at the control site, where numbers exceeded 250 in November 1992, 1994 and 1998, and were just below 200 in November 2002 (Table 1).

Analysis of differences in the number of penguins landing at Jetty Bay and at the control site (data from Jamie Weber pers. comm., analysed in Shaughnessy *et al.* 1999) showed that a similar number of penguins landed in the evening at Jetty Bay and at the control site between March 1993 and March 1994, but statistically significantly fewer penguins landed at Jetty Bay than at the control site between February 1995 and October 1998.

After construction of the walkway for visitors to leave the viewing area to access the tour boat in early 2001, the numbers of penguins that came ashore per night at Jetty Bay had not recovered by 2002. A mean of 37 penguins was recorded coming ashore per night at Jetty Bay in November 2002 compared with 194 at the control site. Although numbers at both sites were lower in 2002 than in 1998, the decline at Jetty Bay (45%) was statistically significant ( $t = 3.17$ ,  $df = 10$ ,  $P = 0.01$ ) but the decline at the control site (32%) was not significant ( $t = 1.56$ ,  $df = 5$ ,  $P = 0.18$ ).

Mean counts at Jetty Bay from 2002 to 2006 showed a small increase (rate of increase = 0.10) that was not significant ( $F = 1.54$ ,  $df = 1,3$ ,  $P = 0.303$ ). The maximum count during that period was 55 in 2005 (Table 1).

## DISCUSSION

The decrease in numbers of Little Penguins landing at Jetty Bay between November of 1994 and 1998 compared with the steady numbers at the control site in the same period suggests that tourist activity may have contributed to the decrease at Jetty Bay. Caution is required in making this comparison because the control site was not replicated. Nevertheless, the stability in abundance of penguins on the island based on censuses of breeding pairs in 1992, 1994 and 1998 (see Trezise *et al.* 2001; Weerheim *et al.* 2003) suggests that the decrease observed at Jetty Bay was atypical. The effect of departing tourists walking along the pathway used by arriving penguins may have been intrusive. Increased heart rate in Adélie Penguins when approached by humans was interpreted by Culik *et al.* (1990) to indicate a strong response to disturbance by the penguins even though they appeared unconcerned.

The decline in numbers of penguins landing at Jetty Bay did not begin until after November 1994, at least 3½ years after penguin viewing began there in 1991. If the decline was caused by tourists, the lag time for the effect to become apparent might be a consequence of Little Penguins being long-lived, faithful to their breeding sites (Dann and Cullen 1990) and because they first breed at two or three years of age (Marchant and Higgins 1990). It is possible that adults continued to return to their breeding sites inland from Jetty Bay, but their numbers declined from natural mortality over time and recruitment was lower after disturbance by tourists began. The number of birds breeding for the first time coming ashore at Jetty Bay may then have declined a few years later because of reduced recruitment and disturbance from tourists.



TABLE 1

Number of Little Penguins (mean and standard error where available) that landed per evening at two sites on the west coast of Montague Island in November of eight years. Number of evenings when penguins were counted is indicated in parentheses below the dates. n.a. = data not available.

Year	Jetty Bay		Control Site		Source
	Dates (# evenings)	No. of penguins	Dates (# evenings)	No. of penguins	
1992	20-30 Nov (7)	222	17-30 Nov (n.a.)	ca. 270 (‘prime site’)	Heyligers and Fullagar (1995, Fig. 2) and MI Partners database
1994	21-30 Nov (6)	247	21 Nov-1 Dec (5)	272	Heyligers and Fullagar (1995, Fig.2) and MI Partners database
1998	10-15 Nov (6)	66 ± 8.9	10-15 Nov (6)	284 ± 57.1	This study, PS and SB
2002	8-13 Nov (6)	37 ± 3.1	8-13 Nov (6)	194 ± 4.5	This study, PS and JL
2003	1-27 Nov (5)	26 ± 1.8	n.a.	n.a.	M. Westwood and tour volunteers
2004	2-22 Nov (4)	35 ± 2.1	n.a.	n.a.	M. Westwood and tour volunteers
2005	15-19 Nov (3)	55 ± 5.1	n.a.	n.a.	M. Westwood and tour volunteers
2006	3-24 Nov (10)	42 ± 4.8	n.a.	n.a.	M. Westwood and tour volunteers

Although speculative, the decline in penguins landing at Jetty Bay between 1994 and 1998 could also have been exacerbated (or caused) by an increase in the density and height of Kikuyu Grass on the western side of the island (Weerheim *et al.* 2003). Although Little Penguins on Montague Island nest in Kikuyu Grass as well as in other vegetation types (Weerheim *et al.* 2003), nesting success was less successful in taller grass (Trezise 1999). In their comparison of nest distribution on the island in November 2000 with that in earlier surveys, Weerheim *et al.* (2003) showed a shift away from areas increasingly dominated by dense Kikuyu Grass. The grass is particularly dense and tall in the area above Jetty Bay (pers. obs.).

Construction of the walkway for departing penguin viewers at Jetty Bay was a valid step toward decreasing disturbance from visitors to the penguins. However, penguin numbers coming ashore at Jetty Bay had not increased 20 months after its construction, based on numbers of penguins landing at Jetty Bay and at the control site in November of 1998 and 2002. Since 2002 there has been a small increase in numbers of penguins coming ashore at dusk at Jetty Bay, although they have not recovered to the levels of 1992 and 1994 (over 200).

Many factors may have contributed to the slow recovery of penguin numbers at Jetty Bay after the walkway was constructed. If potential recruits to the breeding population were deterred from nesting near Jetty Bay because of disturbance from tourists, it could take several years for the nesting

population at Jetty Bay (and therefore numbers of penguins landing there) to recover after removal of the disturbance. Alternatively, there may have been an overall decline in penguin numbers on Montague Island in the 1990s, although this seems unlikely since the abundance of breeding pairs of penguins on Montague Island fluctuated but did not decline over the four breeding seasons, 1992, 1994, 1998 and 2000 (summarised in Trezise *et al.* 2001; Weerheim *et al.* 2003).

A third factor may have been the negative impact of kikuyu in the area above Jetty Bay. Finally, the increasing presence of New Zealand Fur Seals *A. forsteri* there (Shaughnessy *et al.* 2001; M. Westwood, pers. comm.) may have had an impact on penguins at Montague Island. This seems unlikely because studies in South Australia showed that penguins were not an important part of the New Zealand Fur Seals’ diet (Page *et al.* 2005). It does not seem likely that the continuing presence of tourists at Jetty Bay after 2001 when the walkway was constructed continued to suppress numbers of penguins landing there, owing to the modification of the site and the management of tourists to lessen disturbance. Although Little Penguins avoid areas with high levels of human disturbance (Klomp *et al.* 1991), a long-term study of Little Penguins at a major penguin viewing site at Phillip Island showed that breeding success, survival and movements in and out of breeding areas were not affected by tourists where they were strictly managed and their movements made predictable (Dann 1992).

It appears likely that disturbance from tourists may have caused declines in numbers of Little Penguins landing at Jetty Bay during the 1990s, however with modification to the Jetty Bay site and with improved tourist management the adverse situation may have been alleviated. Kikuyu Grass may be continuing to have a negative impact on Little Penguins landing at Jetty Bay. We suggest that monitoring numbers of Little Penguins coming ashore at Jetty Bay be continued, and monitoring numbers coming ashore at the control site be recommenced, in parallel with work currently being undertaken to remove Kikuyu Grass and replace it with native vegetation.

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