BREEDING OF HARTLAUB'S GULL *LARUS HARTLAUBII* AT HOUT BAY HARBOUR, SOUTH AFRICA

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Hartlaub's Gull *Larus hartlaubii* is endemic to the coastline of southwestern Africa (Britton 1986, Williams *et al.* 1990) and there are indications that its population is increasing, particularly in the southwestern Cape Province of South Africa (Williams *et al.* 1990). This increase has been attributed to an enhanced annual survival rate, following the provision of large quantities of supplementary food at sites such as refuse dumps and fishing harbours (Frost 1976, Williams *et al.* 1990). Hartlaub's Gulls do aggregate at these sites (Williams *et al.* 1990, Steele 1992), but population increases may be also due to increased reproductive success (i.e. number of young fledged per pair per year). However, apart from a few published notes (Betham 1931, Williams 1977, 1989, 1990, Robertson & Wooller 1981), comparatively little is known of the breeding biology of Hartlaub's Gull.

In an attempt to determine basic breeding parameters of Hartlaub's Gull at an artificial site close to a source of supplementary food, a colony on the roof of a fish-packing factory at Hout Bay fishing harbour (34 04S, 18 21E) was studied during 15 visits between 30 April and 2 October 1987. On each visit all occupied nests, eggs and chicks were counted and, where possible, chicks were banded with a standard SAFRING metal band. The length and breadth of each egg was measured to the nearest 0.1 mm. In August, prior to the expected second peak in egg-laying, all 27 occupied nests in the colony were marked. The contents of these nests were then checked weekly between 20 August and 2 October 1987, by which time breeding activity had practically ceased at the colony.

Breeding season

According to workers at the factory, Hartlaub's Gull breeding activity peaked in early April, at which time an area of the factory roof was cleared of nests. On 30 April 1987, when the Hout Bay colony was first visited, there were 49 occupied nests (Table 1) as well as a number of unoccupied nests that appeared to have been utilized that year. Thirteen chicks, both feathered and in down, were seen in the colony although this was likely to have been an undercount because there were many hiding places available to chicks on the factory roof (e.g. drain-pipes, guttering and small holes in the roofing). Overall, an estimated 75 pairs of Hartlaub's Gulls were nesting, or had nested, in the section of the colony that had not been cleared by workers. The largest number of adult Hartlaub's Gulls present at the colony was an estimated 500 birds on 19 May, although numbers estimated usually ranged between 200 and 300 adults. A census carried out on 12 June with the aid of a tally-counter counted 268 adults and 41 recently fledged juveniles sitting on or flying over the factory roof.

Hartlaub's Gull is unusual in that it generally breeds during the austral winter, between February and October (Maclean 1985, Britton 1986, Ryan 1987), although the species has been known to breed in every month of the year (see Brown 1990, Williams 1990, Williams *et al.* 1990). Most eggs were laid prior to the commencement of regular observations (Table 1), although egg-laying continued up to the week of 10-16 September when one egg was laid.

TABLE 1

CONTENTS OF HARTLAUB'S GULL *LARUS HARTLAUBII* NESTS AT THE HOUT BAY COLONY

Date in 1987	One egg	Two eggs	Three eggs	Four eggs	Chicks
30 April	19	21	8	1	13
19 May	7	14	2	0	19
03 June	14	9	0	0	18
12 June	6	16	0	0	4
19 June	11	12	0	0	2
26 June	9	9	1	0	0
10 July	9	6	2	0	0
30 July	8	7	0	0	0
20 Aug	11	15	0	0	?
27 Aug	10	10	0	0	4
03 Sept	4	9	1	0	7
11 Sept	6	1	1	0	8
16 Sept	5	0	1	0	2
24 Sept	3	0	1	0	0
02 Oct	1	1	0	0	1

It has been suggested that Hartlaub's Gulls breed during winter because storms strand large amounts of seaweed (such as the kelp *Ecklonia maxima*) on beaches at that time, which then attract large numbers of invertebrates on which the gull feeds (Ryan 1987). At natural breeding sites egg-laying generally takes place between February and June, and Hartlaub's Gulls may only breed throughout the year at artificial sites such as harbours and sewage works (Williams 1990).

Eggs and incubation

The mean length of 58 eggs from the Hout Bay colony was 52.8 ± 2.6 mm (range 47.1 - 59.7 mm) with a breadth of 35.9 ± 2.0 mm (range 30.4 - 39.9 mm), very similar to previously recorded egg dimensions (Maclean 1985, Britton 1986, Williams 1990). This sample did not include a miniature egg, one of a clutch of two eggs, which measured only 32.9 x 22.5 mm.

It is possible that Hartlaub's Gull has a double breeding season which means that the species can raise two broods in one year (Betham 1931, Tinbergen & Broekhuysen 1954, Underhill & Underhill 1986). The volume of eggs laid before 30 July (N = 34; length = 52.3 ± 2.6 mm; breadth = 36.3 ± 1.1 mm) and after that date (N = 24; length = 53.5 ± 3.2 mm; breadth = 35.3 ± 2.8 mm) were calculated using the equation $0.496 \times L \times B^2$. The constant value is that determined for Silver Gull *L. novaehollandiae* eggs by Wooller & Dunlop (1979). Although clutches found after 30 July were presumably second clutches or replacement clutches, there was no significant difference in the volume of eggs laid before 30 July and those eggs laid after this date (Mann-Whitney U-test, U = 312; $p < 0.05$).

Mean clutch size was 1.7 ± 0.5 (N = 55; range 1 - 4 eggs) and the modal clutch was two eggs. Previous studies have found the modal clutch size of Hartlaub's Gull to be two eggs also, with mean clutch sizes of 1.8 (Britton 1986) and 1.9 (from data in Williams 1990). It has been suggested that, in Hartlaub's Gull, there is a reduction in clutch size over the breeding season, because older birds generally breed earlier and have larger clutches than less experienced birds (Robertson & Wooller 1981). No significant difference in size was found between clutches laid before and after 30 July. However, the initial peak egg-laying period during February/March was not covered by this study.

Of 44 eggs laid in the 27 marked nests, three (7%) had not hatched by 2 October, three (7%) were addled, 16 (36%) are known to have hatched and the fate of the remainder is uncertain. Three eggs successfully hatched after 22 and two after 20 days of observation, confirming the previously reported incubation period for Hartlaub's Gull as under 25 days (Williams 1990). Four eggs disappeared after 36, 35, 30 and 28 days in the nest and the three addled eggs were abandoned after 47, 47 and 35 days. The closely related Silver Gull and Blackheaded Gull *L. ridibundus* have incubation periods of 19 - 27 days (Wheeler & Watson 1964, Serventy *et al.* 1971) and 23 - 26 days (Cramp & Simmons 1983), respectively.

Chicks

Mortality among Hartlaub's Gull chicks is high (Williams 1977, 1990, Underhill 1978, pers. obs.); of 14 chicks banded during the study, only four were seen subsequently. Two of 13 unbanded chicks found dead at the colony had severe head injuries and appeared to have been killed by adult conspecifics. Unfortunately, the disturbance caused during visits to the colony almost certainly resulted in a higher mortality of chicks than normal.

Feral Domestic Cats *Felis catus*, which frequented the factory and were seen in the gull colony on a number of occasions, were likely to have been responsible for the disappearance of some chicks. Wheeler & Watson (1964) report rats *Rattus* spp. to be the major predator of Silver Gull chicks in Australia, and it is possible that rats were responsible for some of the chick mortality at the Hout Bay colony although no rats were seen at the colony during visits. Known terrestrial predators of Hartlaub's Gull chicks and eggs, at natural breeding localities, include Yellow Mongoose *Cynictis penicillata* and Cape Grey Mongoose *Herpestes pulverulentus* (Cooper *et al.* 1985, Williams *et al.* 1990), but neither of these was likely to have been responsible for predation of chicks at the Hout Bay colony. Kelp Gulls *L. dominicanus*, Cattle Egrets *Bubulcus ibis* and Sacred Ibises *Threskiornis aethiopicus* are known to prey on Hartlaub's Gull chicks (Williams 1977, 1990), but none of these species was ever seen within the study colony.

One chick, banded on 2 October, was recovered dead 16 days later at Noordhoek beach (34 06S, 18 25E), 8 km from Hout Bay. A second chick, hatched between 20 and 27 August and banded on 3 September, was recovered alive but sick on 19 September in the vicinity of the colony. The low incidence of resightings of banded chicks at the colony precluded any attempt to estimate fledging period.

Fledging Success

Following a long-term study, Underhill & Underhill (1986) calculated that for Hartlaub's Gulls breeding at Robben Island (33 47S, 18 22E), South Africa, to maintain a stable population only 10.6% of eggs laid annually need produce young that successfully fledge. At Hout Bay the 44 eggs followed throughout incubation produced 16 chicks, at least four of which are known to have died prior to fledging. Hence a maximum of 27% of eggs monitored produced young which fledged.

This result is based upon a small number of nests over only half of one breeding season, but it might indicate that fledging success at the Hout Bay colony is higher than that needed to maintain a stable

population, particularly in view of the likelihood of heightened mortality at the study colony due to "observer effect". Furthermore, this study started only after the first clutches at the colony had been destroyed. Because first clutches are likely to be the most successful, the reproductive success of Hartlaub's Gulls breeding at Hout Bay may generally be even higher than that found during the study. Therefore, recently observed increases in Hartlaub's Gull population size may be due, at least in part, to increased reproductive success. This could be explained by the fact that the time adults are away from a colony foraging, and so unable to protect their eggs and chicks, must be reduced when a source of supplementary food is nearby, such as was the case with Hout Bay fishing harbour. A detailed study of the Herring Gull *L. argentatus* found that chick survival increased with the time adults spent at the colony and that this was related to the distance of the colony from a source of supplementary food (Hunt 1972). However, it has been found for Western Gulls *L. occidentalis* and Kelp Gulls that although adults may feed predominantly on supplementary food for most of the year, they feed their chicks high-quality, "natural" prey such as fish and squid (Hunt & Hunt 1976, Annett & Pierotti 1989, Steele 1992). If this is true for Hartlaub's Gull also, the proximity of a source of supplementary food would only affect reproductive success during the incubation period through enhanced hatching success. Comparative studies on the breeding biology of Hartlaub's Gull at colonies at different distances from sources of supplementary food are needed to determine the impact that the provision of supplementary food has on reproductive success.

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