

MUTUALISM BETWEEN LAUGHING GULLS *LARUS ATRICILLA* AND EPIPELAGIC FISHES

Many epipelagic fishes possess only a single visual pigment that is matched to the spectrum of downwelling light in the water column (McFarland & Munz 1975). Consequently, these fish tend to feed by rushing at potential prey in an upward direction because 1) prey are more easily seen when contrasted against the lighter background of the surface, and 2) the predators are less easily seen by prey when rushing out of the darker blue depths. As a result, prey fishes tend to flee laterally and vertically from the attack. The prey generally quickly reach the surface from which they begin leaping in an attempt to escape. This activity presumably contributes to the confusion effect (Hobson 1965, 1968) by causing the predator to have discontinuous visual contact with any single prey item, and probably explains why leaping is a nearly universal predator avoidance pattern in fishes when they are attacked near the surface.

The surface splashing caused by actively feeding marine fishes often attracts substantial numbers of seabirds that hurry to the site of activity. Many surface feeding seabirds visually key on the surface disturbances caused by actively feeding fishes or the leaping activity of their intended prey (Erdman 1967). For many seabirds, gulls *Larus* in particular, potential food farther below the surface than 0,5 m is completely unavailable. It is generally believed that some species of seabirds are benefited by the activities of the feeding fish (*e.g.* Ashmole & Ashmole 1968, Harrison *et al.* 1983, Schreiber & Schreiber 1984), and may be dependent upon feeding fish for a substantial proportion of their total food intake (Ashmole & Ashmole 1967).

Although fish are not dependent upon seabirds, I believe there is often a mutualistic interaction between some seabirds and piscivorous fishes such that the fishes may benefit energetically by the rapid arrival of a large number of seabirds which settle on the disturbance caused by the feeding fish, and prevent the prey fish from leaping above the surface. When this happens quickly, all escape for the prey fish is cut off, and they then undertake a different anti-predation strategy and form a much more compact aggregation (usually referred to as a bait-ball) as a temporary measure in which each individual tries to get into the centre of the ball (*pers. obs.*), presumably to reduce its chances of being eaten (Hamilton 1971).

I call the action of the birds the "lid" phenomenon because the birds seem to be "putting a lid" on the leaping activity. When a lid is formed predatory fish continue to pick off individuals near the edge of the ball with a minimum of energy from chasing, and the seabirds simply seize prey fish that are pressed up against the surface. The key to the occurrence of the lid phenomenon seems to be how quickly the birds arrive and form a lid on the upward eruption of prey fish. If the lid forms before the prey school is scattered by the attacking predators, the prey form a bait-ball. If the birds do not arrive quickly

enough or in sufficient numbers, the prey fish continue to leap upward and laterally and are pursued by the predatory fish.

I regularly witnessed the lid phenomenon along the south shore of St John, U.S. Virgin Islands, during an approximately one-week period around the full moon each month from May to August 1983. The dominant prey fish in the region was a small clupeid known locally as "Sweethead" (*Jenkinsia* sp.). Large numbers of Sweethead moved into bays starting 4-6 days prior to the full moon, and formed dense aggregations. At that time, openwater predatory fish (primarily Blackfin Tuna, *Thunnus atlanticus*, Little Tuna, *Euthynnus alleteratus*, King Mackerel, *Scomberomorus cavalla* and Blue Runner, *Caranx crysos*), that did not normally mass in the nearshore waters of the island, moved into the bays and fed on Sweethead for the first hour or so of daylight. The months in which the lid phenomenon occurred coincided with the peak abundance of Laughing Gulls *Larus atricilla* around St John (Erdman 1976), and Laughing Gulls were the bird species primarily responsible for lid formation. From January to April, and September to November, there appeared to be at least as many Sweethead, but no Laughing Gulls. In the absence of gulls, there were rarely sufficient numbers of other birds (Brown Pelican *Pelecanus occidentalis*, Brown Booby *Sula leucogaster*) to form a lid. However, pelicans and boobies did contribute to most observed lids that were formed by Laughing Gulls.

The presence of the bait-ball underneath the seabird lid was never documented for the precise moment that the birds were sitting on the surface, but in numerous (> 100) instances in which the birds were driven off, the water immediately began to "boil" with leaping prey and predators that had seemingly been quiescent beneath the birds. In one instance I observed a bait-ball from both above and below the surface (by leaning over the side of the boat while wearing a face mask) immediately after the birds were driven off; there was indeed a large bait-ball, and there was a mixed aggregation of teleost (nine species) and elasmobranch (five species) predators observed feeding on it.

The lid phenomenon seems to be a special case of seabird-fish interaction. It is easy to see how birds benefit from the feeding activities of piscivorous fishes; fish do not necessarily benefit from the interaction. When seabirds form a dense enough aggregation, however, there is a temporary mutualistic association that benefits both. The fish certainly do not need the birds feeding at the surface, but undoubtedly benefit energetically by not having to engage in nearly as many high speed chases to reach satiation.

The Laughing Gull was the primary species involved in lid formation, probably because it has only limited ability to catch fish that are not either distracted by other predators or driven to the surface. Brown Pelicans and Brown Boobies, the other two bird species present over fish schools around St John, were both able to dive and readily caught fish in the absence of attacks on prey by predatory fishes. Consequently, forming

lids may be comparatively important for Laughing Gulls.

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ANTARCTIC TERNS *STERNA VITTATA* FEEDING ON THE GROUND AT TRISTAN DA CUNHA

Terns in the genus *Sterna* feed primarily by surface plunging or dipping into water (Ashmole 1971). There are several records of *Sterna* terns flying over land and feeding on aerial or terrestrial prey in a manner more typical of the genus *Chlidonias* (Falla 1939, Feare 1969, Ash 1984, Hallet 1984, pers. obs.), but there are very few observations of *Sterna* terns feeding on the ground. Common Terns *S. hirundo* have been seen feeding while walking or wading in shallow water (Bauer 1965, Christie 1982, Dunn 1984) and Kerguelen Terns *S. virgata* occasionally feed while sitting (Berruti & Harris 1976, A. Berruti pers. comm.). This note reports ground foraging in the Antarctic Tern *S. vittata*.

Eleven Antarctic Terns were observed feeding in open pastures near the Potato Patches at Tristan da Cunha (37 05S, 12 20W), southern Atlantic Ocean, on 17 November 1984. There were ten adults, nine of which were in nuptial plumage, and one first year bird. The birds walked slowly through the grass and herbaceous cover, picking and probing for prey. Their stance was erect with the neck fully extended to raise the head, and the bill depressed, presumably to allow forward binocular vision (Fig. 1). Occasionally a bird would fly a few metres to investigate a new area. The prey taken could not be identified but probably included a small green caterpillar since this was the only invertebrate found during a casual search of the area where the birds were foraging. One tern took 11 prey items in 16 attempted pecks and probes during a five-minute period. The Antarctic Terns were scattered over an area of approximately five hectares of pasture with slightly taller vegetation (30-50 mm) than that found on adjacent, more recently grazed fields. They remained in the area for at least three hours, apparently foraging continuously. The weather was fine and calm at the time and the only other Antarctic Terns seen were in a flock of c. 140 birds roosting and displaying at The Hardies, a nearby rock stack.

Ground foraging has not previously been recorded for the Antarctic Tern (Burger 1978, Stahl & Weimerskirch 1982, Harper *et al.* in press), although Will (1884 in Murphy 1936) saw the species well inland at South Georgia and suspected it of taking terrestrial invertebrate prey. It is unlikely that the Antarctic Terns at the Tristan Island group could have employed this feeding method before the advent of human settlement and the creation of short pastures on Tristan since the native coastal vegetation is tall and dense. The presence of a suitable and profitable food resource has apparently allowed the terns to expand their niche to include this atypical foraging technique. The only potential avian competitors at Tristan are vagrant Cattle Egrets *Bubulcus ibis* and free ranging domestic fowl *Gallus domesticus*. The Tristan Thrush *Nesocichla eremita* and reintroduced Gough Moorhen *Gallinula nesiotis* are absent from low-lying pastures (pers. obs.). Food obtained by ground foraging may be an important energy source for Antarctic Terns at Tristan, particularly during bad weather when strong winds can hamper offshore foraging in terns (Taylor 1983).

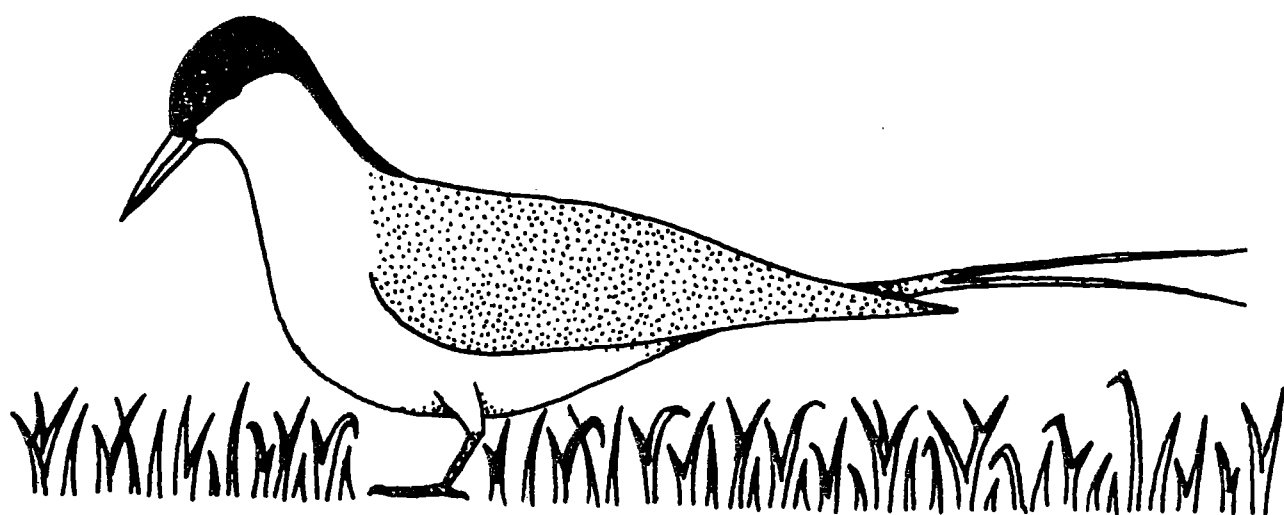


Figure 1

Posture of an Antarctic Tern foraging on the ground at Tristan da Cunha, showing the height of the vegetation

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CAPE CORMORANT *PHALACROCORAX CAPENSIS* CHOKES ON LARGE FISH

A Whitebreasted Cormorant *Phalacrocorax carbo* is documented as having died after trying to swallow oversized prey at Barberspan (26 32S, 25 36E) (Skead 1980). While at Dyer Island (34 41S, 19 25E), on 22 February 1984, we came across a freshly-dead adult Cape Cormorant *P. capensis* which had apparently choked while trying to swallow a Saupe *Sarpa salpa*. The fish weighted 195 g, had a caudal length of 195 mm (total length 217 mm) and a depth of 66 mm.

Cape Cormorants feed almost exclusively on pelagic schooling fish, principally Cape Anchovy *Engraulis capensis*, Cape Pilchard *Sardinops ocellata*, and Pelagic Goby *Sufflogobius bibarbatus* (e.g. Davies 1956, Rand 1960, Crawford & Shelton 1979, Cooper 1984). The mean total lengths for these species in the diet of the Cape Cormorant diet are between 48 mm and 210 mm (Davies 1955, Rand 1960, Matthews & Berruti 1983, Cooper 1984). Pelagic schooling fish have a depth ratio (caudal length divided by dorso-ventral width at the widest part) of 4 - 6 whereas Saupe have a depth ratio of 2.75 (Smith 1977). Cape Cormorants regularly swallow fish longer than the Saupe that we found (Rand 1960, Matthews & Berruti 1983) and the largest pelagic schooling fish recovered from a Cape Cormorant was a pilchard with a total length of 280 mm (Rand 1960). Since pilchard have a depth ratio of five (Smith 1977), this fish was only c. 56 mm deep. Therefore it seems that it was the depth rather than the length of the Saupe that prevented the Cape Cormorant from swallowing it.

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SECOND RECORD OF A KING PENGUIN *APTENODYTES PATAGONICUS* ASHORE IN SOUTH AFRICA, WITH NOTES ON MOULT

On 28 January 1982 a King Penguin *Aptenodytes patagonicus* was found alive at the low water mark on the beach 13 km east of Sundays River mouth, eastern Cape, South Africa (33° 42'S, 26° 02'E). The presence of pink mandibular plates and golden auricular patches, and its subsequent advertising behaviour, identified the bird as an adult of breeding age. Its location suggested it had come ashore very recently, probably on that day. It was not seen on a beach patrol conducted two days previously. Cooper (1978) has described the only other definite South African record of this species. Photographs of the present bird are on file in the Port Elizabeth Museum library.

Comparison of the bill length of this bird (tip to posterior margin of mandibular plate, 121 mm) with comparable data from two colonies westward of South Africa (Barrat 1976) suggests that it did not originate from South Georgia (126-139 mm, n = 6). Whereas the bills of Falkland Islands birds (115-124 mm, n = 5) are similar in length, this colony is very remote from the eastern Cape (>9 000 km), containing only some 150 pairs (Wilson 1983) and therefore seems an improbable origin for this bird. It is more probable that this bird originated from the closest and very large populations (Williams *et al.* 1979) breeding on the Prince Edward Islands, 1 800 km southeast of Algoa Bay, from which a current-assisted route to the South African coast has been proposed (Shaughnessy & Ross 1980). There appear to be no published measurements of birds from these islands, though these are likely to be similar to those of other Subantarctic populations included in the race *A.p. halli* (Barrat 1976). Breeding localities farther to the east are least likely points of origin due to the eastward flow of the West Wind Drift.

The Penguin was netted easily and taken to the Port Elizabeth Oceanarium, where it was placed in an enclosure equipped with a pool, with several Jackass Penguins *Spheniscus demersus*. The King Penguin began swimming soon afterwards, but continuous, unopposed harassment by the smaller Jackass Penguins led us to remove the new arrival on the same day to more peaceful surroundings. It was placed in an enclosure housing a forced aeration unit, which provided shade, a cool draught and intermittent spray, and with free access to an adjacent 800 m³ shaded tank stocked with marine fish. It was maintained there until 28 April 1982 when it was air freighted to the Bird Park, Moreton-on-Water, U.K. Air temperatures in the enclosure during this period have been estimated from a predictive equation derived from four-hourly measurements taken at the airport 3 km westward, and data taken under similar conditions in the enclosure from 28 January - 28 April 1984.

At capture the penguin weighed 14,5 kg. This mass is within the mass range (13,8-17,2 kg) of birds at the same stage of moult on the Crozet Islands (Barrat 1976), but is considerably less than those of South Georgian birds (19-21 kg) (Stonehouse 1960). Moulting of contour feathers began on 5 February, and was virtually complete by 19 February when a few old feathers

remained on the head and c. 25 % of the flipper surface area. The interval between coming ashore and this stage of moult was 22-23 days, considerably less than that recorded at South Georgia (27-36 days) by Stonehouse (1960), but the difference may be due to inability to determine the end of moult in the present circumstances. From 9 February onwards the bird frequently assumed the advertising posture and gave out the short call described by Stonehouse (1960) as part of pairing behaviour. The penguin made no attempt at this stage to enter the water. Following concern by curatorial staff on the bird's thin appearance, on 28 February the bird was force fed c. 300 g Horse Mackerel *Trachurus trachurus* and the following day received c. 500 g Pilchard *Sardinops ocellata*. The bird's mass on 2 March was 7,3 kg, indicating a mean loss over the 33-day period of c. 0,218 kg/day (or 0,242 kg/day, assuming total utilization of the 800 g of fish consumed) during the bird's moult. This rate is lower than the mean rates recorded at South Georgia (0,27 kg/day) (Stonehouse 1960) or at the Crozet Islands (0,245 kg/day and 0,26 kg/day) (Barrat 1976). This difference is probably related to the higher mean ambient temperature experienced by this bird (estimated at 20,1°C for this period), and the resultant lower energy expenditure on thermoregulation.

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CAPE GANNETS *SULA CAPENSIS* ASHORE AT DYER AND ROBBEN ISLANDS,
SOUTHWESTERN CAPE, SOUTH AFRICA

There are six extant breeding colonies of Cape Gannets *Sula capensis*, a species endemic to southern Africa. These are Mercury, Ichaboe, Possession, Bird (Lambert's Bay), Malgas and Bird (Algoa Bay) Islands. Three extinct colonies are known (Hollamsbird, Halifax and Seal (False Bay) Islands) and there are three islands (Marcus, Dassen and Dyer) for which records of gannets breeding are equivocal (Crawford *et al.* 1983). Although the total number of breeding gannets (c. 80 000 pairs in 1980) is large, the number of colonies is small. Three colonies, Mercury, Ichaboe and Possession Islands, have decreased in population size by 66 %, 88 % and 78 % respectively between 1956 and 1980 (Crawford *et al.* 1983). New colonies have apparently been formed on only three known occasions: at Halifax and Possession Islands, in the mid-nineteenth century, thought to have followed the displacement of the huge Ichaboe Island colony in 1843-45 during guano scraping, and at Bird Island, Lambert's Bay about 1912 (Crawford *et al.* 1983). Cape Gannets do not readily form new colonies and do not normally come ashore at sites away from existing breeding colonies.

Thus, the recent presence of Cape Gannets at Dyer and Robben Islands is of considerable interest. On 28 October 1984, the headman at Dyer Island (34 40S, 19 25E) found c. 400 gannets on the southern tip of the island, and he is certain the birds arrived on either 27 or 28 October. I visited Dyer Island between 15 and 20 November 1984 when the gannets were still present. The birds left on, or shortly before, 16 December 1984 according to the island headman. In November 1982, a single gannet was seen ashore at Dyer Island (D.C. Duffy pers. comm.).

During my visit in November 1984 the gannet flock was comprised only of nonbreeding birds, between 315 - c. 1 000 in number, varying from day to day. A high proportion of the birds were in immature plumage. Of 120 birds observed taking off from the colony, 48 % had one or more black feathers amongst the feathers of the scapulars, back, rump or upper wing coverts. These feathers are white in adult birds. Studies of known - aged birds have shown this plumage is characteristic of two- and three-year old birds (pers. obs., Jarvis 1972). However, some birds of these age classes are indistinguishable from adults (pers. obs., Jarvis 1972). Therefore more than half the birds ashore at Dyer Island were three years old or less. The numbers of two metal-ringed birds and the colour combination of one colour-ringed bird were determined using a telescope. Two birds were ringed as nearly full-grown chicks 42 months previously, and one 30 months previously.

The Cape Gannets at Dyer Island did not attempt breeding. They usually breed for the first time at four years of age, although three-year-olds have been found breeding (pers. obs., Jarvis 1972). Rand (1959) did not specifically state that two-year old birds were found breeding, since his statement could apply to three-year olds alone. Therefore many of the gannets at Dyer Island were too young to breed. The date of their first arrival coincided with the end of the egg-laying period elsewhere

in South Africa (Randall *et al.* 1981, pers. obs.). Presumably unmated and inexperienced birds require more time to establish pair bonds and nest sites than do older birds. Two ritualized displays performed by birds at Dyer Island were Mutual Fencing and Bowing. Bowing is a nest-site oriented display, usually performed by a male as an indication of site ownership (Jarvis 1971, 1972). Mutual Fencing is a greeting display between members of the pair at the nest site (Jarvis 1972). Fighting and attempted copulation were also noted. However, nest building and successful copulation were not observed. The Dyer Island gannets were far less approachable than breeding Cape Gannets at other established colonies.

Two of the ringed birds seen ashore at Dyer Island came from Bird Island (Lambert's Bay) (32 05S, 18 18E), and one from Malgas Island (33 03S, 17 55E). These are the nearest established breeding colonies. The breeding record (1869) from Dyer Island, previously considered equivocal by Crawford *et al.* (1983), should now be accepted on the basis of the recent observations reported here.

A tight flock of about 40 Cape Gannets was seen ashore on Robben Island (33 48S, 18 23E) in about 1968 (R.H. Anderson, Biologist, Plant Protection Institute pers. comm.). Nothing else is known of the fate of this group of birds. There are no previous records of gannets ashore on Robben Island (Kriel *et al.* 1980, Crawford *et al.* 1983).

Any attempts by Cape Gannets to establish breeding colonies at Dyer and Robben Islands will be closely monitored.

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PLUNGING BROWN BOOBIES AT COPACABANA BEACH, RIO DE JANEIRO, BRAZIL

The breeding biology of the Brown Booby *Sula leucogaster* has been well documented (Nelson 1978). However, relatively little information exists on its foraging ecology. Although regarded as an inshore forager (Nelson 1978), the Brown Booby also feeds offshore (Anderson 1954). Simmons (1967 quoted by Nelson 1978) reports that they "specialize in low, oblique plunge dives and torpedo dives at a slight angle to the surface" while Gibson-Hill (1947) mentions diving from heights of 10 - 15 m. Simmons (1967) regards it as a solitary species but Nelson (1978) reviews references which suggest Brown Boobies may forage socially. Finally, although Gibson-Hill (1947) reports submergence times of 25- 40 s, and Howell (in Nelson 1978) documented underwater swimming using wings and feet, Bryant (1861 in Nelson 1978) observed rapidly-repeated dives of short duration.

In this note I summarize observations of foraging by Brown Boobies made at Copacabana Beach, Rio de Janeiro, Brazil, made between 08h00 - 09h30 on 1 and 3 December 1984 and between 15h00 - 16h00 on 2 December 1984. I recorded group-size for foraging boobies, presence of frigatebirds *Fregata* sp., and foraging behaviour. I timed plunges from first contact with the water until emergence, estimated by eye angles of approach ($<30^\circ$; $30 - 60^\circ$; and $60 - 90^\circ$) and the height to the nearest metre from which plunges were initiated, based on number of body thicknesses above the water.

I saw eleven foraging groups (including singletons): eight consisted of single birds, two were of two birds and one was of seven birds and one frigatebird. Most solitary birds fed beyond the breakers, flying back and forth parallel to the beaches. The single large group fed in a convergence line or area of rough water between two apparently different water masses, extending at least a kilometre from Ponta do Leme, a hill at the north end of Copacabana - Leme beach.

Of 37 foraging attempts observed, 35 were 'plunges' and the rest were 'surface seizes' (definitions from Ashmole 1971). Two food-piracy attempts were made by frigatebirds during these foraging attempts. Most of the plunges were made from relatively low heights. Plunges began from an estimated mean height of three metres (SD 1,5 m; range 1 - 8 m). Birds often descended in spirals, as reported by Nelson (1978). Of 22 dives for which the angle of fall could be estimated, 36 % were vertical or near-vertical ($60 - 90^\circ$) and the rest were at approximately 45° . There were no oblique dives ($<30^\circ$) as reported by Simmons (1967). Mean duration of dives was only 2,2 s (SD 1,1 s; range 0,5 - 5,6 s), far shorter than the 25 - 40 s reported by Gibson-Hill (1947). There was no correlation ($r = -0,27$; $n = 35$) between height and duration of plunge.

The waters off Copacabana Beach were turbid, with vertical depth of visibility less than one metre, suggesting that Brown Boobies could not see a great distance into the water which perhaps explains the short durations of plunges. On the other hand, the lengthy plunges recorded by Gibson-Hill (1947) may have occurred in less turbid water where birds could see fish at greater depths or while birds were scavenging dead fish as they

did during the underwater swimming filmed by Howell (in Nelson 1978). Whereas such swimming is very maneuverable, it may not be rapid enough to catch live fish, for which plunging is required. Further observations concerning the conditions under which sulids use diving and plunging during foraging would be useful.

Whereas birds at Copacabana Beach occasionally plunged nearly synchronously, there was no evidence of coordinated foraging as reported in records collected by Nelson (1978). The prevalence of small groups suggested that solitary foraging was the norm. Even in the group of eight, the birds were dispersed at distances between 10 and 100 m along a line.

Given the variety of foraging methods documented for this species and the ease with which data can be collected, replicates of this brief study would provide a better understanding of regional and seasonal variations in inshore foraging behaviour of the Brown Booby.

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SEABIRDS BREEDING ON HALIFAX ISLAND

OFF THE COAST OF SOUTH WEST AFRICA / NAMIBIA, JUNE 1984

Halifax Island (26 39S, 15 04E) is a South African possession situated 100 m off the mainland of South West Africa/Namibia (Rand 1963). Five species of seabirds have been reported breeding on the island: Jackass Penguin *Spheniscus demersus*, Crowned Cormorant *Phalacrocorax coronatus*, Swift Tern *Sterna bergii*, Hartlaub's Gull *Larus hartlaubii*, and Kelp Gull *L. dominicanus*. (Rand 1963, Berry *et al.* 1974, Cooper *et al.* 1977, Crawford *et al.* 1982ab, Shelton *et al.* 1984, nest record cards held by the South West Africa/Namibia Directorate of Nature Conservation). I visited the island on 8 June 1984 when three species, Jackass Penguins, Swift Terns and Hartlaub's Gulls, were found breeding.

The principal species breeding on the island is the Jackass Penguin. In November 1956 Rand (1963) found 6 489 penguins in ten colonies with a further 2 150 on the beaches. In five counts from May 1971 to November 1972 Berry *et al.* (1974) counted between 2 215 and 4 836 penguins on the island in from seven to nine colonies with the lowest counts in May 1972. Shelton *et al.* (1984) give counts for the period 1977 to 1981. In May 1982 1 644 adults were counted mainly in eight colonies (J. Stutterheim & B.R. Riekert unpubl. data). In June 1984 I counted 1 001 penguins in six colonies plus scattered birds attempting to breed under bushes and in abandoned buildings. This indicates a c. 50% reduction in population size since the early 1970's.

The Jackass Penguin surface colony near the houses held at least seven broods of chicks about two to four weeks old. At nests in the other surface colonies most birds appeared to be incubating or to be involved in courtship.

No Crowned Cormorants were reported breeding at Halifax Island prior to 1978. A total of 96 nests was found there in November 1978 and 88 in January 1980 (Crawford *et al.* 1982a). In June 1984 I found eight unoccupied Crowned Cormorant nests on rock ledges in the house area.

Swift Terns have been reported breeding at Halifax Island in May 1976, 120+ pairs, (Cooper *et al.* 1977) and in May 1982, 72 pairs (nest record cards). In June 1984 I found at least 50 highly mobile one- to two-week old chicks on the sloping rocky area behind the buildings. The chicks in this colony were about two to three weeks younger than those at nearby Shark Island, Lüderitz examined the previous day (Williams 1985).

Hartlaub's Gulls have been recorded breeding at Halifax Island in 1976, eight nests (Cooper *et al.* 1977) and in 1982, when 252 nests were found (nest record cards). In June 1984 I saw a single almost fledged Hartlaub's Gull chick being fed in an area adjacent to the Swift Terns.

Kelp Gulls breed in the austral summer (Williams *et al.* 1984) and no nests were found in June 1984. A total of 261 breeding pairs was counted on Halifax Island on 30 November 1978 (Crawford *et al.* 1982).

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BLACKNECKED GREBES *PODICEPS NIGRICOLLIS* IN THE VICINITY OF LÜDERITZ, SOUTH WEST AFRICA / NAMIBIA, JUNE 1984

Blacknecked Grebes *Podiceps nigricollis* are nonbreeding visitors to the Namib coast of southern Africa where they occur in sheltered marine waters and in flooded saltworks close to the coast with peak numbers of 5 000 birds. Where this population breeds is unknown. There are less than 10 breeding records for South West Africa/Namibia (nest record cards held by South West Africa/Namibia Directorate of Nature Conservation). On the basis of the few breeding records and the regionally important wintering population this species is accorded a high conservation priority in South West Africa/Namibia (A.J. Williams unpubl. data).

Berry & Berry (1975) reported that at Sandwich Harbour (23 20S, 14 30E) Blacknecked Grebes left in January to breed on inland waters, following seasonal rains, and returned to the coast in May. Shaughnessy (1983) presents data from 38 surveys of

Blacknecked Grebes in the Lüderitz region (26 37S, 15 07E) of South West Africa/Namibia and comments on seasonal variation in numbers. His interpretation of seasonal variation there was hampered by a paucity of records from the period April to June when, on the Sandwich Harbour model, the grebes should be returning from inland.

On 7-10 June 1984 I surveyed the coastal areas of Lüderitz and of the adjacent Swartberg Peninsula and the municipal sewage works for coastal birds. I found Blacknecked Grebes on the sea off Agate Beach (102), Radford Bay (43) and in Grosse Bucht (86) as well as at the sewage works (14). The combined count of 245 birds presumes that no movement occurred between counted localities.

Maximum numbers of Blacknecked Grebes in the Lüderitz area for each month are: January 900, February 500, March 4, April 75, May more than 1 000, June 245, July 9, August 200, September no data, October 30, November 735, December 100 (data and references in Shaughnessy (1983) and this note). The overall pattern is unclear. Numbers certainly seem to fall in March and April, when the birds could be expected to be away breeding, but are also low in July and October. Various factors are obviously influencing these population estimates. Some surveys are of only limited areas; Shaughnessy's low counts during July and October for example. Numbers can also be expected to vary in relation to rainfall inland, with reduced breeding in "drought" years and a predicted earlier return to coastal waters, and in relation to breeding success in preceding years if, as seems likely, prebreeding birds remain in coastal waters.

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SEABIRDS BREEDING ON SHARK ISLAND, SOUTH WEST AFRICA / NAMIBIA

JUNE, 1984

Shark Island (26 38S, 15 09E) is connected to the town of Lüderitz, South West Africa/Namibia by a causeway (Cooper *et al.* in press). Three species of seabirds regularly breed on the island, Crowned Cormorants *Phalacrocorax coronatus* Swift Terns *Sterna bergii*, and Hartlaub's Gulls *Larus hartlaubii* (Kazmaier 1974, Cooper *et al.* 1977, Shaughnessy & Shaughnessy 1978,

Crawford *et al.* 1982).

I found all three species breeding close together between the outbuildings of the hospital and the harbour on 7 June 1984. In order not to disturb the birds, which included many large mobile chicks, I observed from the northern edge of the breeding area only. Since some of the occupied area was out of sight total counts were not possible. The numbers of chicks in the observable area were Crowned Cormorants 54, Swift Terns c. 125 and Hartlaub's Gulls 36+. The Crowned Cormorants had nested on several small bushes, the Swift Terns on rocks between the fenced hospital area and the sea and the Hartlaub's Gulls mostly within the hospital grounds. Hartlaub's Gulls were also observed breeding in the fenced railway shunting area of Lüderitz Harbour where at least 25 large chicks were present.

The estimated age of the largest chicks (based on personal experience in handling each species) observed at Shark Island in June 1984 was: Crowned Cormorants about 30 days old (downy but with well developed flight feathers); and Swift Terns and Hartlaub's Gulls each about three to four weeks old (some chicks were completely feathered but not yet able to fly). Crowned Cormorants have a 22-day incubation period and chicks can fly when 35 days old (Williams & Cooper 1983). Swift Terns have an incubation period of about 26-28 days and chicks fly at about 45 days (W. Suter *in litt.*). Incubation in Hartlaub's Gulls lasts 25 days (unpubl. data) and, although no precise observations are available, chicks of this species probably fly from the colony when four to five weeks old. Egg-laying by these species at Shark Island in 1984 must therefore have begun in April with Swift Terns laying in the first week and Crowned Cormorants and Hartlaub's Gulls from the middle of the month. Although no eggs were seen, at least two Swift Terns were considered to be incubating in early June as were some Hartlaub's Gulls.

The numbers of these three species breeding at Shark Island, although small, are important in a regional context. Along the Namib coast of southern Africa (between the Cunene and the Orange River mouths) Swift Terns are known to breed only at Shark, Halifax and Possession Islands, all in the vicinity of Lüderitz (Cooper *et al.* 1977 and nest record cards held by the South West Africa/Namibia Directorate of Nature Conservation). Of the three localities, Shark Island has the largest population and is apparently the most consistently used (W. Suter & J. Cooper *in litt.*). The Swift Tern is a species with a primarily Indo-Pacific coastal distribution. The southern African population, the nominate race *bergii* - a well developed subspecies, whose overall population is about 4 600 breeding pairs (Cooper *et al.* 1984) is the only population of this species in the Atlantic Ocean. Cohort-colour ringing of chicks has indicated that most Swift Terns breeding in South Africa appear to migrate to winter quarters in the Indian Ocean (W. Suter & J. Cooper *in litt.*). The population of Swift Terns which regularly winter along the Namib coast may be mostly birds from the Lüderitz populations.

Both the other species breeding at Shark Island are endemic to Benguela Current waters or immediately adjacent areas and have small total world populations: Crowned Cormorants c. 2 700 pairs of which 977 pairs breed along the Namib coast and Hartlaub's Gulls c. 8 000 pairs of which c. 1 300 pairs breed

along the Namib coast with populations in the Lüderitz and Walvis Bay-Swakopmund areas of about equal size (Crawford *et al.* 1982, Cooper *et al.* 1984, A.J. Williams unpubl. data).

All three species are considered to warrant high conservation priority in South West Africa/Namibia (A.J. Williams unpubl. data). Conservation of the populations of these three species at Shark Island is therefore important. The causeway provides access for local mammalian predators. Feral cats *Felis catus* and domestic dogs are known to occur on the island (Cooper *et al.* in press, pers. obs.). Of other species known from within the town of Lüderitz Black and Brown Rats, *Rattus rattus* and *R. norvegicus* respectively, almost certainly occur and, although probably rarely, Blackbacked Jackals *Canis mesomelas* and even Brown Hyaena *Hyaena brunnea* may reach the island (W. Walter pers. comm.). However, there is no evidence to suggest that predation of seabirds at Shark Island by these species is serious. Man is the most serious threat to the seabirds either directly through entering the colonies and causing wholesale disturbance, stoning the birds or snaring them or taking eggs for food (Frau Dick pers. comm.) or through building or other developmental activity. Future conservation of these seabirds, which could if handled correctly provide a seasonal tourist attraction, will depend on further observations through one (or more) entire breeding seasons to establish species requirements and probably some form of policing of the area during the breeding season.

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THE EARLIEST KNOWN PUBLISHED RECORD OF JACKASS PENGUINS

SPHENISCUS DEMERSUS ON SEAL ISLAND, FALSE BAY

Shelton *et al.* (1984) gave the earliest record known to them of Jackass Penguins *Spheniscus demersus* at each breeding locality. Following Shaughnessy (1984) they gave the first record for Seal Island, False Bay, South Africa, as the winter of 1772 when Anders Sparrman visited it. Neither Shelton *et al.* (1984) nor Shaughnessy (1984) took note of Rosenbroijer (1963) who provided a translation from the Swedish book "Captain Carl Gustav Ekeberg's east indian journey in the years of 1770 and 1771" of extracts, with the page numbers of the book, concerning the natural history of the Cape where Ekeberg spent most of June 1770. In respect of Seal Island, False Bay, he comments on p. 44 "an undisturbed habitat for seals, penguins and seagulls.". It is clear from other extracts that Ekeberg's 'seagulls' means almost any kind of flying seabird: both Cape Cormorants *Phalacrocorax capensis* and Cape Gannets *Morus capensis* (nomenclature following Clancey (1980)) are called 'seagulls' on pp. 63 and 64 dealing with the Agulhas Bank.

Since this is probably the first comment on the matters set out in Shelton *et al.* (1984), it is expedient to note an error in that paper. On the last page of Appendix 1 (p. 249) there is a list of footnotes, mostly concerning sources of statements in the Appendix. In the main part of the Appendix these notes are referred to by the superscript lower case Greek letters alpha to lambda, nu to omicron. These were, unfortunately, omitted in the footnotes where they should have appeared in the order of the Greek alphabet.

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NEW BREEDING LOCALITY DATA FOR SOUTHERN AFRICA SEABIRDS

Jackass Penguin

Spheniscus demersus

Twentyeight breeding localities are known for the Jackass Penguin. Four localities are recently discovered small (1-20 breeding pairs) colonies on the mainland of southern Africa (Shelton *et al.* 1984 *S. Afr. J. Mar. Sci.* 2: 217-257; Loutit & Boyer 1985 *Cormorant* 13:27-30). A fifth mainland breeding locality is near The Boulders (34 12S, 18 27E) on the east side of the Cape Peninsula, South Africa, where a single pair, breeding under an overhanging rock close to the sea, hatched a single egg on 3 May 1985. A single egg had been laid at this site on 30 March, giving an incubation period of 34 days. A second pair of penguins was present at a nest site at the same locality in mid-May 1985 but had not laid by the time of writing. A pair of penguins had previously occupied this nest site during October-December 1984 but did not lay (P. Chadwick *in litt.*). No penguins were present at the locality on 17 June 1985 (G.D. La Cock pers. comm.).

Two other recently established Jackass Penguin colonies have continued to expand in size. At Robben Island (33 48S, 18 22E) I counted 86 occupied nests on 4 May 1985, an increase from the previous census of 24 nest sites in May 1984 (Shelton *et al.* 1984). In May 1985 there were 85 pairs of penguins in various stages of breeding under 11 low *Myoporum serratum* and *Acacia cyclops* bushes (1-23 nests per bush) just above highwater mark and one nest was found slightly farther inland under wooden planking, all c. 500 m north of Murray Harbour. Approximately 10 adult (one of which was seen to be flipper banded) and five juvenile penguins were seen on the adjacent shoreline. At Stony Point (34 22S, 18 54E) 10 occupied nest sites were counted on 13 June 1985 (G.D. La Cock pers. comm.), an increase over the previous highest published total of four on 1 June 1984 (Shelton *et al.* 1984).

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