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BREEDING BIOLOGY OF KELP GULLS (*LARUS DOMINICANUS*) ON DESERTA ISLAND, SOUTHERN BRAZIL

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Resumo. – Biologia reprodutiva do Gaivotão (*Larus dominicanus*) na Ilha Deserta, sul do Brasil. – Apesar de a biologia reprodutiva do Gaivotão ser relativamente bem conhecida em algumas partes de sua distribuição, pouco se sabe sobre a reprodução desta espécie no Brasil. Este trabalho descreve a biologia reprodutiva do Gaivotão na ilha Deserta (27°16'S, 48°20'W), incluindo informações sobre o período reprodutivo, o tamanho da população, o número de ovos por ninho, o tamanho dos ovos, o sucesso de eclosão e de criação e o período de cuidado parental pós-vôo. A colônia abrigou pelo menos 421 casais na estação reprodutiva de 2006. O estabelecimento dos casais ocorreu em abril e o primeiro ovo foi colocado em junho. Ocorreu um acentuado pico de posturas entre agosto e meados de setembro e o período de posturas foi incomumente longo, 127 dias. A média de ovos por ninho foi 1,97 ± 0,58. Os terceiros ovos foram significativamente menores que os outros e eclodiram assincronicamente. O período médio de incubação foi de 27 dias. O sucesso de eclosão foi de 51% e a maior parte das perdas foi atribuída à negligência parental ou à infertilidade dos ovos. O sucesso de criação foi de 57% e a maior parte das perdas foi provocada provavelmente por inanição. A mortalidade afetou diferentemente filhotes criados sozinhos ou com irmãos; os terceiros filhotes tiveram a mais alta taxa de mortalidade. O sucesso reprodutivo total foi de 29% ou 0,57 filhote por ninho criado até o vôo. Em média, os juvenis começaram a voar com 6,8 semanas, mas o período de cuidado parental pós-vôo se estendeu pelo menos até as 14 semanas de vida. Ocorreu uma redução no sucesso reprodutivo dos casais ao longo da estação.

Abstract. – Although the breeding biology of the Kelp Gull (*Larus dominicanus*) is relatively well known in some parts of its range, its reproduction in Brazil remains poorly studied. This work describes the breeding biology of the Kelp Gull on Deserta Island (27°16'S, 48°20'W), including information about breeding period, population size, clutch size, egg size, hatching and fledging success, and post-fledging care. The colony had at least 421 pairs in the 2006 breeding season. Settlement occurred in April and the first egg was laid in June. The laying period showed an accentuated laying peak from the end of August to mid September and was unusually long, 127 days. The mean clutch size was 1.97 ± 0.58. Third-laid eggs were significantly smaller than others and hatched asynchronously. The mean incubation period was 27 days. Hatching success was 51% and most losses were attributed to parental negligence or egg infertility. Fledging success was 57%, and most losses occurred probably due to starvation. Mortality for chicks reared alone were different from those reared with siblings; third-chicks had the highest mortality rate. The total breeding success was 29% or 0.57 chick fledged per brood. On average, juveniles started to fly at 6.8 weeks, but the period of post-fledging care extended up to the 14th week of life. There was a reduction in the breeding success through the season. *Accepted 8 January 2009.*

Key words: *Larus dominicanus*, Kelp Gull, breeding success, hatching asynchrony, southern Brazil.

INTRODUCTION

The Kelp Gull (*Larus dominicanus*) has an extensive breeding range, which encircles the globe along a broad belt within the Southern Hemisphere. It includes the Antarctic Peninsula, Antarctic and sub-Antarctic islands, western and eastern coasts of South America, islands in the southern Atlantic Ocean, South Africa, New Zealand, Australia, and islands in the southern Indian Ocean (Kinsky 1963, Watson 1975). The species is of significant ecological importance as it feeds on organic waste on beaches and in adjacent waters (Escalante 1970). This generalist food habit also allows it to take advantage of non-natural food sources that result from human activities (e.g., Steele & Hockey 1990, Giaccardi & Yorio 2004). Population increases have been observed at places with an excessive supply of non-natural food (e.g., Gwynne & Gray 1959, Fordham 1967, 1970; Yorio *et al.* 1998), while population sizes have remained stable when such food are unavailable (Sander *et al.* 2006).

In southern and southeastern coasts of Brazil, the Kelp Gull is one of the most common seabirds, found on beaches, lagoons, and coastal islands (Bege & Pauli 1988). The breeding population, however, is relatively small. Deserta Island, with c. 500 pairs breeding annually, is probably the largest colony in Brazil (Branco 2003, 2004), whereas some colonies in other countries may have more than 8000 breeding pairs (e.g., Yorio *et al.* 2005). It is probable that at least part of the Kelp Gull population wintering in the State of Rio Grande do Sul comprise migrants from other South American countries.

The breeding biology of the Kelp Gull has been relatively well studied in Argentina (Yorio & Borboroglu 2002, Yorio *et al.* 2005), South Africa (Crawford *et al.* 1982, Williams *et al.* 1984, Altwegg *et al.* 2007), New Zealand (Fordham 1964a, 1964b), and the Antarctic region (Clark 1906, Parmelee *et al.* 1977, Maxson & Bernstein 1984). In Brazil, however, only Soares & Schiefler (1995) and Branco (2003) provided data on its reproduction. Here we describe in detail the breeding biology of the Kelp Gull on Deserta Island, including information about the breeding period, population size, clutch size, egg size, hatching and fledging success, and post-fledging care.

MATERIAL AND METHODS

Deserta Island (Fig. 1) is a small coastal island located in the State of Santa Catarina, southern Brazil, that is part of the archipelago protected by the Arvoredo Marine Reserve. The island is 1052 m long and 175 m wide, and has areas that reach an altitude of 60 m. It is covered by restinga vegetation, a coastal ecosystem associated with the Atlantic Forest and composed of herbaceous plants and small shrubs (IBAMA 2004).

Field work was carried out in 2006 during five expeditions: two days in late March, three days in late April, 12 days in May and June, 30 days from early July to early August, and 57 days from mid September to mid November. To estimate the number of breeding pairs, about 85% of the island area was surveyed. The remaining area was difficult to access and the number of family groups was counted at a distance using binoculars.

The study was conducted in two areas that had 138 nests, or c. 30% of the total number of nests counted in the 2006 breeding season. For estimating the lenght of the breeding period, the laying dates of all nests found were determined through daily monitoring. When it was impossible to accurately pinpoint the laying date, it was estimated by using hatching date and counting backwards an incubation period of 27 days (see Results).

Nests in which vegetation or rock disposition prevented chicks from being captured were excluded from the determination of

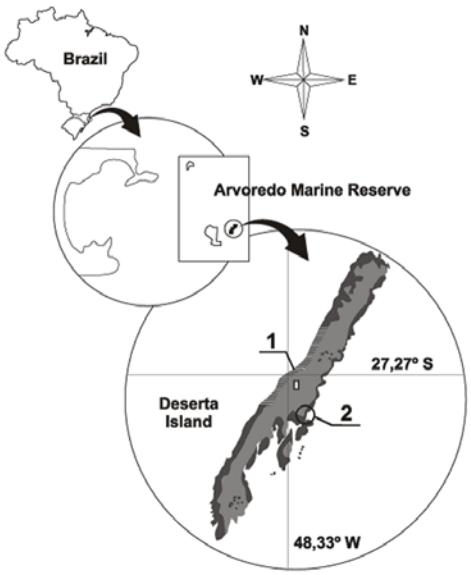

FIG. 1. Geographic location of Deserta Island, Brazil. Numbers 1 and 2 indicate the study areas; rocky areas are represented in dark gray, vegetated areas in light gray.

breeding success, since nests were not fenced. The remaining nests were monitored every day during the egg period and every two days during the chick-rearing period. Eggs and chicks were individually marked with permanent marker pen and plaster marks attached to the left wing, respectively. There were used a number to indicate nest identity and a letter indicating the laying or hatching order ("A", "B", or "C"). When the laying order was unknown, it was considered equivalent to the hatching order. Egg length and width were measured with calipers (to the nearest 0.05 mm), and the egg volume was calculated with the formula: $V\ (cm^3) = length \times width^2 \times 0.51$ (Hoyt 1979).

Few nests were monitored during the entire laying and incubation periods. Thus, we determined the minimum number of eggs per brood and estimated hatching success through the Mayfield method (Mayfield 1961, 1975). Egg losses were determined and classified as follows: (1) addle, when eggs exhibited no signs of damage, but chicks did not hatch; (2) broken in the nest, when eggs had thin cracks, probably caused by parents during incubation, causing loss of egg content; (3) predated, when the shell was found near the nest with beak marks; (4) missing, when they disappeared from the nest; (5) rolled, when eggs were found near the nest without any damage; (6) destroyed by storm tides, when tides destroyed nests and eggs; and (7) dead during hatching, when chicks began to hatch, but died still inside the egg. Incubation period and hatching interval between successive eggs from a clutch were also recorded.

The chick survival rate was estimated according to the Mayfield method (Mayfield 1961, 1975). Since mortality is dependent of age (e.g., Fordham 1964b, Williams *et al.* 1984), breeding success was calculated through successive multiplication of different weekly chick survival rates. Chick losses were determined and classified as: (1) dead without any apparent cause, when chicks were found

dead without any sign of external injuries; (2) missing, when they had not been found in their territories until the end of the monitoring period; (3) dead during storm tides, when they disappeared from territories reached by a storm tide; (4) killed by other Kelp Gulls, when they were found dead in their own territories or in neighboring territories, with wounds (mainly on the head) caused by pecks; (5) dead due to other wounds, when found dead with other kinds of wounds; (6) dead caught in the vegetation, when the chicks were found dead entangled in the vegetation; (7) dead because they fell down from their nests, when young chicks hatched in nests located above ground level and were found dead beneath their nests; and (8) undetermined, when chick carcasses were found eaten by Black Vultures (*Coragyps atratus*).

Results were also analyzed in relation to the laying date. Eggs laid before the laying peak (weeks 1–12) were not monitored, but eggs were monitored when laid during the laying peak (weeks 13–15; n = 77 nests and 163 eggs) and after the laying peak (weeks 16–19; n = 26 nests and 46 eggs), and all parameters were compared between these groups.

As chick-rearing period we considered the mean time between hatching and the almost complete development of the first juvenile plumage, with the subsequent acquisition of flight capacity. It was determined based on the observation of plumage development of 32 nestlings and on the observed first flight of five nestlings. The period of post-fledging care was also recorded.

The disturbance caused by research activities was not measured. However, due to the rugged island relief and nest locations (usually between large rocks), disturbance was limited to the nest that was being examined and, at most, to a few neighboring nests.

All results are expressed as means ± SD. Egg volumes were compared through Factorial analysis (Tukey test) and other results were compared using the Student t-test ($P < 0.05$). The normality of the data was checked through the Kolmogorov-Smirnov test.

RESULTS

Breeding population and breeding period. On Deserta Island, 362 nests were counted and 59 family groups were observed at a distance. The estimated minimum breeding population was therefore 421 breeding pairs. Only adults, nestlings, and recently fledged juveniles were observed; older birds with immature plumages (second and third year plumages; see Kinsky 1963) were absent. Most nests were built on rocky areas, since the vegetation is dominated by gravatá (*Dyckia encholirioides*), a thorny bromeliad of about 50 cm in height that occurs at high densities on the island.

Adults started to occur regularly on the island in April, considered the beginning of the before-egg stage. Laying and incubation stages began on 1 June, when the first egg was laid. The date of first hatching (28 June) marked the beginning of the chick-rearing stage. The juvenile stage began on 9 August, when the first chick completed 7 weeks of life. The last egg was laid on 6 October, marking the end of the laying stage. The incubation stage ended with the hatching of the last egg, on 2 November. Field work ended in mid November, but the chick stage probably ended when last-hatched chicks reached seven weeks, in mid December. The juvenile stage probably ended only in mid February 2007, when the last-hatched chicks would have reached 14 weeks of age.

Laying, incubation, and hatching stages. Egg-laying took place from early June to early October (Fig. 2); 50% of the eggs were laid within 94 days after the first egg. In weeks 1–12 (84 days), 14% of the eggs were laid. Between weeks 13–15 there was an accentuated laying peak: 57% of eggs were laid within 21 days.

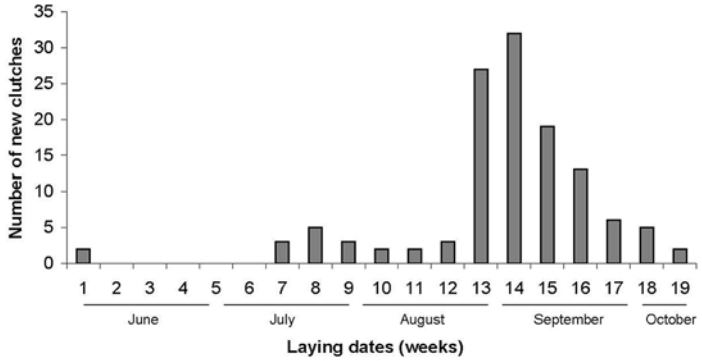

FIG. 2. Number of new Kelp Gull clutches on Deserta Island in each week, June-October 2006.

Between weeks 16–19 (23 days), the remaining 19% of eggs were laid. Ten percent of all nests (n = 14) were not considered because the laying date could not be determined and all eggs failed to hatch.

Mean length, width, and volume of eggs varied according to their number per clutch and order of laying (Table 1). Comparing volume, eggs from nests with only one egg were significantly smaller than "A" eggs from nests with two eggs (P = 0.00049); "C" eggs were significantly smaller than all others (P = 0.00002 vs 2A, 0.00124 vs 2B, 0.00194 vs 3A, 0.01896 vs 3B), except for eggs from single-egg nests (P = 0.94525). Observed mean clutch size was 1.97 ± 0.58 (n = 120 nests; minimum of 1 and maximum of 3 eggs) and the hatching success was 51% (n = 236 eggs). Lost eggs occurred mostly due to addling, followed by eggs broken in the nest and dead while hatching (Table 2).

We determined the incubation period of four eggs, each from a different nest. They hatched 27 days after being laid. The hatching process, as considered in this study, began when the chick cracked the egg shell and finished when the chick left the shell. The mean duration of this process, observed with daily intervals (n = 78 eggs), was 2.58 ± 0.92 days (min/max: 1/7 days). The interval between successive hatchings in two-egg clutches (n = 20 nests) was 1.85 ± 0.99 days (min/max: 0/3 days). In five three-egg clutches, the interval between the hatching of the first and the second egg was of 1.00 ± 0.71 days (min/max: 0/2 days), and between the second and the third egg was 2.6 ± 0.55 days (min/max: 2/3 days).

The chick-rearing stage. The chick survival rate was lowest in the first week and highest in the seventh week (Table 3). The total fledging success was 57%. The commonest categories of chick loss were death without any apparent cause, chicks missing (probably predated by Black Vultures, since no other predators are found on Deserta Island and no evidence of predation by other Kelp Gulls was observed), and death due to storm tides (Table 4). Mortality rates were lower for chicks reared alone compared to those reared with siblings; "C" chicks had the highest mortality rate (Table 5). Chicks killed by storm tides were excluded from analysis because this event was related to nest placement and was independent of hatching order.

A breeding success of 29% was obtained by multiplying the observed hatching success

TABLE 1. Length, width, and volume (mean ± SD) of Kelp Gull (*Larus dominicanus*) eggs on Deserta Island in 2006, according to number of eggs per brood (1, 2, or 3) and hatching order (A, B, or C). Indices: [1]weeks 13–15; [2]weeks 16–19.

Eggs	No. of eggs	Length (cm)	Width (cm)	Volume (cm^3)
1A	10	7.01 ± 0.24	4.78 ± 0.14	81.82 ± 5.92
2A	48	7.25 ± 0.25	4.98 ± 0.15	91.61 ± 7.12
2B	48	7.11 ± 0.25	4.93 ± 0.14	88.03 ± 6.50
3A	11	7.16 ± 0.35	4.97 ± 0.11	90.16 ± 6.65
3B	11	7.22 ± 0.29	4.89 ± 0.17	88.31 ± 7.48
3C	11	6.90 ± 0.20	4.74 ± 0.12	79.13 ± 5.41
All	140	7.15 ± 0.29	4.92 ± 0.16	88.66 ± 7.93
All from peak period 1	112	7.16 ± 0.29	4.93 ± 0.16	89.06 ± 8.22
All from after-peak period 2	28	7.14 ± 0.27	4.89 ± 0.14	87.07 ± 6.50

TABLE 2. Losses of Kelp Gull (*Larus dominicanus*) eggs on Deserta Island in 2006. Indices: [1]weeks 13–15; [2]weeks 16–19.

Losses	Egg losses (%)		
	Total (n = 71)	Peak period[1] (n = 23)	After-peak period[2] (n = 27)
Addle	34	43	26
Broken in the nest	18	9	15
Dead during the hatching process	18	22	26
Missing	13	17	15
Predated	13	0	15
Rolled	3	9	0
Destroyed by meteorological tides	1	0	4

and the fledging success. With the observed mean clutch size of 1.97, the average number of chicks reared per brood was 0.57. Complete development of the first plumage and acquisition of flight capacity was attained at and mean age of 47.83 days. At this stage, only the remiges have still to reach their maximum length.

Post-fledging care. Despite the acquisition of flight capacity, observations in five territories (n = 7 nestlings) showed that recently fledged juveniles were fed by their parents on the island until at least the 14th week of life. During this post-fledging period, juveniles stayed away from their territories for prolonged periods and sometimes formed large groups that spent hours at sea. Their parents continued to defend their territories and continued to feed the juveniles regularly.

Breeding success relative to laying dates. Egg volumes (Table 1) were not significantly different between eggs laid during the peak period ("peak group") and those laid afterwards ("after-peak group"; $P = 0.23$). However, the

TABLE 3. Weekly survival rate of Kelp Gull (*Larus dominicanus*) chicks between hatching and the end of the 7th week of life on Deserta Island in 2006. Indices: [1]weeks 13–15, [2]weeks 16–19.

Week	Total		Peak period[1]		After-peak period[2]	
	No. of nests (chicks)	Survival rate	No. of nests (chicks)	Survival rate	No. of nests (chicks)	Survival rate
1	68 (116)	0.81	55 (100)	0.81	13 (16)	0.83
2	63 (91)	0.92	51 (79)	0.90	12 (12)	1.00
3	61 (81)	0.93	50 (71)	0.93	10 (10)	0.90
4	53 (71)	0.95	46 (64)	0.97	7 (7)	0.75
5	48 (66)	0.91	44 (62)	0.91	4 (4)	1.00
6	35 (48)	0.96	35 (48)	0.96	-	-
7	22 (31)	1.00	22 (31)	1.00	-	-
Total		0.57		0.57		0.56

TABLE 4. Losses of Kelp Gull (*Larus dominicanus*) chicks on Deserta Island in 2006. Indices: [1]weeks 13–15; [2]weeks 16–19.

Losses	Egg losses (%)		
	Total (n =50)	Peak period[1] (n = 42)	After-peak period[2] (n = 8)
Dead without any apparent cause	38	36	50
Missing	20	25	0
Dead during meteorological tides	16	16	17
Killed by other Kelp gulls	10	9	17
Dead due to other hurts	4	2	0
Dead caught in vegetation	4	5	0
Dead fell from nest	4	2	17
Undetermined	4	5	0

TABLE 5. Kelp Gull (*Larus dominicanus*) chick survival rate on Deserta Island in 2006, according to the number of chicks per brood (1, 2, or 3) and hatching order (A, B, or C).

Chicks per brood	Hatching order			Final number of chicks per brood
	A	B	C	
1	0.72	-	-	0.72
2	0.66	0.58	-	1.24
3	0.59	0.57	0.29	1.45

observed mean clutch size was significantly different: 2.12 ± 0.53 (min/max: 1/3) for the peak group and 1.77 ± 0.43 (min/max: 1/2) for the after-peak group (P = 0.0043). Hatching success was 66% for the peak group and 49% for the after-peak group. In both groups,

addling was the main cause of egg failure, followed by death during the hatching process (Table 2). The weekly chick survival rate differed from 2 to 23% (Table 3) between groups, but the total chick rearing success was similar (57% for peak group vs 56% for after-peak group). However, chicks of the after-peak group were monitored only until the 5th week, because the field work ended when fledgings had at most this age. Causes for chick loss in both groups remained mostly undetected (Table 4). Breeding success was 38% for the peak group (0.80 chick reared per brood). In the after-peak group, breeding success was 27% (0.49 chick reared per brood). Given a number of 421 nests found on the island, a minimum of 289 juvenile gulls were reared in the colony in 2006.

Adult mortality. During the 2006 breeding season (March to November), 14 adults were found dead on Deserta Island. From this, the adult mortality can be calculated as 1.7% based on the adult populational estimate. However, this is a minimum estimate since some parts of the island could not be monitored searching for carcasses due to difficulty of access, and the number of adults that died outside Deserta Island is not known.

DISCUSSION

In 2006, at least 421 Kelp Gull pairs reproduced on Deserta Island. As the mean number of pairs on the island in previous years was 497 (Branco 2003), the breeding population appears to be stable. Settlement occurred in April, approximately two months before the start of egg-laying. A long pre-egg stage has already been observed in Brazil and elsewhere (Fordham 1964a, Soares & Schiefler 1995, Yorio & Borboroglu 2002, Branco 2003). Egg-laying started in the early June and extended over 127 days. In other parts of the species' breeding range, egg-laying begins between September–January (reviewed in Williams *et al.* 1984, Altwegg *et al.* 2007), usually spans from a month to about two months (Williams *et al.* 1984, Yorio & Borboroglu 2002), and is longer in New Zealand (99 days; Fordham 1964a). In southern Brazil, egg laying starts around June (Soares & Schiefler 1995, Branco 2003). The long duration of the pre-egg and laying stages may be related to the latitude and to the climatic conditions of these places (Fordham 1964a).

"C" eggs were significantly smaller than other eggs from all clutches, except for those from single-egg nests. This is frequent in Kelp Gull clutches (Fordham 1964a, Williams *et al.* 1984, Yorio & Borboroglu 2002) and in other gull species (e.g., Schreiber *et al.* 1979), but the trend is not always found (Pierotti & Bellrose 1986). Eggs from one-egg clutches were significantly smaller than "A" eggs from two-egg clutches and almost significantly smaller than "A" eggs from three-egg clutches, which could indicate that pairs that lay fewer eggs than the expected clutch size have a reduced fitness (e.g., Coulson 1966).

The observed mean clutch size on Deserta Island is similar to those found in other parts of the species' breeding range, where clutch size varies from 1.87 to 2.60 eggs per brood (Fordham 1964a, Parmelee *et al.* 1977, Crawford *et al.* 1982, Williams *et al.* 1984, Soares & Schiefler 1995, Yorio *et al.* 1995, Yorio & Borboroglu 2002, Branco 2004, Altwegg *et al.* 2007). Fordham (1964b) and Williams *et al.* (1984) found a hatching success similar to that determined on Deserta Island, but Williams *et al.* (1984), Yorio *et al.* (1995) and Yorio & Borboroglu (2002) observed higher hatching success. These authors attributed brood losses mainly to missing eggs, while parental negligence or egg infertility are the main causes of lost on Deserta Island. High losses by parental negligence or egg infertility could indicate lower food availability or inferior food quality,

which can negatively affect clutch size, egg size, and quality (Pierotti & Bellrose 1986). On the other hand, it is possible that predators are more likely to prey on the eggs and nestlings of negligent parents.

The incubation period is also similar to that observed in other parts of the species' breeding range, which varies between 23 and 30 days (Clark 1906, Fordham 1964a, Escalante 1970, Serventy *et al.* 1971, Watson 1975, Yorio & Borboroglu 2002). Hatching synchrony between "A" and "B" eggs from two-egg clutches was smaller than the synchrony observed between "A" and "B" eggs from three-egg clutches. "C" eggs were the most asynchronous to hatch, which means a great disadvantage for those fledglings relative to their "A" and "B" siblings. The hatching interval between eggs from a clutch is poorly known for the Kelp Gull, but Fordham (1964a) and Williams *et al.* (1984) observed the same phenomena between egg-laying dates.

On Deserta Island, most chick mortality occurred in the first week of life, and most losses had no apparent cause. In other parts of the breeding range, the average number of chicks reared per brood varies from 0.44 (Williams *et al.* 1984) to 1.93 (Calf *et al.* 2003). However, it is very hard to compare breeding success data, since field methods are very different, and several authors made conclusions from insufficient sample sizes. Fordham (1964b) searched for chick carcasses in his study areas; Williams *et al.* (1984) have a small sample size; Yorio *et al.* (1995) and Yorio & Borboroglu (2002) established fledging success as survival to the 28th day of live; and Altwegg *et al.* (2007) calculated the fledging success indirectly. Starvation seems to be the predominant mortality factor on Deserta Island and also on Marion Island (Williams *et al.* 1984). In Argentina (Yorio *et al.* 1995, Yorio & Borboroglu 2002), predation is responsible for most chick losses.

Mortality was lower in chicks reared alone and was similar in "A" and "B" chicks from nests with two– and three–egg clutches. The mortality rate of "C" chicks was the greatest, reflecting the smaller size of "C" eggs and the asynchronous hatching. Some hypotheses have been proposed to explain the adaptive function of hatching asynchrony and size hierarchy observed among siblings (reviewed in Mock 1994, Stenning 1996, Mock & Parker 1998, Drummond 2001). The brood-reduction hypothesis suggests that hatching asynchrony is an adaptive response to unpredictable levels of food availability. When food is abundant, all nestlings can fledge; in the opposite case, the smallest chick could be quickly sacrificed to benefit the remainders (Lack 1954). Yorio & Borboroglu (2002) found no significant reduction of survivorship and growth rate of "C" Kelp Gull chicks in Argentina. Whatever the reasons for asynchronous hatching may be, differences in food availability between Patagonia and southern Brazil probably could explain the divergence in results. The Argentinian coast is more productive than the southern Brazilian coast (Seeliger *et al.* 1988), and this greater food availability there may allow most third-chicks to survive, while on Deserta Island brood-reduction occurred.

The chick-rearing period spreads through almost seven weeks. Observations indicate that the post-fledging care period is long and could last up to the 14 th week of life or more. Fordham (1964a), Williams *et al.* (1984), Parmelee *et al.* (1977), and Yorio & Borboroglu (2002) observed that chicks complete the juvenile plumage development at a similar age to that found in this study. Maxson & Bernstein (1984) observed 11-week old chicks with fully developed flight capacity being fed by their parents. Schreiber & Burger (2001) stated that chicks complete the juvenile plumage development later, but the total period of parental care does not diverge too much from

that observed in this study. During this period of post-fledging care, juveniles improve their flight capacity and, probably, also their ability to navigate to their natal colony, acquire the capacity to feed independently, and establish the social interactions needed for the formation of migration groups.

Branco (2003) stated that Kelp Gulls were absent from Deserta Island in December. However, in mid November 2006 the breeding process of most pairs was far from being completed, and the definitive abandonment of the island by the last pairs and juveniles would not have occurred until February 2007.

Mean clutch size and hatching success decreased through the season, but total chick rearing success did not, probably because individual chick rearing success was greater when few chicks were reared together. Nevertheless there had been a significant reduction in the breeding success during the season. Previous studies (e.g., Fordham 1964a, Coulson 1966) found similar results, since pairs with lower reproductive fitness - with less experience or recently divorced - tend to breed later and to have a smaller clutch size and a lower breeding success.

In summary, despite being one of the main Kelp Gull breeding sites in Brazil, Deserta Island hosts only a small number of breeding pairs. Population appears to be stable. The subtropical weather allows a long breeding season; egg-laying on Deserta Island starts earlier and is the longest ever recorded for Kelp Gulls. Other breeding parameters observed on Deserta Island are in general similar to those observed throughout the species' breeding range, but there is an indication of a lower breeding success, which may have been caused by lower food availability. There was a significant reduction in the breeding success during the season. The period of post-fledging care was long and the island was occupied by Kelp Gulls almost all year long.

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