

CHICK CRECHING AND INTRASPECIFIC AGGRESSION IN THE JACKASS PENGUIN

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Abstract.—Creching of penguin chicks is believed to offer protection from predators and/or cold weather conditions. An alternative explanation is proposed for the close association of Jackass Penguin (*Spheniscus demersus*) chicks. The frequency of creching by Jackass Penguin chicks during the pre-independence phase was examined. Unguarded chicks of all ages may form creches of 4–11 chicks. Unguarded chicks may be exposed to high levels of aggression (maximum mean attack rate 3.8/h, range 0–12) from 1–6 adults at a time. Differential attack rates between guarded, creching and unguarded chicks, and the response of chicks to attack, suggest that creching of unattended chicks may confer protection against adult aggression.

CONGLOMERADO DE PICHONES Y AGRESIÓN INTRAESPECÍFICA EN *SPHENISCUS DEMERSUS*

Sinopsis.—Se cree que el conglomerado de pichones de pingüino ofrece protección contra depredadores, o contra condiciones ambientales de extremo frío. En este trabajo se ofrece una explicación alterna para los conglomerados de pichones de *Spheniscus demersus*. La misma es el resultado del estudio de la frecuencia de formar conglomerados, por parte de pichones de pingüino, durante la fase de pre-independencia. Pichones de todas las edades que no son protegidos por los adultos, pueden formar conglomerados que contienen de 4–11 individuos. En un tiempo particular, los pichones no-protegidos, pueden estar expuestos a niveles altos de agresión (promedio máximo de tasas de ataque = 3.8/h, alcance de 0–12) por parte de adultos (1 a 6 individuos). Diferencias en las tasas de ataque entre pichones protegidos, pichones conglomerados y pichones no-protegidos, y la respuesta de los pichones a los ataques, sugieren que los conglomerados de pichones no-protegidos pueden proveerle a éstos, de protección del ataque por parte de adultos.

Creching, the close association of post-guard-phase chicks, occurs in many penguin species (see Davis 1982 for review). A number of adaptive advantages have been proposed to explain the tendency for chicks to form creches; these include protection against predation and huddling to stay warm in cold weather. Jackass Penguin (*Spheniscus demersus*) chicks form creches, a habit believed to offer protection from predators such as the Kelp Gull (*Larus dominicanus*) (Cooper 1974). The Jackass Penguin is endemic to southern Africa. Breeding occurs in all months of the year, almost solely on islands off the coast of Namibia and the west and south-east coasts of South Africa (Crawford et al. 1990). Traditionally Jackass Penguins dug burrows in the guano cap that once covered many of the breeding islands to a depth of several meters. The commercial removal of guano deposits from Jackass Penguin breeding islands has increased

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the incidence of surface nesting (Frost et al. 1976), and is believed to have increased the occurrence of creching (Cooper 1977). The aims of this study are to document the occurrence of creching by Jackass Penguin chicks, to examine how creching behavior changes with age and to determine the proximate cause(s) of creching.

METHODS

Creching.—On Dyer Island (34°41'S, 19°25'E) during June–November 1990 we recorded creche composition in randomly selected sub-colony groups. A sub-colony group was defined as a close aggregation of nesting birds (mean interest distance about 1 m). Only one survey, consisting of 10 sub-colonies, was made on any one day. For each survey we used a table of random numbers to select a sector spanning approximately 22.5°, originating from a central point on the island. We then surveyed the first 10 sub-colonies encountered while moving out from the central point. At each sub-colony we recorded the numbers of chicks in each of four identifiable age/stage classes, these were: “medium-downy” chicks (MD, 10–25 d), “large-downy” chicks (LD, 26–39 d), “down-droppers” (DD, 40–60 d) including all stages of down loss, and “fully feathered” chicks (FF, ≥61 d) without any down remaining. Each chick was recorded as being alone (not obviously associated with an adult), in a creche or guarded (associated with an adult). Creches were defined as clusters of three or more chicks. Some general observations of chick creching behavior were also made on Dassen Island (33°25'S, 18°06'E) during September 1989.

Intraspecific aggression.—During the period of the creching surveys we observed chicks for 1-h periods between 1700 and 1900 hours, and recorded the frequency of, and behavior associated with, adult/chick interactions. Aggression towards chicks included any pecking, seizing, twisting and tweaking with the beak, and/or striking with the flippers. An attack was considered to be any continuous and sustained series of pecks or strikes directed at a single chick, by a single adult.

RESULTS

One hundred sub-colonies were surveyed, 66 of which had one or more creches. The proportion of chicks in creches in groups of 10 sub-colonies ranged from 6.7 to 56.1% (mean = 37.3%), with creche size ranging from 4 to 11 (overall mean = 6.7 chicks per creche).

Sub-colony composition over the period of study consisted of 21.1% MD, 27.7% LD, 42.8% DD and 8.4% BB. There were transitions in the incidence of creching between the four age classes indicating that creching decreased with age (Fig. 1). MDs were guarded most (77.4%) and alone least (5.5%). LDs showed similar levels of alone (20.3%) and creching (21.3%), though were still accompanied by parents >50% of the time. DDs showed the highest level of creching (47.3%), whereas BBs were most often alone (58.1%) and guarded least often (13.1%) (Fig. 1).

There was no significant correlation between the percentage of un-

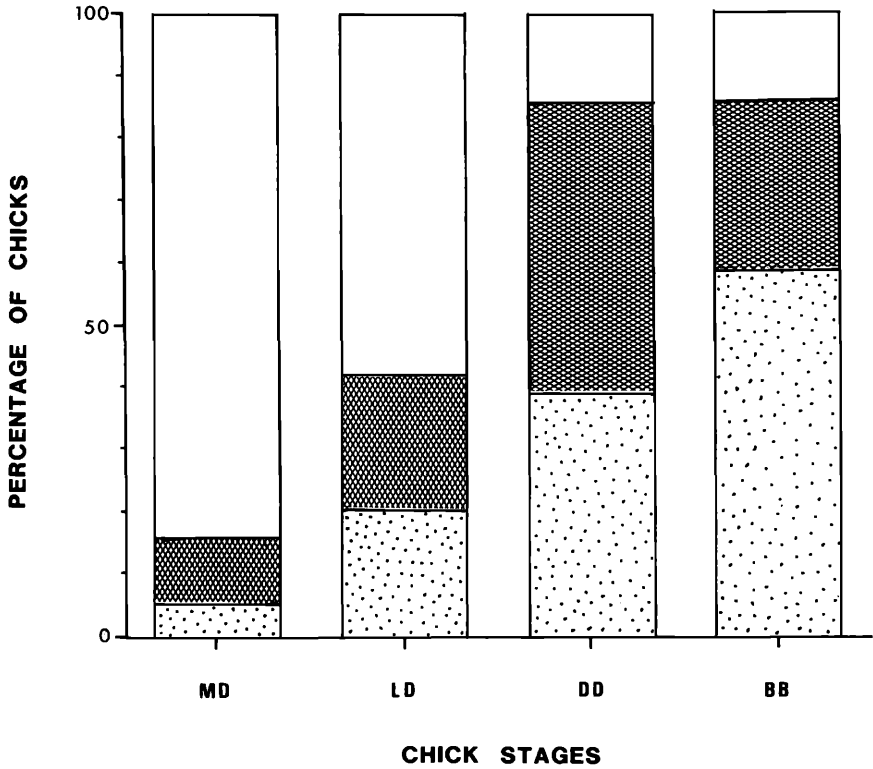
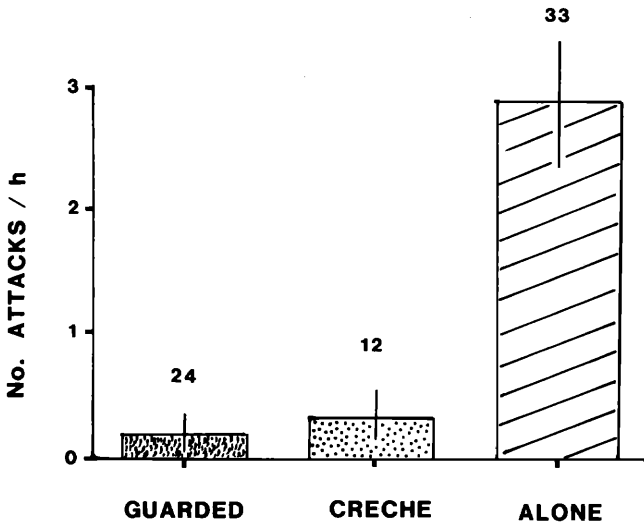


FIGURE 1. Proportions of Jackass Penguin chicks of different stages being guarded (clear), in creches (cross-hatched), or alone (dotted) during the day. Stages: MD = medium downy; LD = large downy; DD = down dropper; FF = fully feathered. See text for definitions.

guarded chicks in creches and an estimate of effective temperature based on cloud cover, wind direction and force, and time of day ($r_s = 0.52$, $n = 10$, $P > 0.05$)

Observations were made on a total of 69 chicks, comprising 24 guarded, 33 unguarded (alone) and 12 creching chicks. Attack rate (attacks per hour) was highest for unguarded chicks, intermediate and much lower for creching chicks, and lowest for guarded chicks (Fig. 2). Lone chicks of different ages suffered different rates of attack, highest for DD, intermediate for LD and lowest for BB (Table 1), no data were available for MDs as chicks of this age are seldom left alone (see Fig. 1). Unguarded LD and DD chicks suffered significantly higher rates of attack than guarded chicks of the same age (Mann-Whitney U -test, $P < 0.01$ and $P < 0.02$, respectively) (Table 1). Unguarded FF chicks suffered higher attack rates than guarded FFs (Table 1), though low numbers of guarded FF chicks in the sample make these differences non-significant ($P = 0.055$).



CHICK STATUS

FIGURE 2. Frequency (mean \pm 1 SD) of intraspecific attacks directed towards Jackass Penguin chicks that are guarded (stippled), in creches (dotted), or alone (clear) during the day. Numbers above bars indicate the number of individual chicks observed.

Attacks involved 1–6 adults at a time, and peck rates were 1–4 per attack. Chicks responded to attacks in two ways: crouching low to the ground with the head turned to avoid direct pecks, or by moving away. There was a significant difference in the destination of chicks that moved to avoid attack (1-sample χ^2 , $df = 3$, $n = 19$, $P < 0.01$); chicks that moved from an attacking adult had the choice of moving towards another adult (0% of the time), towards a clear area (24%) or towards other chicks (74%).

TABLE 1. Attack rates per hour (mean \pm 1 SD) of unguarded and guarded chicks in four age categories (see text for definitions). MD = medium downy, LD = large downy, DD = down dropper, FF = fully feathered.

Age	Unguarded			Guarded		
	n	Attack rate	Range	n	Attack rate	Range
MD	0	—	—	6	0	0
LD	8	1.8 \pm 1.0	0–3	8	0	0
DD	18	3.8 \pm 3.6	0–12	6	0.7 \pm 1.6	0–4
FF	7	1.3 \pm 1.3	0–4	4	0.3 \pm 0.5	0–1

DISCUSSION

Unguarded Jackass Penguin chicks of all ages form creches. The frequency of creching increases as the frequency of guarding decreases. Attending adults provide warmth for chicks before homeothermy develops, so creching may offer protection against adverse weather conditions. Thermally mature DD and LD chicks will join creches, however, and such groups form in warm weather conditions, even containing panting chicks. Guarding adults also protect chicks from predation; creching in other penguin species has been shown to confer protection on some members of the group (Davis 1982). Of the stages of Jackass Penguin chick development studied, only MD chicks are small enough to be at risk of predation by Kelp Gulls (Seddon and van Heezik 1991), particularly at exposed, surface nest sites. The presence of much larger chicks in creches suggests that protection from predation is not an adequate explanation for creching by Jackass Penguins.

Aggression by unrelated adults toward unguarded Jackass Penguin chicks is intense on Dyer Island where most birds nest above ground. On Dassen Island, where burrowing is possible, unguarded chicks remain in nest burrows during the day. To a large extent this limits encounters with other adults because territories are visually isolated and foreign chicks are seldom seen. In surface sub-colonies, as on Dyer, unrelated chicks will be constantly visible and thus visually intruding. The changing rates of attack indicate that for a chick it is best to be attended by a parent, but if unguarded then the next best is to be part of a creche, where other chicks may deflect or shield attacks. Creches may form passively through a gradual gathering of post-guard-phase chicks, or actively when chicks under attack enter or form huddles. Even the older (FF) chicks, just before fledging, are subject to attack, though their greater mobility and ability to anticipate and avoid potential attacks may explain their lower creching rate.

It would be useful to examine the function of creching by chicks of other species of penguin in relation to levels of aggression by adults. It may, however, be difficult to separate the relative influences of weather and predation from any possible effects of intraspecific aggression in the Antarctic species. Crested penguins, genus *Eudyptes*, show some degree of chick creching and have apparently high levels of inter-adult aggression (Warham 1975), though the levels of aggression directed towards unguarded chicks need to be documented in detail. Other species of the genus *Spheniscus* are logical subjects for testing these ideas, but again no comparable data are available. Future work should attempt to predict the size of creches according to presumed function, whereby an optimal chick creche size could be calculated according to the primary stimulus, whether this be ambient temperature, predation or adult aggression.

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