

Marine Environment & Ecology



Little Penguins at Troubridge Island: *establishing a monitoring program for the future.*



A. S. Wiebkin

**SARDI Publication No. F2010/000190-1
SARDI Research Report series No. 443**

**SARDI Aquatic Sciences
PO Box 120 Henley Beach SA 5022**

March 2010

Report to Nature Foundation SA incorporated



**Government
of South Australia**



**Little Penguins at Troubridge Island:
*establishing a monitoring program for the future.***

Report to Nature Foundation SA incorporated

A. S. Wiebkin

**SARDI Publication No. F2010/000190-1
SARDI Research Report Series No. 443**

March 2010

Table of contents

This Publication may be cited as:

Wiebkin, A. S (2010) Little Penguins at Troubridge Island: *establishing a monitoring program for the future*. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2010/000190-1. SARDI Research Report Series No. 443.

South Australian Research and Development Institute

SARDI Aquatic Sciences
2 Hamra Avenue
West Beach SA 5024

Telephone: (08) 8207 5400

Facsimile: (08) 8207 5406

www.sardi.sa.gov.au

DISCLAIMER

The authors warrant that they have taken all reasonable care in producing this report. The report has been through the SARDI Aquatic Sciences internal review process, and has been formally approved for release by the Chief, Aquatic Sciences. Although all reasonable efforts have been made to ensure quality, SARDI Aquatic Sciences does not warrant that the information in this report is free from errors or omissions. SARDI Aquatic Sciences does not accept any liability for the contents of this report or for any consequences arising from its use or any reliance placed upon it.

© 2010 SARDI

This work is copyright. Apart from any use as permitted under the *Copyright Act* 1968, no part may be reproduced by any process without prior written permission from the authors.

Printed in Adelaide: May 2010

SARDI Publication No. F2010/000190-1
SARDI Research Report Series No. 443

Author: A. S. Wiebkin

Reviewer(s): B. Page and M. Theil

Approved by: J. Tanner
Principal Scientist – Marine Environment & Ecology

Signed: 

Date: 25 May 2010

Distribution: SAASC Library, University of Adelaide Library and Nature Foundation SA

Circulation: Public Domain

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY.....	5
2. INTRODUCTION.....	6
3. AIMS.....	6
4. MATERIALS AND METHODS.....	7
5. RESULTS.....	9
5.1 POPULATION.....	9
5.2 TAG RESIGHTS.....	9
5.3 BREEDING SUCCESS.....	10
5.4 BODY CONDITION.....	11
5.5 TAGGING FOR THE FUTURE.....	12
6. DISCUSSION.....	12
6.1 POPULATION.....	12
6.2 BREEDING SUCCESS.....	13
6.3 ADULT SURVIVAL.....	13
6.4 BODY CONDITION.....	14
7. MONITORING FOR THE FUTURE.....	14
8. CONCLUSION.....	15
9. ACKNOWLEDGEMENTS.....	15
10. REFERENCES.....	16

LIST OF FIGURES

Figure 1. Location of Troubridge Island in South Australia.....	8
Figure 2. The eastern beach showing the low sandy topography, habitat and lighthouse, and the boardwalk under which the runway lies (white arrow)	8
Figure 3. The permanent automatic tag reader with an aerial positioned along a natural penguin runway under a boardwalk	8
Figure 4. Portable TIRIS® tag reader.....	9
Figure 5. Measuring the bill of a little penguin to determine sex.....	9
Figure 6. Number of penguins tagged prior to August 2009 passing through the permanent gateway reader each night (August-November). Moon phases also indicated.....	10
Figure 7. The proportion of active nests that contained eggs, chicks or were empty throughout the breeding season.....	11
Figure 8. The monthly weights $g \pm SE$ of adult little penguins arriving on Troubridge Island's shore at dusk.....	12

LIST OF TABLES

Table 1. Breeding success of little penguins at Troubridge Island during 2004, 2005, 2006 and 2009.....	10
---	----

1. EXECUTIVE SUMMARY

A long-term monitoring program for little penguins was established at Troubridge Island, where one of South Australia's largest colonies is located. A previous study in 2003-06 surveyed the population size and breeding success, and a subset of the population was tagged with microchips. This project, conducted in 2009, resurveyed the population, monitored the breeding success and used an automatic tag reader to determine survival of the tagged penguins since 2004. An additional 203 penguins (adults and chicks) were tagged for future survival and breeding success monitoring. The population is currently stable, breeding success was higher than average, and 23% of the tagged adults from 2004/05 were resighted. Mortality of these adults is likely to be low, whereas post-fledging mortality of chicks is likely to be high, indicated by only 8% of chicks being resighted since 2004/05. Additional years of monitoring and tagging will allow any future declines to be detected and understood.

2. INTRODUCTION

Little penguin *Eudyptula minor* populations across Australia have been declining in recent years including colonies at Granite, West, and Kangaroo islands (SA), Phillip island (Vic) as well as Manly (NSW) and several in Tasmania (Boo *et al.* 2006, Dann *et al.* 2000). Troubridge Island is the only penguin colony in Gulf St Vincent (Fig. 1) and one of the largest colonies in South Australia. The geographical isolation of most of South Australia's colonies, together with strong natal colony affiliations (philopatry) and small foraging ranges, limits the likelihood of inter-colony interaction and immigration (Collins *et al.* 1999). Furthermore, a recent thesis study found significant genetic differences, in nuclear and mitochondrial DNA, between several penguin colonies sampled in South Australia (A. Peucker pers. comm. Deakin University). Troubridge Island was particularly different from other colonies in the region. Mitochondrial DNA analysis indicated that all penguins that were sampled from Troubridge Island were the descendants of only a few females and nuclear DNA analysis showed that the population was genetically less variable than other colonies. This suggests that the Troubridge island colony is relatively new and/or genetically isolated. For these reasons, declining populations in South Australia may be especially vulnerable and recolonisation rates are likely to be low. There is currently limited information on the population trends for the colony at Troubridge Island, and it is important for management to establish if it is declining like many other populations of this species, or if it is stable or growing.

3. AIMS

- To determine how the little penguin population at Troubridge Island has changed since late 2003 when a three-year population, tagging and breeding study was initiated.
- To determine how current breeding success, and the timing of breeding, compare with the previous study by regularly checking marked nests for eggs and chicks.
- To predict population trends by estimating adult survival rates.
- To determine body condition (mass) of adults as an indication of local prey availability, which is likely to affect breeding success and adult survival.
- Set up a long-term monitoring program to ensure early detection of population declines and to aid management for the conservation of the population.

4. MATERIALS AND METHODS

Troubridge Island (~8ha) is a sandy cay, mostly vegetated with nitre bush, *Nitraria schoberi* and African boxthorn *Lycium ferocissimum* (Fig. 2). This study was conducted during the peak-breeding season of 2009, over four months, involving four fieldtrips of three days each (August, September, October and November). The penguin population on the island was estimated by counting all active nests in representative habitat covering 20% of the colony in October. The results were compared with previous surveys conducted in 2003.

An automatic microchip (TIRIS ®) tag reader was set up along a natural 'main runway' that was regularly used by a proportion (~10%) of the colony (Fig. 2. and Fig.3). This permanent reader passively recorded previously tagged birds with known histories (breeding, age, gender, previous body condition). The reader was powered with batteries that were replaced each 4-5 weeks. The reader allowed survival rates to be estimated since the implantation of tags in 2004 and 2005. The penguins that were tagged in 2004 and 2005 were first caught in the area serviced by the reader, however penguins nesting in this area did have access to other runways. Individual penguins that are of breeding age (>2-3years old) have been found to regularly use specific runways because they use the same burrow/nest (or one within a few meters) in consecutive years (A. Wiebkin pers. obs.). Birds that have not yet reached breeding age tend to move about the colony and may use multiple runways. A second automatic reader was set up temporarily at three other nearby runways for a month each to record additional tagged birds in the area that did not use the main runway. A portable reader was also used to opportunistically resight tagged birds in the colony (Fig. 4).

Breeding success was determined by repeatedly visiting 60 active nests on each fieldtrip to ascertain the survival of chicks from hatching to fledging. An additional 60 randomly chosen active nests were checked each month and classified as having eggs, chicks or empty. This allowed the peak lay month to be determined.

Adult birds were weighed as they arrived at dusk on shore from fishing trips with meals for their chicks. Birds present in the colony during the day were also weighed to establish average weights with empty stomachs. Average meal masses were estimated from the difference between the average day and dusk weights for each sex. Birds were sexed using a discriminant equation based on bill measurements (A. Wiebkin, unpublished data) (Fig. 5).

TIRIS® microchip tags were implanted subcutaneously in adults and chicks found in the area of the colony serviced by the automatic reader to increase the size of the monitored population. The automatic tag reader will be able to detect a larger subset of birds that are tagged in future years to better determine survival rates of cohorts, survival trends and population sizes.

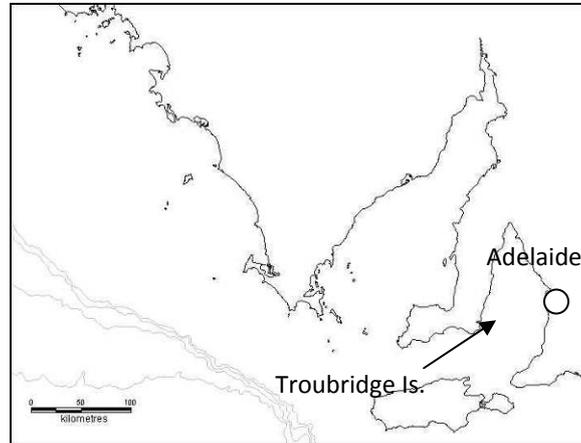


Figure 1. Location of Troubridge Island in South Australia.



Figure 2. The eastern beach of Troubridge Island, showing the low sandy topography, habitat and lighthouse, and the boardwalk under which the runway lies (white arrow).



Figure 3. (left) The permanent automatic tag reader with an aerial positioned along a natural penguin runway under a boardwalk.

Figure 4. (right) Portable TIRIS® tag reader.



Figure 5. Measuring the bill of a little penguin to determine sex.

5. RESULTS

5.1 Population

The nest count across 20% of the island was extrapolated to the whole area of the island. This resulted in an estimate of 1505 active nests, compared with 1264 in October 2004.

5.2 Tag resights

During this study, a total of 23.6% (64) of the 271 tagged adults and sub adults (≥ 1 year old) from 2004-05 were resighted alive (specifically, 23.8% from 2004 and 21% from 2005). Only 8.2% (12) of the 153 penguins that were tagged as chicks in 2004-05 were resighted. Males and females were tagged in equal proportions in both 2004 and 2005, and resighted in equal proportions (22 vs 22.3% respectively). All but three resighted birds were recorded in the first 2 months of this study. The permanent TIRIS reader recorded 74% of the resighted penguins, with the additional 26% being picked up using the portable reader whilst wandering around the colony, as well as the second temporary automatic reader at two other nearby runways. The third runway that was serviced by the temporary reader was the most distant (80 m) from the permanent reader, and no tagged penguins were resighted on this runway. In 2004, 61 adults that had been previously flipper-banded as adults between 1989 and 2003 were resighted. Of these, 21.3% (13) were again resighted in this study. No resights of tags from other South Australian colonies (~500 implanted in 2004/05) were recorded at Troubridge Island throughout this study.

Of the adult and sub adult penguins that were tagged in 2004-05, 28% (74) never used the main runway and a further 11% (31) only used the runway once (when they were released near it). 58% used the main runway for more than a month, of which 44% were resighted in this study.

The number of tagged birds passing the permanent reader each night did not correlate with moon phases but it did decrease throughout the study (20 to 12 tagged birds per night) (Fig 6).

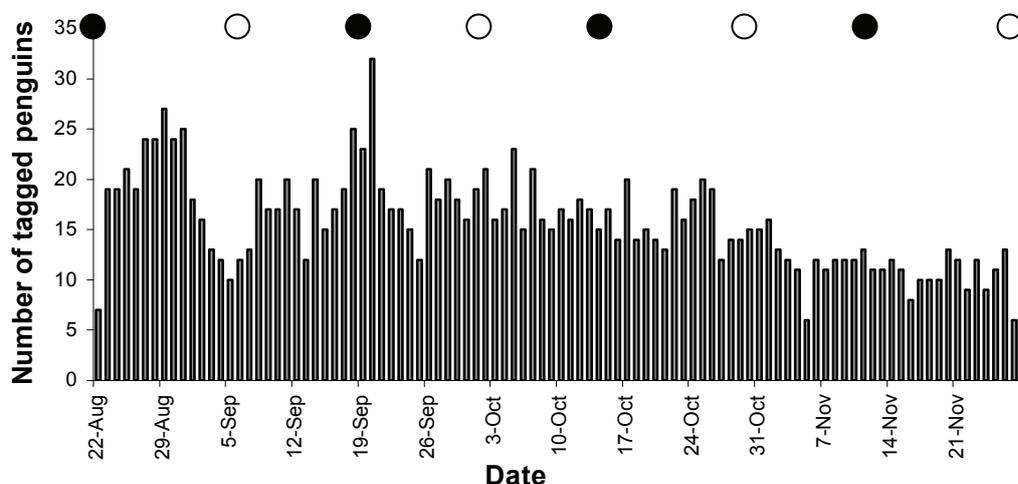


Figure 6. Number of penguins tagged prior to August 2009 passing through the permanent gateway reader each night (August-November). New and full moon phases also indicated.

5.3 Breeding success

Breeding success was monitored between August and November 2009. Of the 60 nests that were monitored, 47 produced eggs (total number of eggs was 70) and 51 chicks fledged (or were close to fledging age at last check) (Table 1). The breeding success was 1.08 per breeding pair and fledging success (chicks fledged per eggs hatched) was 0.96. Most eggs were laid in August and chicks were most prevalent in September and October (Fig 7). Most nests were empty by November, at which time adult birds were moulting.

Table 1. Breeding success of little penguins at Troubridge Is. in 2004, 2005, 2006 and 2009.

	2004(early)	2004(late)	2005	2006	2009
hatching success (eggs hatched/laid)	0.73	0.33	0.55	0.26	0.76
egg success (chicks fledged/eggs laid)	0.64	0.21	0.46	0.19	0.73
fledging success (chicks fledged/eggs hatched)	0.88	0.63	0.84	0.73	0.96
breeding success (chicks fledged/breeding pair)	1.11	0.40	0.91	0.35	1.08
active nests monitored	114	50	209	141	60
nests breeding (with eggs)	95	42	122	62	47
eggs laid	164	81	239	124	70
eggs hatched	119	27	132	30	53
chicks fledged	105	17	111	22	51

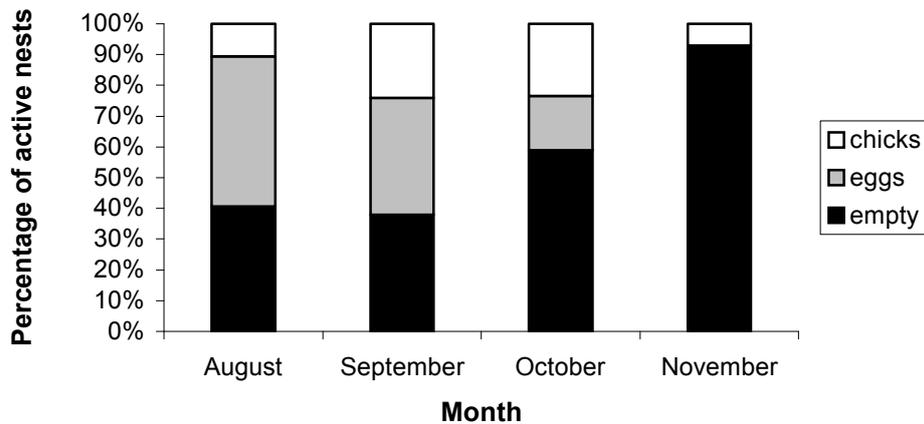


Figure 7. The proportion of active nests that contained eggs, chicks or were empty throughout the breeding season

5.4 Body Condition

Body masses were recorded from 317 adult penguins. Excluding the pre-moult period of November, females weighed $1234 \pm \text{SE}44\text{g}$ (no food in stomach) and $1343 \pm 21\text{g}$ (after returning from fishing). Males weighed $1384 \pm 31\text{g}$ and $1523 \pm 19\text{g}$ respectively. Weights of both sexes increased throughout the season (Fig 8). Estimated meal masses (weight differences between day/colony and dusk/shore weights) also increased from 0g and 45g (female and male respectively) in August, to 119g and 273g in October respectively. Dusk weights in the pre-moult period of November increased dramatically in both sexes to $1580 \pm 74\text{g}$ and $1710 \pm 57\text{g}$ respectively.

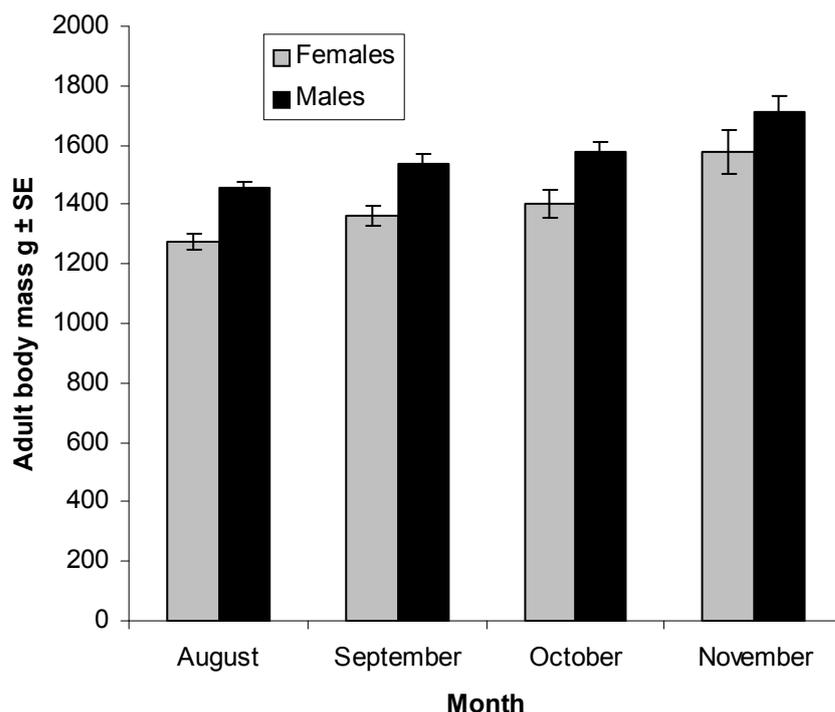


Figure 8. The monthly weights of adult little penguins arriving on Troubridge Island's shore at dusk.

5.5 Tagging for the future

In this study, 62 adult males, 64 adult females and 77 chicks were tagged in the area serviced by the permanent automatic reader.

6. DISCUSSION

6.1. Population

Although there was an increase in active nest numbers in 2009, we would require further censuses in coming years to confirm this apparent population trend. The current projection is that the population is stable. The island has changed shape considerably since 2004 as it has eroded in an anti-clockwise direction. Much of the western side has been inundated by seawater and the vegetation has died or been covered in weed wrack. Despite contraction of the island's area since 2003, the area supporting preferred penguin habitat, on the south-eastern side, has not changed significantly in size. In fact the remaining vegetated habitat, particularly the nitre bush, has grown considerably since 2004, providing more shade cover for penguin nests. Unlike many other colonies in Australia where little penguins nest in burrows, the nests of penguins at Troubridge Island are often small scrapes in the unstable sand, under bushes or sometimes under logs, tin or building foundations. These scrapes make nest censuses relatively accurate because the observer can easily identify signs of activity and

these nests are likely to erode after a year if they are not in use. Nest counts are, however, not entirely accurate because multiple pairs may breed in the same nest at different times of the year. The nest survey provides an index of population change, but it most likely underestimates the population size.

6.2. Breeding Success

The breeding success (chicks fledged/pair) (1.08) was higher than average (2004-2006: $0.7 \pm \text{SE}0.17$), and within the range of previous years: 1.1 (early 2004), 0.91 (2005) and 0.35 (2006). In previous poor breeding seasons (late 2004 and 2006), breeding generally failed prior to hatching. In 2009, hatching success was high (0.76), which suggests that food was readily available throughout the breeding period. The fledging success (chicks fledged per eggs hatched) at Troubridge Island in 2009 was higher than that reported for Phillip Island (VIC), Motuara Island (central NZ), Penguin Island (WA) and Oamaru (southern NZ) (0.96 vs 0.5, 0.5, 0.7 and 0.8 respectively) (Chiaradia *et al.* 2007).

The period in which this study was conducted (August-November) could be considered a late or a second breeding season. Breeding at Troubridge Island may commence as early as April or May (2004) and second seasons generally commence in August/September. Very few fledglings or chicks were found in mid August, suggesting that the first breeding season was either very early or very poor. The caretaker of Troubridge Island did not see many chicks before this study commenced in August, which supports the likelihood that few breeding attempts were successful early in the year. Johannesen *et al.* (2002) suggests that the double brood strategy, which is common at Troubridge Island, is prevalent in areas where food abundance is high during nesting time.

6.3. Adult and chick survival

The relatively low proportion of resighted penguins (23.6%) in the study area was most likely because a considerable proportion of tagged penguins were sub adults (aged ≤ 2 years) or non-breeding adults at the time of tagging and therefore not necessarily regular visitors or nesters of the area. This was supported by the fact that of the penguins (>1 yo) that were tagged in 2004-2005 only 58% regularly used the main runway (serviced by the permanent reader), of which 44% were also resighted in this study. This is comparable to the 45% of regular runway users that were last resighted in summer 06/07 when the permanent reader was last in operation. Therefore very little mortality or emigration has occurred in tagged breeding adults (using the main runway) in the last 2.5 years. Similar proportions of all tagged adult birds (both users and non-users of the main runway) were resighted in the study area from 2005 (21%) (all ≥ 5 yo), and 2004 (23.8%) (all ≥ 6 yo) as well as those flipper-banded prior

to 2004 (21.3%) (all ≥ 7 yo), further supporting low mortality during these years. At other sites, adult little penguins rarely live beyond 7 years (Reilly 1995), but the birds at Troubridge Island are likely to exceed this, due to the low level of mortality at this minimum age. Further years of tag resights will clarify this.

Tagging studies provide good indications of survival rates in little penguins because chicks have high natal colony philopatry (after 2 years when they return to breed), and immigration is very low (Dann *et al.* 2000). Tagging studies in Victoria have indicated that juvenile survival is low (Reilly 1995), which supports the low post-fledging survival rate of chicks (8%) in this study. The chick survival rate in this study could be an underestimate because some surviving tagged fledglings may have settled in other areas of the colony, which were not searched as thoroughly as the tagging/main runway area. High chick mortality probably explains why a high proportion of adults live beyond the average life span. In future years, with more years of data, we may be able to investigate any relationships between low breeding success and poor chick survival as both are likely to result from years of poor food availability.

6.4. Body Condition

Penguin weights at Troubridge Island were much higher than some other SA colonies (Pearson Island: 1100g females and 1200g males) (A. Wiebkin unpublished data) and are a good indication of short term food availability. In late November, the particularly high dusk/shore weights most likely reflect the weight gain that is typical of penguins in the pre-moult period. The pre-moult period is characterised by penguins spending long periods out at sea feeding up to prepare for the moult when they must sit on land for 2 weeks to grow a new coat of feathers. This is also the most likely reason for the reduced number of tagged birds passing the runway in November.

Estimated mean penguin meal weights were similar to those in previous years at Troubridge Island ($140 \pm \text{SE}10\text{g}$ 2004-2006, $n=101$). The increase in estimated meal masses throughout the season reflects the increasing proportion of chicks in the colony, and the food requirements of growing chicks.

7. MONITORING FOR THE FUTURE

The automatic tag reader continues recording the comings and goings of penguins on Troubridge Island. We will seek funds to continue monitoring the population, breeding and survival each year, along with the implantation of ~200 tags annually. The proximity of the island to the mainland, the large number of tags already in the population and the established

automatic reader provides a valuable opportunity to maintain a long-term monitoring program at Troubridge Island. Early signs of population decline will inform future management decisions and the success of the nearby proposed marine park may be partly measured through this monitoring project.

8. CONCLUSION

The little penguin population at Tonbridge Island appears stable, but annual censuses should be maintained to detect declines. The breeding season in 2009 appeared to be better than average, but as this is only the 4th year where breeding success has been measured, the average success for this island is still uncertain. The tag resights indicated that at least 23% of adults survived over the past 4-5 years. Low mortality occurred for birds that were at least 5, 6 and 7 years of age. Because we do not know the age of these adult birds, the continued tagging of chicks is imperative for actual survival estimates in the future. Chick survival appears to be relatively low (8% over 5 years), despite good food availability indicated by high adult weights, so predation may be a threat for young penguins. New Zealand fur seals are possible causes of the extinction or decline of many colonies at Kangaroo Island and the dramatic decline at Granite Island (Bool et al. 2006). Opportunistic observations reveal that seals are gradually spreading into Gulf St Vincent, so annual surveys at seal haul out sites (i.e. nearby Troubridge Point) would augment this monitoring program.

9. ACKNOWLEDGEMENTS

Great appreciation is extended to Chris Johnson (Troubridge Island caretaker) and Ioane Vakaci, Sue and Ole Wiebkin, Chris Hedger, Brad Page, Jane McKenzie, Rob Brandle and Kirrily Blaylock. Ethics and permits for this project were approved by PIRSA and SA Department for Environment and Heritage.



Little penguin on eggs, nesting under a small bush

10. REFERENCES

- Bool, N.M., Page, B. and Goldsworthy, S. (2007). What is causing the decline of little penguins (*Eudyptula minor*) on Granite Island, South Australia? SARDI Aquatic Sciences report to the South Australian Department of Environment and Heritage, Wildlife Conservation Fund and The Nature Foundation of South Australia.
- Chiaradia, A., Ropert-Coudert, Y., Kato, A., Mattern, T. and Yorke, J. (2007). Diving behaviour of Little Penguins from four colonies across their whole distribution range: bathymetry affecting diving effort and fledging success. *Marine Biology* 151, 1535–1542.
- Collins, M., Cullen, J.M. & Dann, P. (1999). Seasonal and annual foraging movements of little penguins from Phillip Island, Victoria. *Wildlife Research*. 26, 705-721.
- Dann P., Norman F.I. and Cullen J.M. (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.
- Johannesen, E., Perriman, L. and Steen, H. (2002). The effect of breeding success on nest and colony fidelity in the Little Penguin (*Eudyptula minor*) in Otago, New Zealand. *Emu*, 102: 241-247.
- Reilly P. (1994). Penguins of the world. Oxford, Oxford University Press Australia.