

**BREEDING ECOLOGY OF MAGELLANIC PENGUINS *SPHENISCUS*
MAGELLANICUS AT CALETA VALDES, ARGENTINA**

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ABSTRACT

A nesting colony of Magellanic Penguins *Spheniscus magellanicus* at Caleta Valdes, Argentina, grew in size from two pairs in 1969 to 503 pairs in 1978. Clutch sizes and egg dimensions were found to be typical for this species. Nest densities were relatively low, and the abundance of nesting space available suggested that the colony has a substantial capacity for expansion. During the 1978/1979 breeding season, hatching success was 76.7%. Chick survivorship was twice as high at nests with two-egg clutches than at those with one-egg clutches. During the day, parents alternated nest incubation/guard duty every six to eight hours, on average, but only one parent seemed to guard the nest during the night. Penguins tended to aggregate on the colony's beach late in the afternoon before taking over nest attendance for the night-time shift.

INTRODUCTION

The Magellanic Penguin *Spheniscus magellanicus* is one of the least studied penguins in the world, and much of the literature pertaining to it has been reviewed by Boswall & MacIver (1974), who have also carried out extensive surveys on this species. The distribution of known nesting colonies in Argentina was compiled by Boswall (1972). Later work by Daciuk (1976a, 1976b, 1977) and Scolaro (1978) showed the breeding range of Magellanic Penguins to have expanded north to Peninsula Valdes by 1970. These studies along with work by Boswall & Prytherch (1972) demonstrate that the size of the breeding population at existing colonies in Argentina has been increasing. The two newest nesting colonies have been established on Peninsula Valdes. During the 1969/1970 season, Daciuk (1976a, 1977) found two pairs of Magellanic Penguins with chicks at a site near Punta Cero (42 28S, 63 37W). By the 1972/1973 nesting season, their numbers had increased to 13 pairs. In 1978, Scolaro & Kovacs (1978) counted 93 nests on the north coast of Peninsula Valdes, in Golfo San Matias, along the shores of Estancia San Lorenzo (42 05S, 63 21W). The latter is currently the northernmost colony within the known breeding range for Magellanic Penguins in Argentina.

This study was conducted between 17 November and 15 December 1978 to count nests, survey the colony and document aspects of the breeding ecology of Magellanic Penguins at the breeding colony near Punta Cero on Peninsula Valdes.

STUDY AREA

The colony is located on the Atlantic coast of Peninsula Valdes along the western slopes of a long (24 km) and narrow (1 km) creek, called Caleta Valdes (Fig. 1). The major concentration of nests (n=442) extended approximately 1,5 km along a 9-18 m escarpment, whose steep slope near the top (45 - 30) grades into a more gentle incline before flattening into a sand-pebble beach near the water's edge. Other occupied nests (n=61) were scattered about 0,5 km to the north of this main aggregation (not shown in Fig. 1). In several places, the escarpment has been deeply eroded by former stream channels, probably carved by the infrequent but torrential rain storms that occur at Peninsula Valdes. A flat, single-lane dirt road passes some 50-70 m from the edge of the escarpment, but since the penguin nests are located below the top of the embankment, passers-by cannot see the colony. Nevertheless, its proximity to the road makes it vulnerable to disturbance by visitors who know of its existence.

The colony is situated about 3 km north of the mouth of the creek. This southern and deep part of Caleta Valdes is used by a variety of birds and such marine mammals as the Southern Right Whale *Eubalaena australis*, dolphins, and Southern Elephant Seals *Leonina mirounga*. Water circulation is vigorous, and the large tidal amplitude (5 m) creates rip currents and whirlpools.

The penguin nests at Caleta Valdes can be categorized either as burrows or scrapes, similar to those described by Boswall & MacIver (1974) and Scolaro (1978) at Punta Tombo. Burrows are excavated into the hill and are typically surrounded by herb and low shrub vegetation (Table 1). Scrapes are bowl-shaped depressions. Some are dug under bushes (e.g. *Atriplex* sp.), which provide some shade and shelter, but others are more exposed. Within the colony as a whole, there are roughly equal numbers of each nest type, with burrows more common along the steep parts of the embankment.

METHODS

The study began with a census of nests in the colony. All occupied nests were marked with numbered tags and searched to obtain counts of eggs and chicks where possible. To determine the frequency with which parents alternated incubation and/or guard duty at their nests, two separate areas with 20 and 10 nests (Area I and Area II), respectively, were chosen to subsample the colony. Length of nest attendance by each parent at the 30 nests was measured by applying a red paint mark to the white ventral surface of one member of each mated pair.

A seven-day trial to test the durability of the red paint marks proved successful, and subsequent records of shift intervals in nest duty were systematically collected between 25 November and 15 December. From 25 - 30 November, the 30 nests were checked three times a day at three to seven-hour intervals. Since parental attendance at nests exceeded this time span, the sampling was reduced to twice a day at intervals of 9 to 12 hours for the rest of the study.

~Caleta Valdes~

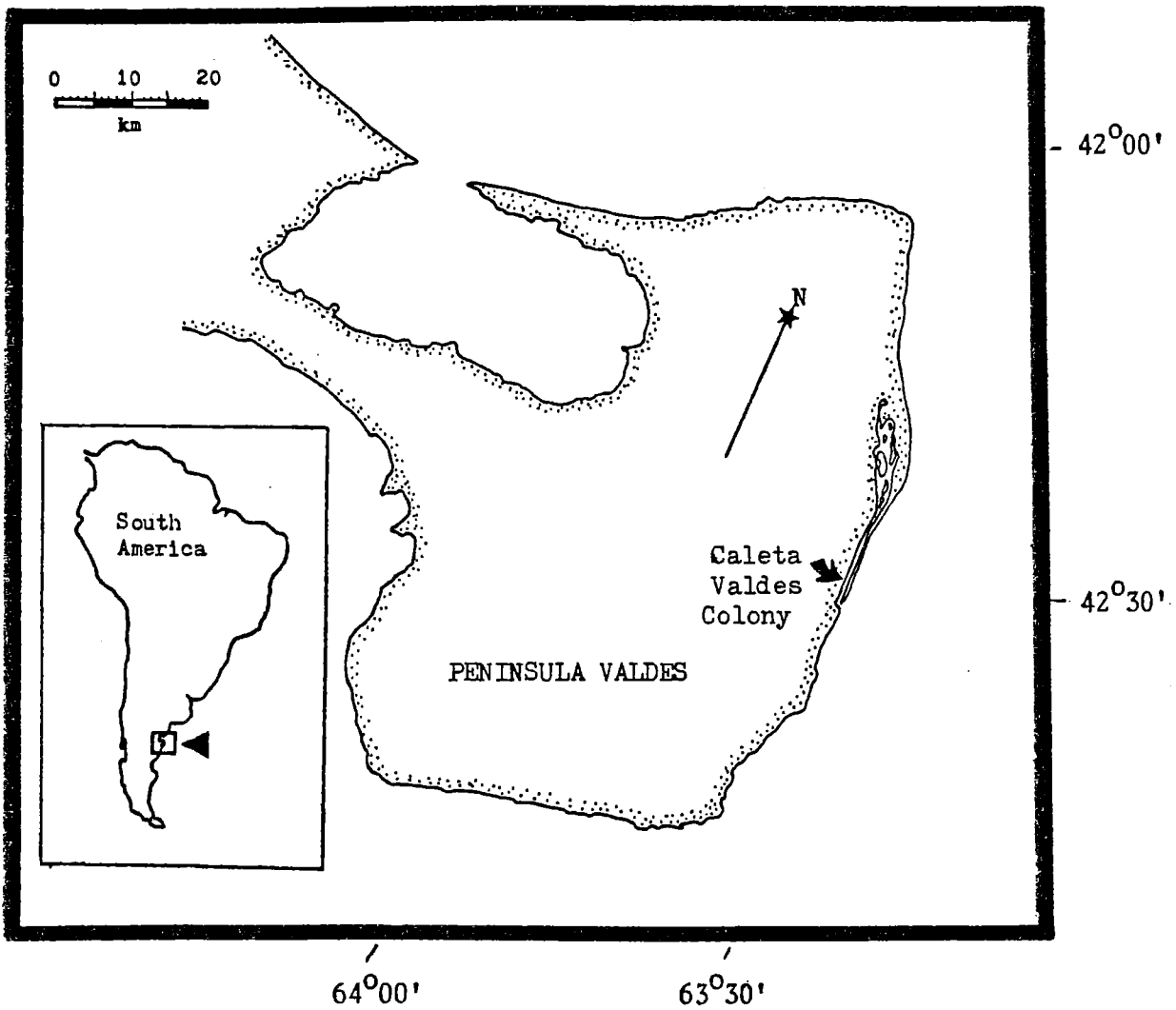
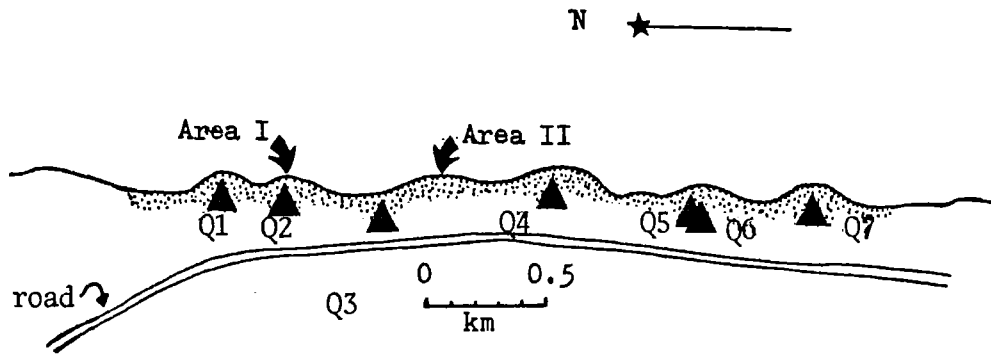


Figure 1

Location of the Magellanic Penguin *Spheniscus magellanicus* nesting colony at Caleta Valdes showing Area I and Area II and the position of plots used to calculate nest densities

TABLE 1

PRINCIPAL VEGETATIVE COVER AT THE MAGELLANIC PENGUIN *SPHENISCUS MAGELLANICUS* BREEDING COLONY AT CALETA VALDES, 1978 *

Anacardiaceae <i>Schinus polygamus</i>	Coviferae
Chenopodiaceae <i>Atriplex rosae</i> <i>A. lampa</i> <i>Salicornia ambigua</i> <i>Suaeda divaricata</i>	Ephedraceae <i>Ephedra ochreatea</i>
Compositae <i>Brachyclados megalanthus</i> <i>Cyclolepis genistoides</i> <i>Senecia filagenoides</i>	Leguminosae <i>Prosopidestrum globosum</i>
	Rosaceae <i>Tetrogruie calspitosus</i>
	Solanaceae <i>Lycium chilense</i>

* Identifications by Ana Maria Beeskow, Biologist, Centro Nacional Patagonico, Puerto Madryn, Chubut, Argentina.

TABLE 2

NEST DENSITIES OF MAGELLANIC PENGUINS *SPHENISCUS MAGELLANICUS* AT CALETA VALDES, 1978

	Plot no.	Mean	No. occupied nests/ 100 m ² quadrat			
			A	B	C	D
North	Q1	3,8	1	8	4	2
	Q2	6,0	5	9	4	6
	Q3	5,6	4	4	10	4
	Q4	3,0	2	4	5	1
	Q5	3,3	3	4	1	5
	Q6	1,8	0	2	4	1
South	Q7	11,3	12	10	8	15
Total		4,9				

During guard duty observations, two abandoned hatchlings were placed in different nests where chicks had died, with the hope that foster parents would rear them. Since adoption seemed to be successful, both nests containing these chicks were excluded from calculations of hatching success to avoid introducing a bias.

The colony was surveyed and mapped, and plant samples were collected. Nest densities were calculated from seven plots spread throughout the colony, each of which contained four 10 x 10 quadrats. Dimensions of 55 eggs from 27 nests were measured with dial calipers to an accuracy of 0,1 mm.

RESULTS

Nest census, egg measurement and nest density

A total of 503 nests, including 61 located north of the main colony, was counted. In the 431 nests where it was possible to tally the eggs and/or chicks, the clutch sizes were found to be : 38 (8,8 %) had one egg, 392 (91,1 %) had two eggs, and only one nest (0,1 %) had three eggs. The dimensions of 55 measured eggs were: mean length 74,4 mm (range 67,4 - 98,3 mm) and mean greatest breadth 54,2 mm (range 41,1 - 59,3 mm)

The highest average nest density was 11,3 nests 100 m² in the southernmost location (Q7), and the range of variation among the sox other plots (1,8 - 6,0 nests 100 m² did not indicate a directional gradient from high nest density in the south to a low in the north (Fig. 1 and Table 2).

Hatching success

By 15 December 1978, hatching success of eggs in 290 nests within the main part of the colony was found to be 76,7 % (Table 3). Chick survivorship was twice as high at nests with two eggs than at those with one-egg clutches. Although 42 of the 290 total nests sampled (14,5 %) were abandoned, the relative proportion abandoned in one-egg nests (46,2 %) was much higher than in two-egg nests (11,4 %) (Table 3).

Incubation and guard duty replacement interval

At the 30 nests where parental attendance was monitored, changeovers in incubation/guard duty during the day occurred, on average, every six to eight hours (Fig. 2 and Table 4). When nest checks were lumped into two intervals of three to seven hours and nine to twelve hours, respectively, significant differences were found in the frequency of parental replacement at the nests ($X^2 = 180,07$; $p < .001$). This outcome is not altered when the sample is divided into nests having two surviving chicks and those with different nest contents at the end of the study.

Sixtynine percent (308/448) of the parents found at their nest during the evening nest checks were also present at the first morning nest checks, suggesting that eggs, and/or chicks are guarded by the same parent throughout the dark hours of night

TABLE 3

HATCHING SUCCESS OF THE MAGELLANIC PENGUIN *SPHENISCUS MAGELLANICUS*
 AT CALETA VALDES, 1978

	Nest outcomes		Fate of eggs			
	Nests	% Total	no. eggs produced	no. eggs hatched	% Hatched	% Lost ^a
Sample total	290	100	554	425	76,7	23,3
Two-egg clutches	264	100	528	415	78,6	21,4
Outcome 15 Dec:						
2 chicks	183	69,3	366	366		
1 chick	49	18,6	98	49		
no chicks	32	12,1	64	0		
One-egg clutches	26	100	26	10	38,5	61,5
Outcome 15 Dec:						
1 chick	10	38,5	10	10		
no chicks	16	61,5	16	0		

^a Causes unknown. ^c 12 of these (46,2 %) were abandoned.

^b 30 of these (11,4 %) were abandoned.

TABLE 4
 DURATION OF NEST ATTENDANCE AT 30 MAGELLANIC PENGUIN *SPHENISCUS MAGELLANICUS*
 NESTS BETWEEN 25 NOVEMBER AND 15 DECEMBER 1978, CALETA VALDES

Time Interval (hrs)	Day (07-20h)			Night (18-10h)		
	Same parent at nest	Different parent at nest	No. nests checked	Same parent at nest	Different parent at nest	No. nests checked
3	17 (85%)	3 (15%)	20	-	-	-
4	47 (85%)	8 (15%)	55	-	-	-
5	71 (70%)	30 (30%)	101	-	-	-
6	46 (60%)	30 (40%)	76	-	-	-
7	46 (55%)	38 (45%)	84	-	-	-
8	-	-	-	-	-	-
9	0	17 (100%)	17	-	-	-
10	13 (15%)	71 (85%)	84	-	-	-
11	12 (13%)	83 (87%)	95	21 (60%)	14 (40%)	35
12	13 (16%)	69 (84%)	82	17 (71%)	7 (29%)	24
13	-	-	-	94 (57%)	72 (43%)	166
14	-	-	-	35 (67%)	16 (33%)	51
15	-	-	-	4 (57%)	3 (43%)	7
16	-	-	-	5 (50%)	5 (50%)	10

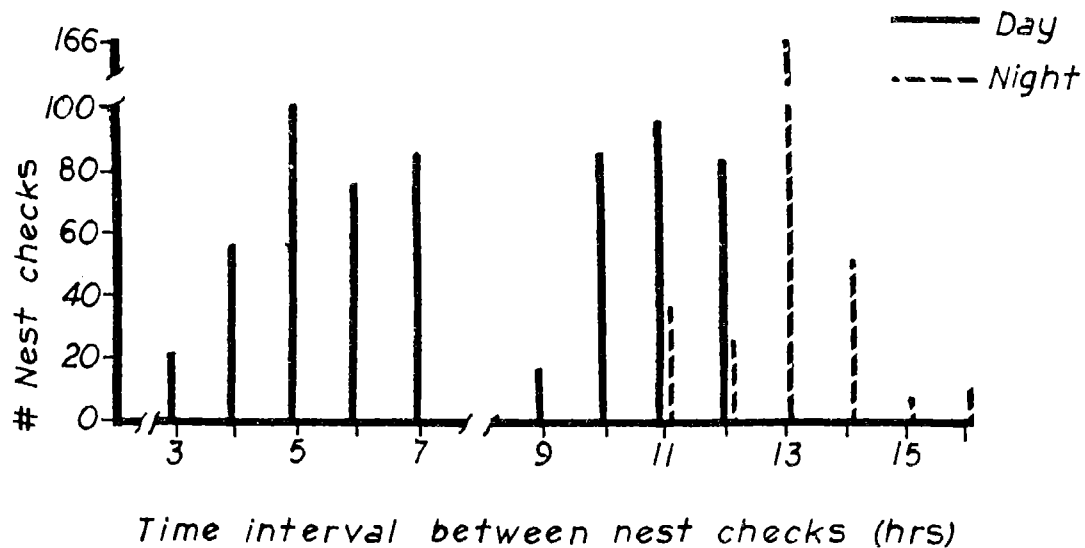
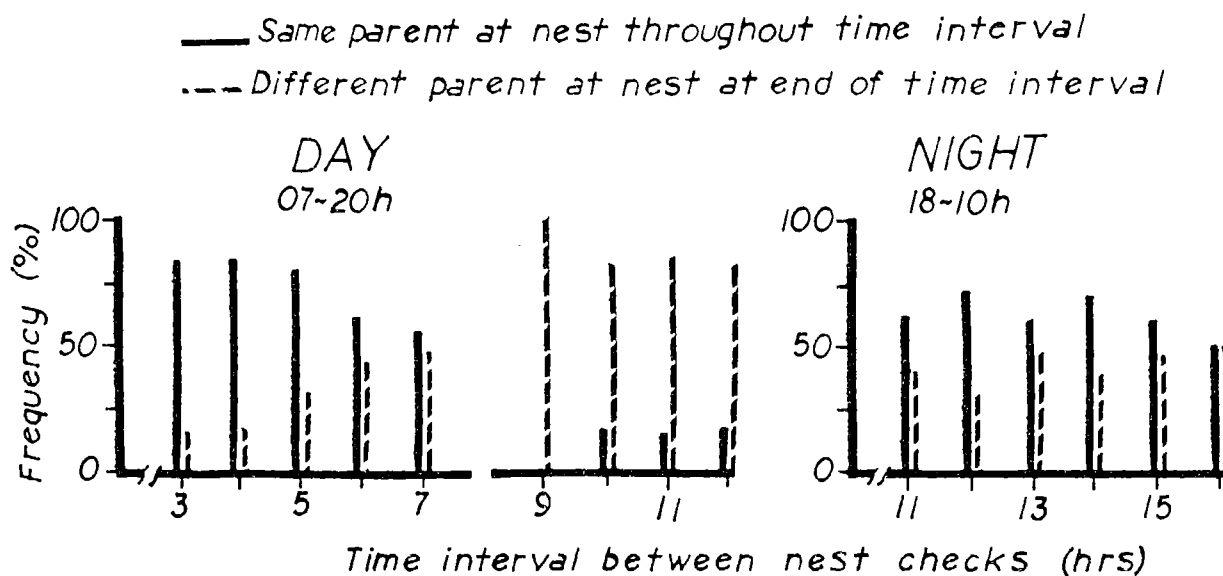


Figure 2

Changeovers in incubation/guard duty at 30 nests of Magellanic Penguins *Spheniscus magellanicus* at Caleta Valdes

(usually between 19h and 07h). These results are significant ($z=7.94; p<.0001$). Since night-time nest checks were not made it is, however, possible that shifts in parental duty at the nest occurred during these hours.

DISCUSSION

During the nine years since its discovery, the number of Magellanic Penguins nesting at the Caleta Valdes colony has increased by a factor of six to seven every three years (Table 5). Furthermore, the abundance of suitable nesting space available suggests that this colony has a very large capacity for expansion, barring disturbance from human activities or from catastrophic natural events. Although Peninsula Valdes is geographically isolated (Fig. 1) and it is a provincial park, the penguin colony is easily accessible from the road, which loops around the peninsula, making it extremely vulnerable to human activity.

Clutch sizes and egg dimensions agree with those measured for Magellanic Penguins by Zapata (1967), Boswall & MacIver (1974) and Scolaro (1978). At Punta Tombo, Boswall & Prytherch (1972) found nest densities in 100 m² squares to range between 80/100 m² and 1-2/100 m² ($\bar{x}=20/100$ m²) in a 2,23 km² sample area. In 1978, Scolaro (1978) calculated approximately the same range of densities at Punta Tombo. In comparison, nest densities at Caleta Valdes were low.

Although the most southerly plot (Q7) contained by far the highest nest density, no directional gradient was detectable which might suggest that colonization had radiated north from the southern part of the creek. Whereas high nest densities at Punta Tombo and on some islands in the Strait of Magellan have caused much of the vegetation to be killed or defoliated due to nest excavation (Pisano 1971), this condition has not yet become noticeable at the Caleta Valdes colony.

Hatching success at Caleta Valdes can only be evaluated in absolute terms, since it was beyond the scope of this study to assess its relationship with nest site quality, parental age differences, parental use of the same nest each year, and predation. Biases related to the timing and length of the study may have been introduced. For instance, chick survivorship might have been lower if calculated at fledging time. Comparisons of chick survivorship between one and two-egg clutches may add distortions if, for example, parents with one-egg clutches were less experienced, weaker, or in some way selected against.

Nothing is known about predation at this colony. No Chilean Skuas *Catharacta chilensis*, Kelp Gulls *Larus dominicanus*, Dolphin Gulls *Leucophaeus scoresbii*, or American Sheathbills *Chionis alba* were seen. These birds have been observed stealing or eating Magellanic Penguins' eggs and chicks at Punta Tombo (Zapata 1967, Conway 1971, Boswall 1973, Boswall & MacIver 1974). The only potential predators seen during this study were the Patagonian Fox *Dusicyon griseus* and the armadillos *Chaetophractus villosus* and *Zaedyus pichyi*. On 11 December 1978, a Patagonian Hare *Dolichotis patagonum* ran into an occupied penguin burrow near the top of the escarpment.

TABLE 5

GROWTH IN THE MAGELLANIC PENGUIN *SPHENISCUS MAGELLANICUS*
 NESTING COLONY AT CALETA VALDES, 1969-1979

Breeding season	Population estimate (breeding pairs)	Reference
1969/1970	2	Daciuk 1976a, 1977
1970/1971	3	Daciuk 1977
1972/1973	13	Daciuk 1977
1978/1979	503	This study

The frequency of changeovers in incubation/guard duty in this study cannot be applied to early egg laying stages or to later guard stages, in which chicks are near fledging age, since this research began just prior to hatching. For the duration of the study, however, these data show that Caleta Valdes penguins are making round-trip feeding voyages, returning with food for their chicks, every six to eight hours during the day, on average. Although several food items from stomachs of Magellanic Penguins around Peninsula Valdes have been recorded (Jehl *et al.* 1973, Boswall & MacIver 1974, Scolaro 1978, Perkins in press), it is not known if Caleta Valdes penguins forage in the creek, in the nearby South Atlantic or both.

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