

Short Communications

Adoption of chicks by Little Penguins *Eudyptula minor* on Penguin Island, Western Australia

Barbara C. Wienecke

Biological and Environmental Sciences, Murdoch University, Murdoch, WA 6150

Present address: Australian Antarctic Division, Channel Highway, Kingston, Tas. 7050

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Adoption of unrelated or foreign chicks by breeding adults appears to be a rare event in natural populations, although Graves & Whiten (1980) reported a high incidence of adoption amongst Herring Gulls *Larus argentatus* on the Isle of May, in Scotland. Individual recognition of chicks by their parents elicits a selective response towards family members, particularly in colonial nesting seabirds (Miller & Emlen 1975). Adults able to discriminate foreign young from their own would be expected to reject intruders, especially if failure to discriminate would endanger the survival of their own offspring.

Little Penguins *Eudyptula minor* lay a maximum of two eggs per clutch which are incubated for 36-38 days. Both parents incubate the eggs and rear the young. Chicks are guarded until 10-12 days old, after which their demands for food require both parents to forage simultaneously. They leave the nest permanently when 65-70 days old and tend to lose weight during the few days prior to their departure from the colony, because parents desert their broods a few days before the young leave the colony (Stahel & Gales 1987). This paper reports adoption among Little Penguins on Penguin Island in Western Australia.

Methods

During the breeding seasons from 1989 to 1992, weekly visits were made to the colony of Little Penguins on Penguin Island, Western Australia (32°18'S, 115°42'E). Fifty nest-boxes have been well-established on Penguin Island since 1986 and allowed access to their occupants with little disturbance. This made it possible to take regular measurements of the occupants and to determine unambiguously the contents of a nest on each sampling occasion. It was felt that more frequent visits might adversely affect the penguins. A digital balance was used to weigh chicks up to 500 g (± 1 g); heavier young were weighed to ± 10 g in calico bags, using a

spring balance. Chicks from the same nest were identified by attaching coloured wool to their flippers until the upper part of the flipper was wide enough to retain a stainless steel band, which was usually when the chicks weighed 750-800 g.

Nestlings that were still damp when found were classified as age 0. Chicks more than one day old were aged using the characteristics outlined by Stahel & Gales (1987). All chicks included in the analyses of growth rates lived for at least 35 days and were weighed and measured weekly throughout their period of growth.

Results

In each of the four seasons studied, at least one of the 43 breeding pairs of Little Penguins that used the nest-boxes appeared to adopt one or two chicks that were not its own. The percentage of adoptions occurring in the study area were 1% in 1990 and 1991, 2% in 1989 and 3.5% in 1992. The foreign chicks had been abandoned by their parents, in some cases after severe winter storms, and had begun to lose weight rapidly. All adopted chicks were old enough to be sufficiently mobile to explore their surroundings and find adoptive parents. These chicks not only remained in other nests for several weeks but also maintained, or even increased, their body weight, indicating that they were fed. Incidental observations indicated that chicks that were fed regularly were generally, but not always, fed inside the nest-box. All abandoned chicks that entered foreign nests were at least 30 days old and of similar age to the original chicks.

Five of the seven adopted chicks had been banded before the event; the parents of these chicks were not seen again on the island until several months later when they returned to moult. The other two chicks, whose parents were unknown, were banded when they were first found.

Table 1 Mean weight changes per day after initial weighing and fates of original (O) and adopted (A) Little Penguin chicks at Penguin Island, Western Australia.

Year	Original (O) or adopted (A)	First or 2nd chick	Age at adoption (days)	Weight at adoption (g)	Weight change (g per day)	Fate
1989	O	1st	29	720	-3.3	Died
	O	2nd	27	690	-10.5	Died
	A	—	34	690	-5.4	Died
1990	O	1st	37	1130	+10.0	Fledged
	O	2nd	36	1090	+6.7	Fledged
	A	—	31	700	+38.9	Fledged
1991	O	1st	37	1020	+15.4	Fledged
	O	2nd	35	750	+0.8	?
	A	—	33	820	+3.1	Fledged
	A	—	30	750	+2.5	Died
1992	O	1st	35	1280	-15.0	Fledged
	O	2nd	33	890	-18.3	Died
	A	—	31	1080	-13.3	Fledged
	A	—	29	750	-15.0	Died
1992	O	1st	37	1250	+6.5	Fledged
	A	—	27	680	+1.2	Fledged

Table 1 summarises the mean daily weight changes once adoption had occurred and the fates of original and adopted chicks. The initial weights are those when original and adopted chicks were first found together. Occasionally, chicks were found in boxes from which they had not hatched but were not seen again, or it was known that the box had not contained a breeding pair; these were classified as visitors and are not included in Table 1.

The mean daily weight changes varied considerably between years and between chicks. In 1989, all three chicks were severely underweight and none fledged. In 1990, the adopted chick was the smallest but showed the greatest positive weight change. The four-chick broods of 1991 and 1992 had mixed success. In 1991, the two smallest chicks were barely able to maintain their body weight; one was known to have died and the other probably also perished. In 1992, a brood of four chicks all showed weight losses. However, the two largest young, one original and one adopted, fledged, whereas the other two did not survive. In another nest, the one original chick was somewhat older than the one stranger. Both survived to fledge but the original chick fledged about a week before the adopted chick; the latter was still fed after the original chick had disappeared.

Figure 1(a) shows the weight changes of the mixed

brood in 1989, as well as the mean growth curve for chicks of broods in which no adoption had occurred. Initially, the weight increased in all chicks at a similar rate. The decline in growth rate of all young coincided with a strong storm that prevented parents from returning to their nests for several days; the waves had cut a sheer cliff into the dunes at the beach to which the penguins usually returned. Adults were observed usually attempting to find a way into the colony for some time but because the cliff was too high to overcome, they returned to sea. During this storm, the adopted chick was abandoned by its parents. Once, the adoptive parents attempted to feed three chicks; the weights of all three declined and were far below those of the control siblings. Eventually, none of the three chicks had sufficient body reserves and all died of starvation.

Figure 1(b) gives an example of a successful adoption that occurred in 1990. The growth curves of the original, as well as the adopted chick, were again compared to the mean growth curve estimated for 1990. The weight of all three chicks continued to increase and all chicks fledged.

Discussion

Adoption of strange chicks by breeding adults has re-

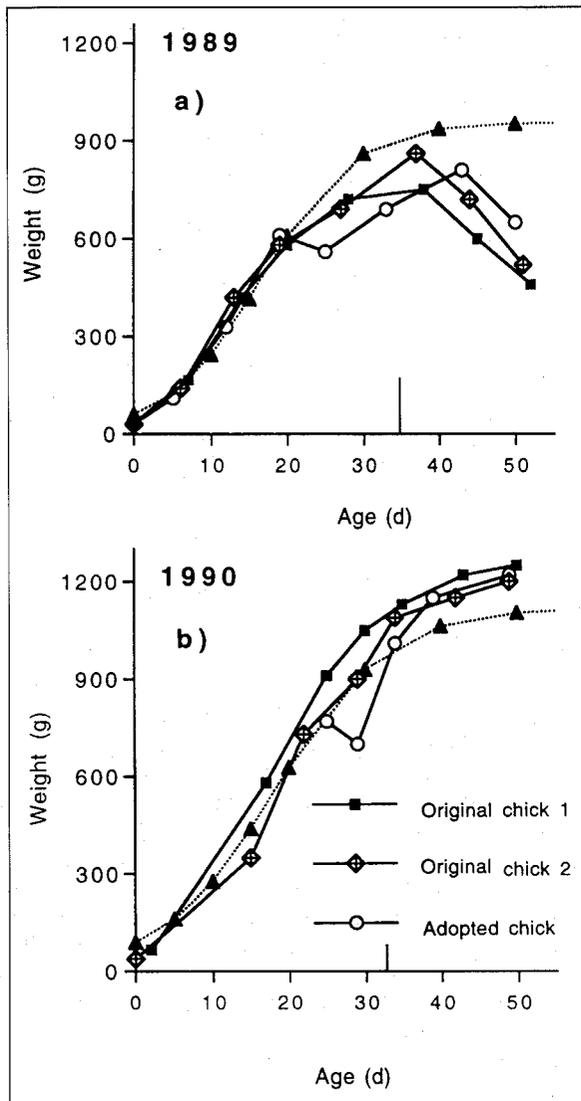


Figure 1 Comparison of weight (g) increases of Little Penguin chicks in broods in which adoption was (a) unsuccessful; and (b) successful. Bars indicate the age at which the adopted chick was first seen in a foreign nest. Solid triangles indicate mean growth curve for each year; symbols for 1989 as for 1990.

ceived little attention and reports of such behaviour are rare and often anecdotal. Parental recognition of their own offspring appears to be usually by vocal cues, although Miller & Emlen (1975) suggested that differences in physical appearance of the chicks may help

parents to distinguish their own from foreign chicks, at least in Ring-billed Gulls. Adoption appears more likely to occur in colonially nesting seabirds, particularly gulls that nest on open ground at high densities. In a population of Herring Gulls *Larus argentatus*, Graves & Whiten (1980) described a comparatively high incidence of permanent adoption of chicks by adults other than their parents; 10 of 19 chicks that moved into a new territory remained there. Some chicks left their home territory spontaneously but others were driven away by intruders. Interestingly, some chicks were old enough to be recognised as foreign by the adoptive parents at the time they invaded new territories.

Although Little Penguin parents on Penguin Island were never seen feeding foreign chicks, there was indirect evidence that adoption occurred. The chicks were usually abandoned by their parents either because of difficulties in finding sufficient food or because return to their broods was impossible due to severe weather conditions. The abandoned chicks showed significant loss of weight during a week alone.

The fate of chicks depended, in part, upon their weights at the time of adoption and upon the number of chicks present. Chicks that were already severely underweight usually did not survive to fledging; either they were too weak to compete with the other chicks or the parents could not meet the increased demand for food. When adoption occurred about a week before fledging, the chances of survival were relatively high. At that point, growth has slowed and the energy requirements of chicks may be reduced.

The difference in ages between adopted and original chicks was also an important factor. Seddon & van Heezik (1991) demonstrated that equally sized chicks of Jackass Penguins *Spheniscus demersus* had a greater chance of survival than those with substantial differences in their body mass because of the intense competition for food. Only chicks of similar size managed to achieve a relatively even share of the available food; smaller chicks were more likely to starve.

With the exception of 1989, when both original Little Penguin chicks and the adopted one died, at least one of the adopted chicks survived in each brood from 1990 to 1992. In composite broods of four chicks only the biggest chicks, whether original or adopted, survived. The strain on the parents of feeding an additional two chicks was obvious because the parents lost weight. The intensity of begging by the chicks may have influenced the distribution of food.

Dann's (1988) work with artificially enlarged clutch

sizes on Phillip Island demonstrated firstly, that Little Penguins are likely to adopt foreign eggs and, secondly, that parents are able to raise more than two chicks to fledging. The difference between Dann's study and the observations from Penguin Island is that the parents on Phillip Island actually hatched the extra egg and raised the chick, whereas, on Penguin Island, parents encountered extra chicks at a stage when they might have been expected to distinguish between their own and foreign chicks (Montague 1982; Seddon & van Heezik 1993). Clutch size of Little Penguins on Penguin Island was very constant and three-egg clutches were never found to occur naturally. Therefore, adults would normally not encounter more than two chicks in their nests so that any additional young should have been recognised as foreign. Adelie Penguins *Pygoscelis adeliae* appear to recognise their own offspring by the time the chicks are 8-17 days old. At this age, foreign chicks are actively discouraged from approaching adults that are not their parents (Thompson & Emlen 1968; Spurr 1975). However, Evans (1980) examined the processes of parent and chick recognition in seabirds in more detail and concluded that rejection of foreign chicks may not necessarily imply that parents are able to distinguish between their own and foreign chicks. The behaviour of the chicks rather than their individual identity may lead to their acceptance by non-parent breeders.

The observations described in this paper imply that feeding additional Little Penguin chicks represents genuinely adoptive behaviour. For adult Little Penguins, adoption appears to disadvantage their own fitness, since they risk losing their own genetic offspring. For the disadvantaged, abandoned chicks, on the other hand, the risk in leaving the parental nest seems to be outweighed by the chance of finding food elsewhere.

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