THE FORAGING BEHAVIOUR AND BREEDING SEASONALITY OF HARTLAUB'S GULL LARUS HARTLAUBII

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SUMMARY

The foraging behaviour of the Hartlaub's Gull *Larus hartlaubii* is described in an attempt to explain the species' winter breeding season and apparent correlation between breeding success and rainfall (= winter storms). Hartlaub's Gulls use a wide range of foraging techniques, but prior to recent changes in food availability due to human activities, most foraging probably occurred at sheltered coastal waters, estuaries, lagoons and beaches. Small crustaceans and arthropods are important prey species, and prey abundance is related to the amount of stranded kelp (*Ecklonia*, *Laminaria* and *Macrocystis*) and other seaweeds. Breeding occurs when winter storms strand large amounts of kelp. Recent changes in foraging behaviour associated with increased food availability due to human activities have resulted in breeding occurring earlier.

INTRODUCTION

The Hartlaub's Gull *Larus hartlaubii* is restricted to the south and west coasts of southern Africa, where it is locally abundant and has become a scavenger in urban areas (Maclean 1985). Breeding occurs primarily during the austral winter (Maclean 1985) and breeding success in the southwestern Cape, South Africa is positively correlated with winter rainfall (Underhill & Underhill 1986). Rainfall is related to cyclonic activity in the southwestern Cape and it has been inferred that winter storms increase food availability for Hartlaub's Gulls (Underhill & Underhill 1986). However, little has been published on the foraging behaviour and diet of Hartlaub's Gulls (Steyn 1957, Hockey 1982, Walter 1984, Morant 1987); other accounts mention only "unusual" feeding behaviour (Winterbottom 1971, Simon 1977a, Silbernagl 1979). This report describes the feeding behaviour and diet of Hartlaub's Gulls,

and examines whether winter breeding is related to increased food availability. The effect of changes in foraging behaviour on breeding seasonality is examined.

METHODS

Breeding seasonality of Hartlaub's Gulls was determined from an examination of the Southern African Ornithological Society's Nest Record Cards. Egg-laying dates were estimated to the nearest month assuming an incubation period of 25 days and a chick-rearing period of 40 days (Britton 1986). Several laying months were inferred for colonies containing eggs and chicks of various ages. Each card was given equal ranking, irrespective of colony size. All cards for the southwestern Cape between the Olifants Estuary (31 42S, 18 12E) and Cape Agulhas (34 50S, 20 01E) were included in the analyses. Breeding seasonality was compared using contingency tables for cards from before and after 1970.

Observations on the feeding behaviour of Hartlaub's Gulls were made over a number of years throughout the species' range. The stomach contents of 10 birds collected at Marcus Island (33 03S, 17 58E) on 11 and 12 July 1985 were examined, and an adult bird was stomach pumped (Wilson 1984) at Dyer Island (34 41S, 19 25E) on 28 August 1983.

The relative importance of different types of foraging behaviour was derived from habitat use during mid-summer waterbird surveys of the northwestern and southwestern Cape coasts, adjacent wetlands and offshore islands (Ryan & Cooper 1985, Ryan *et al.* in press). However, these surveys did not cover urban areas away from the coast and wetlands in the southwestern Cape where many Hartlaub's Gulls scavenge.

RESULTS

Breeding seasonality

Egg-laying in the southwestern Cape occurred between February and October, with peaks in April and again in August. The proportion of colonies where laying took place before May prior to 1970 (26,7 %, n = 30) was significantly lower than that after 1970 (49,1 %, n = 163, X^2 = 5,13, d.f. = 1, $p < 0,05$).

Foraging behaviour

Large populations of Hartlaub's Gulls forage in areas greatly altered by human activities. The species' largest breeding colony, at Robben Island (33 48S, 18 22E), is *c.* 10 km from central Cape Town (Kriel *et al.* 1980). During the breeding season, large numbers of birds commute between urban feeding areas and Robben Island (L.G. Underhill pers. comm., pers. obs.). Other large breeding colonies around Cape Town occur at Strandfontein Sewage Works (Robertson & Wooller 1981), Rietvlei, and on top of various buildings (Broekhuysen & Elliott 1974, Simon 1977b, Morgan 1982).

In the Cape Town area, foraging occurs at refuse tips, the harbour and other coastal localities in the company of the larger Kelp Gull *L. dominicanus*, as well as throughout the suburban area, where the Kelp Gull is absent (Brooke & Cooper 1979). Large numbers of birds feed at sewage works where they pick prey items from near the surface of settlement ponds. The diet presumably consists largely of scraps obtained by scavenging, although insects and other invertebrates also are eaten (Simon 1977a, Silbernagl 1979). Hartlaub's Gulls occasionally forage behind ploughs (Winterbottom 1971). During heavy rains in winter, large numbers of birds congregate on flooded areas of short grass (especially playing fields and road verges) where they eat earthworms forced to the surface.

The second largest breeding concentration of Hartlaub's Gulls occurs at islands and on the mainland in Saldanha Bay (Cooper 1976), where scavenging occurs at the harbour, fish factories and urban area. Flocks of Hartlaub's Gulls snatch fish from open trailers filled with pelagic fish, and search for scraps in the effluent water from fish factories. This commensal existence with man is repeated at all the towns and harbours along the south and west coast of southern Africa. Each town supports a population of Hartlaub's Gulls, frequently with a nearby breeding colony. Away from human settlements, Hartlaub's Gulls are less abundant, and practically nothing has been published on their foraging behaviour (Steyn 1957, Hockey 1982, Morant 1987).

Hartlaub's Gulls frequently have been observed feeding less than 10 m from the shore in shallow bays by picking at small prey items near the sea surface (Hockey 1982, R.K. Brooke, J. Cooper, D.C. Duffy, M.W. Fraser, W.R. Siegfried, C.B. Walter pers. comm., pers. obs.). Closer examination has revealed the sea to be full of amphipods and isopods associated with the run-off from stranded kelp and other algae. Hartlaub's Gulls also have been seen picking over fronds of stranded algae, and actively chasing the crustaceans

and insects they disturbed. The adult Hartlaub's Gull sampled at Dyer Island contained some 270 *Talorchestia* spp. (amphipod), 14 *Ligia* spp., one *Deto echinata* (isopods), and two dipteran larvae, all species characteristic of decaying stranded kelp (Day 1974).

Surface seizing while swimming, wading or paddling in soft substrata is a foraging technique commonly used by Hartlaub's Gulls feeding at estuaries and coastal lagoons (Steyn 1957, Morant 1987). Prey in these habitats is little known, but may include fish (Morant 1987). Similar foraging behaviour is occasionally observed at sea during calm conditions. Approximately 150 Hartlaub's Gulls were observed feeding by surface seizing in Fish Hoek Bay (34 08S, 18 26E) for three days during December 1985. At the time a large swarm of amphipods was present in the surface waters of the bay. These probably were the prey of the gulls, because the gulls were taking very small prey items, no other potential prey items were observed, and the gulls were concentrated over areas with high densities of amphipods. Similar behaviour has been seen at sea off Marcus Island in Saldanha Bay (J. Cooper pers. comm.).

Hartlaub's Gulls also feed on the wing. Simon (1977a) described birds catching insects attracted to lights at night. When checked during 1979 and 1980, the prey taken at night on the Cape Town foreshore were swarming tettigonid grasshoppers (R.K. Brooke pers. comm.). On 15 November 1980, a flock of some 400 Hartlaub's Gulls, 50 Kelp Gulls, 500 Common Terns *Sterna hirundo* and 50 Sandwich Terns *S. sandvicensis* was observed hawking insects during the day over the low hills southeast of St Helena Bay (32 46S, 18 03E). Such behaviour previously has been recorded in southern Africa for the Kelp Gull and Greyheaded Gull *L. cirrocephalus* (Summers 1977, Underhill 1987). Aerial chases and contact dips are used during attempts at kleptoparasitism. Target species include other Hartlaub's Gulls, cormorants, terns and occasionally waders (Duffy 1982, Morant 1987, pers. obs.).

Aerial foraging by dipping is more frequent than either of the above aerial feeding techniques. Morant (1987) observed Hartlaub's Gulls chasing fish into shallow water by flying low over fish schools. When the sea is too rough to allow surface seizing, Hartlaub's Gulls also hover over the inshore zone. The 10 birds collected at Marcus Island were foraging in this manner, and one contained the soft parts of Black Mussel *Choromytilus meridionalis*, which presumably was made available by severe wave action.

Only two of the other nine Hartlaub's Gulls collected at Marcus Island contained identifiable prey remains; both had partially digested whitefish (possibly hake *Merluccius* spp.) in their stomachs. Walter (1984) found otoliths of Pelagic Goby *Sufflogobius bibarbatus* and lantern fish *Lampanyctodes* sp. in Hartlaub's Gull pellets. It is not certain whether such fish are scavenged from boats or are caught alive by the gulls. Hartlaub's Gulls generally are not found farther than a kilometre from the coast, and, although they occasionally follow boats, they are usually excluded from flocks scavenging around boats, apparently by large numbers of the dominant Kelp Gull.

Walter (1984) suggested that Hartlaub's Gulls may catch fish at night. Fishing boats entering Saldanha Bay at night often are accompanied by Hartlaub's Gulls, whereas those which enter during the day are followed by Kelp Gulls. On 14 April 1984, a flock of eight Hartlaub's Gulls was seen 14 km due west of Cape Town at dawn, flying towards land. These observations suggest that nocturnal foraging by Hartlaub's Gulls at sea occurs, and further investigation is warranted. Hartlaub's Gulls have been observed to forage in the intertidal zone at night (P.A.R. Hockey pers. comm.).

Hartlaub's Gulls also are opportunistic foragers. Examples include the scavenging of cormorant regurgitations and excreta, the snatching up of scraps from feeding Cape Fur Seals *Arctocephalus pusillus* (J. Cooper pers. comm.) and the searching of sandy beaches for stranded organisms. They occasionally feed on the fruits of bushes growing at breeding sites (P.A.R. Hockey pers. comm.).

Coastal distribution of Hartlaub's Gulls

The proportions of Hartlaub's Gulls counted at different coastal habitats are given in Table 1. On the northwestern Cape coast, where human population density is very low, the density of Hartlaub's Gulls was greatest on mixed sandy and rocky shores (14,5 birds.km^{-1}), compared with sandy beaches (7,6) and rocky shores (4,7), calculated from Ryan & Cooper (1985). There are few wetlands in this area and only the Orange River estuary supported any Hartlaub's Gulls (Ryan & Cooper 1985).

In the southwestern Cape, mixed sandy and rocky shores also supported higher densities (20,9 birds.km^{-1}) than did sandy beaches (3,8) and rocky shores (11,3), although the highest coastal densities occurred at coastal localities modified or

TABLE 1

NUMBERS OF HARTLAUB'S GULLS IN DIFFERENT HABITATS IN THE CAPE PROVINCE, SOUTH AFRICA (AFTER RYAN & COOPER 1984, RYAN *ET AL.* IN PRESS). NO GULLS WERE COUNTED AWAY FROM THE COAST OR ADJACENT WETLANDS

Habitat	Northwestern Cape		Southwestern Cape		Total	
	n	%	n	%	n	%
Coastline						
Cliffs			36	0,1	36	0,1
Rocky shore	229	7,6	2 982	12,5	3 211	11,9
Mixed rock & sand	1 115	37,1	3 014	12,6	4 129	15,4
Sandy beaches	259	8,6	1 670	7,0	1 929	7,2
Disturbed areas			5 176	21,7	5 176	19,3
Coastal wetlands						
Estuaries and lagoons	800	26,6	4 222	17,7	5 022	18,7
Fresh water bodies			550	2,3	550	2,0
Sewage ponds			4 581	19,2	4 581	17,1
Offshore islands	606	20,1	1 638	6,9	2 244	8,3
Total	3 009		23 869		26 878	

disturbed by human activity (44,6), calculated from Ryan *et al.* (in press). A large proportion (39,2 %) of the southwestern Cape population of Hartlaub's Gulls occurred at coastal wetlands, with most birds at sewage works, estuaries and coastal lagoons (Table 1).

At least 36,3 % of Hartlaub's Gulls in the Cape Province occurred at coastal localities altered by human activities or at sewage ponds (Table 1). The proportion of Hartlaub's Gulls feeding in habitats greatly modified by human activities probably would be greater than 50 % if all birds in urban areas had been surveyed.

DISCUSSION

Hartlaub's Gulls employ a wide array of foraging techniques similar to those reported for closely related species of hooded gulls (Tinbergen 1957, Serventy *et al.* 1971, Cramp & Simmons 1982). This diversity of foraging techniques results in a diverse diet and allows successful co-existence with man. Apart from foraging at habitats extensively modified by man, most foraging occurs by picking or surface-seizing small invertebrates, primarily along the coast and at sheltered coastal waterbodies (bays, estuaries and lagoons).

I hypothesize that, prior to recent human habitat modification, Hartlaub's Gulls fed primarily on small crustaceans, insects and other invertebrates obtained at sea (surface seizing and dipping) or along the shore and at estuaries (picking). Stranded kelps and other seaweeds probably were an important source of invertebrate prey. This hypothesis is supported by 1) the highest densities of Hartlaub's Gulls on the coast occurring on mixed sandy and rocky shores which typically have large amounts of stranded kelp, supporting large populations of crustaceans and insects (Summers *et al.* 1977, Griffiths *et al.* 1983), and 2) the coincidence of the ranges of the Hartlaub's Gull and large seaweeds associated with the upwelling of nutrient-rich water in the Benguela region (the small numbers of Hartlaub's Gulls east of Cape Agulhas, beyond the range of large kelps, may be a recent phenomenon associated with human settlements). The winter breeding season of Hartlaub's Gulls probably is timed to coincide with winter storms which strand large amounts of kelp and other algae (Koop & Field 1980), increasing prey populations. This would account for the positive correlation between breeding success and rainfall reported by Underhill & Underhill (1986).

Of the 15 hooded gulls for which breeding seasons are recorded (Harrison 1983), only Hartlaub's Gulls and Silver Gulls *Larus novaehollandiae* in the upwelling region of western Australia are winter breeders (Serventy *et al.* 1971). The foraging behaviour of Silver Gulls is similar to that of Hartlaub's Gulls and Silver Gulls also feed on crustaceans and insects associated with rotting kelp (Serventy *et al.* 1971), thus Silver Gulls in Western Australia may also time their breeding to coincide with winter storms. Silver Gulls elsewhere in Australia do not breed in winter (Serventy *et al.* 1971).

The commensal relationship between Hartlaub's Gulls and man has resulted in a large proportion of the population feeding in urban areas. Almost 40 % of birds counted in coastal surveys of the Cape Province were within artificial or disturbed habitats (Table 1). Several factors point to an increase in the population of Hartlaub's Gulls, presumably in response to urban feeding: 1) the highest coastal density in the southwestern Cape occurs at localities disturbed by human activities, 2) the formation of new breeding colonies on man-made structures in urban areas (Broekhuysen & Elliott 1974, Simon 1977b, Morgan 1982), at sewage works (Robertson & Wooller 1981) and at protected mainland sites in harbours (Cooper 1976, Williams 1985), and 3) the largest breeding colonies occur near large urban areas. Presumably breeding occurs earlier now than in the past because urban feeding situations are available throughout the year.

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