CAPE FUR SEAL *ARCTOCEPHALUS PUSILLUS* PREDATION ON CAPE CORMORANTS *PHALACROCORAX CAPENSIS* AND OTHER BIRDS AT DYER ISLAND, SOUTH AFRICA

M.A. MARKS[1,2], R.K. BROOKE[3] & A.M. GILDENHUYS[4]

[1]*Department of Zoology, University of Cape Town, Rondebosch 7701, South Africa*
[2]*Shark Research Centre, South African Museum, PO Box 61, Cape Town 8000, South Africa*
[3]*Percy FitzPatrick Institute of African Ornithology, University of Cape Town, Rondebosch 7701, South Africa*
[4]*Cape Nature Conservation, Pvt Bag 5014, Stellenbosch 7599, South Africa*

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SUMMARY

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Between summer of 1994 and winter of 1996, a period covering two breeding seasons, at least 2461 newly fledged Cape Cormorants *Phalacrocorax capensis* were taken as prey by Cape Fur Seals *Arctocephalus pusillus* at Dyer Island, Western Cape, South Africa. The estimated minimum level of predation for the first of these seasons is 7.3% of the available cohort. This is the first report of substantial predation on cormorants, and records predatory behaviour patterns also reported in other otariid seal species. Prey-handling techniques are described.

INTRODUCTION

Predation on seabirds by fur seals and sea lions (Otariidae) has been widely reported (Glegg 1945, Hamilton 1946, Spellerberg 1975, Bonner 1981, Bonner & Hunter 1982, Lucas & McLaren 1988, Gjertz 1990, Riedman 1990). The incidents were, however, at low levels of intensity and the predatory behaviour appeared to have been restricted to small subgroups. Penguins (Spheniscidae) and auks (Alcidae) are the families most commonly preyed upon, whereas petrels (Procellariidae), ducks (Anatidae), gulls (Laridae), and other bird families have been occasionally reported as prey. Curiously, seal predation on seabirds was not discussed by Burger (1988), in a major review of marine homoiotherm interactions.

Only a single incident of Cape Fur Seals *Arctocephalus pusillus* attacking and killing Cape Cormorants *Phalacrocorax capensis* has previously been reported (Shaughnessy 1980). This report documents substantial predation on newly fledged juveniles and quantifies methods of attack by the predator.

METHODS

All observations were made from Dyer Island (34º41'S, 19º25'E), Western Cape Province, South Africa (Fig.1), which is a year-round breeding site for a number of southern African endemic seabird species, including the Cape Cormorant. Dyer Island is adjacent to Geyser Rock, which is a breeding colony for the Cape Fur Seal (Fig.1). Seal predation was investigated in two ways. The first was by direct observations from various vantage points, including the island's landing jetty and a six-metre vertical observation platform built to facilitate study of the behavioural ecology of White Sharks *Carcharodon carcharias* (Chondrichthyes: Lamnidae) by MAM. Predation events were recorded by still photography, video Hi-8 tape, sketches and field notes. The second method involved the collection of dead cormorants from the shoreline. Shoreline surveys were conducted around the circumference of the island along the high tide mark on a daily basis, weather permitting. The island area was demarcated into eight zones, and the boundaries marked by flags. Seabird carcasses considered to be the remains of seal predation were collected, and placed in piles where they were later sorted by location. Birds from the first breeding season were also forensically examined for distinctive injury types attributed to Cape Fur Seals. These injuries were categorised after post-mortem examination of specimens that were directly observed being attacked and killed by seals.

Injuries sustained by the birds were assigned to four main categories, based on the nature and position of the wounds. These can be summarised as: 1. 'Degloving', where the pelt of the bird is torn and stripped from the victim, and usually found stretched and inverted over the head or legs; 2. 'Abdominal bite', where the peritoneum is perforated and soft tissue is removed from the abdomen, including excision of viscera and stomach contents; 3. 'Pectoral bite', where pectoral muscle tissue or the complete sternum is removed; and 4. 'Neck bite', which appeared to be a single bite where tissue was removed from the dorsal portion of the neck during manipulation (often as deep as the vertebral column).

RESULTS

A total of 2461 dead Cape Cormorants judged to have been killed by seals was collected on the shoreline of Dyer Island between 10 December 1994 and 18 June 1996. Only the first

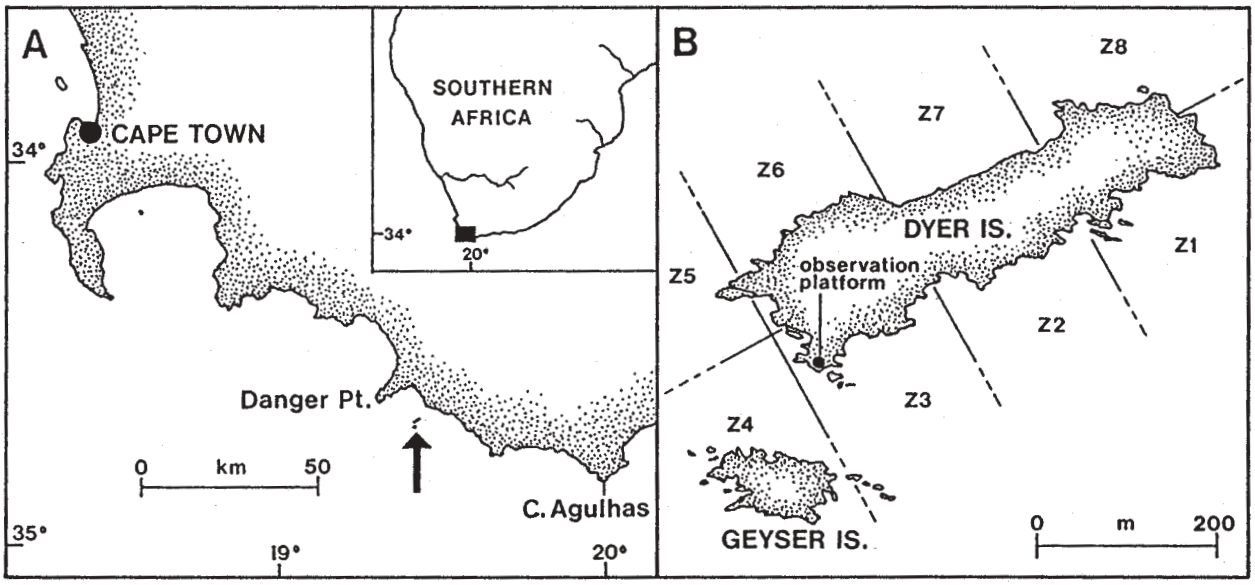

Fig. 1. *Study area: (A) Western Cape Province, South Africa; (B) Dyer Island and Geyser Rock showing shoreline zones.*

breeding season's fledged cormorants, a total of 1065 (including three adults), was analysed for injuries. Degloving was the favoured technique, being used on 919 (86.3%) birds. This method rarely damaged the skeleton, with the exception of disarticulation of cervical vertebrae and fracture of the sternum. Degloving enables the seal to feed selectively on soft tissues of the torso. Other techniques include biting the abdomen (in 102 cases, 9.6%) and seizing the breast and biting out much of the sternum (in 39 cases, 3.7%). The remaining four (0.4%) were killed using other methods. In all cases, part of the bird was consumed by the predator; primarily soft tissues were eaten. No skeletal material was consumed by the seals.

Twelve predation events on Cape Cormorants by Cape Fur Seals were directly observed from initial strike to termination of attack. These attacks occurred from 09h45 to 17h25. From the 12 directly observed predation bouts, only two carcasses were recovered; one bird was degloved and the other killed by an abdominal bite. Seals seized resting cormorants floating at the surface either by surprising them from below or lunging over them from above the surface. The seal then snapped the bird back and forth above the surface in quick, vertically planed, arcs until there was no sign of struggle by the bird (Fig. 2a–i). Vigorous shaking resulted in a loosening of the skin (degloving) from the torso.

In two of the 12 observed cases, an adult seal (*c.* 2-m long) was involved, apparently trying to teach several one- and two-year old juveniles how to catch and deglove seabirds (MAM pers. obs.). The juvenile seals repeatedly surfaced nearby, and actively watched the adult seal manipulate and deglove a fledgling cormorant. On one occasion a juvenile cormorant flew into open water among a forest of kelp *Eklonia maxima*. Three minutes later the bird was seized from below by a seal and shaken forcefully, then tossed through the air in a high arc. As the seal resurfaced it was seen to be accompanied by two juveniles which then mimicked its behaviour, but with inadequate vigour. The adult seal then took the bird and continued degloving it. It appeared that the juveniles soon learnt that greater force was required to achieve degloving. This carried on for almost one hour, with the adult occasionally joining in for short periods. A similar event involving one adult and two juvenile seals was observed the following day, and ended with one of the juvenile seals successfully killing a juvenile cormorant. During this interaction the seal that made the kill was closely followed by the second juvenile. The cormorant carcass was repeatedly tossed into the air and exchanged between the two juveniles in what resembled functional 'play' behaviour over the next 30 minutes. The adult seal remained in the immediate area without actively participating while the juveniles practised grabbing and tossing the carcass back and forth.

During a period of 12 intermittent months of observation, seals off Dyer Island were implicated in the killing of other bird species, including 842 African Penguins *Spheniscus demersus*. Of the penguins, 419 (49.7%) were degloved. Penguin degloving was observed 47 times (MAM unpubl. data). In addition, carcasses of one adult and five juvenile Cape Gannets *Morus capensis*, one adult Black-crowned Night Heron *Nycticorax nycticorax* (a visitor to the island), and two Kelp Gulls *Larus dominicanus* were found with injuries of the types described above.

DISCUSSION

The total southern African non-chick population of Cape Cormorants has been estimated at *c.* 1.3 million, with *c.* 500 000 birds in South Africa (Crawford *et al.* 1991). The seal population at Geyser Rock was estimated to be 35 000–50 000 animals during the observation period (Sea Fisheries Research Institute unpubl. data). Clearly, only a small minority of seals are involved in predation on cormorants. From 1977–1981, the total population of southern African Cape Cormorants was 277 032 breeding pairs (Cooper *et al.* 1982). The population size fluctuates annually, but there is no evidence for an overall decrease (Crawford *et al.* 1994).

It is estimated from repeated island counts of Cape Cormorant nest contents that approximately 15 000 Cape Cormorants fledged from Dyer Island in the summer of 1994/1995. This figure is similar to that obtained during a census of Cape

Cormorant nests undertaken by the Sea Fisheries Research Institute (SFRI) in October 1994, when a total of 14 556 fledged birds was present on Dyer Island. Adjacent Geyser Rock was not visited but its breeding population was only two pairs in October 1993 (R.J.M. Crawford pers. comm.). Based on the 1994 SFRI estimate of fledged birds on Dyer Island, we calculated that the predation rate was at least 7.3%, clearly a significant mortality factor. Furthermore, this figure is a minimum estimate. The most recent population census of African Penguins at Dyer Island, made by the SFRI in July 1996, was calculated to be 9690 individuals (B.M. Dyer per. comm.). Thus, our report of 842 penguins killed represents nearly 8.7% of the total Dyer Island population.

Due to the predominantly rocky topography of the island's shore, certain sections were inaccessible, and a percentage of carcasses were obscured beneath the thick layers of washed-up kelp which remains until broken up by wave action or decomposition. Also, seabirds killed offshore may be carried out to sea by currents and not beached on the island, as observed by MAM on several occasions. Thus the total number of seabirds collected and reported is likely to be less than the number killed.

Shaughnessy (1984) indicated that the decrease of seabirds during the 1950s at Seal Island, False Bay, corresponded to the increase in the Cape Fur Seal population at the Island, and Rand (1951) attributed the same decrease of seabirds to the disruptive effects of seals on seabirds. The SFRI has unpublished data showing such predation, particularly at Ichaboe (26º19'S, 14º57'E) and Possession (27º01'S, 150º12'E) Islands, Namibia (R.J.M. Crawford pers. comm.). RKB has frequently seen degloved carcasses of Cape Cormorants of various ages, during patrols of the southern 15 km of the beach north of Yzerfontein (33º20'S, 19º09'E), Western Cape Province. Degloved carcasses of Bank *P. neglectus* and White-breasted *P. carbo* Cormorants have also been observed on such patrols.

Only two published accounts refer to Cape Fur Seals killing or attacking cormorants in South Africa. Shaughnessy (1978) records evidence of this by a witness to the 1906–1907 Cape Colonial Commission of Enquiry into the Administration of the Guano Islands. Crawford & Robinson (1990) allude to seal predation, but present no details. Outside southern Africa, seal predation on cormorants is seldom reported. However, Pierotti (1988) reported that Harbour Seals *Phoca vitulina* were known to attack cormorants. Murphy (1936) mentioned what he believed to be very casual predation on newly fledged Guanay Cormorants *Phalacrocorax bougainvillii* by South American Sea Lions *Otaria byronia* and predation by Leopard Seals *Hydrurga leptonyx* (Phocidae) on Imperial Cormorants *P. atriceps*. Many species of Otariidae have been reported as preying on seabirds, but amongst the Phocidae, only the Leopard Seal does this on a regular basis. The North Atlantic Walrus *Odobenus rosmarus* (Odobenidae) (Gjertz 1990) has also been shown to take seabirds.

Crawford & Robinson (1990) reported that approximately 2.5% of newly fledged Cape Gannets at Malgas Island (33º03'S, 17º55'E) Western Cape Province, South Africa were killed by seals. It is rare to find degloved carcasses of Cape Gannets. However, during this survey six adult Cape Gannets were found dead with abdominal injuries. The apparent increase in seal predation on birds in southern Africa correlates with the marked increase in seal populations in recent years, estimated at 3.7% per annum (David 1989). Alternatively, increased seal

Fig. 2. *A Cape Fur Seal's attack on a juvenile Cape Cormorant: (a) approach to the prey; (b–d) seizing the prey; (e–h) shaking the prey which will lead to degloving (or freeing the torso from the skin); (i) consumption of soft tissue.*

predation on seabirds may be an indication of a reduction in other normal food resources such as the hakes *Merluccius* spp, hence some individuals may be learning 'specialist tactics' and turning to seabirds as a food source. If the unavailability of normal prey was the motivation behind increased seabird predation, it might be expected that a higher rate of predation would be taking place. Seals might begin migrating to areas of higher food reliability, thus reducing the number of seals at Geyser Island. This does not appear to be the case.

The 'stripping' techniques used by Cape Fur Seals are similar to those reported by Lucas & McLaren (1988) for the Grey Seal *Halichoerus grypus* (Phocidae) at Sable Island (43°57'N, 60°00'W) off Nova Scotia, Canada. Similarly, Weddell Seal *Leptonychotes weddelli* (Phocidae) seabird feeding techniques parallel the handling methods of Leopard Seals upon Chinstrap Penguins *Pygoscelis antarctica* (Todd 1988). Additionally, Todd (1988) describes the predator repeatedly smacking the penguin on the water in an attempt to dismember it. On numerous occasions the penguin was tossed several metres into the air. The flinging of fledgling Cape Cormorant carcasses into the air by Cape Fur Seals has also been observed numerous times during predatory bouts at Dyer Island.

The low mortality of adult cormorants, and the high frequency of dead juveniles surveyed, clearly indicates the vulnerability of juveniles to predatory seals. There are a number of possible reasons for this. The seasonality of predation appears to correspond with the time at which fledglings first enter the sea. A possible causal factor of high mortality among this cohort is the collective inexperience of the birds. Overt reaction to the predator by the juvenile birds seemed to be minimal. In most cases where prey was not killed outright, and the predator was

observed prior to attack, the young cormorants made little effort at evasion. Williams *et al*. (1990) reported similar naive behaviour of fledgling Bank Cormorants, Cape Cormorants and African Penguins towards Killer Whales *Orcinus orca*. Many of the birds which were attacked by the whales had in fact detected the predator's presence and attempted evasive manoeuvres unsuccessfully. However, individual birds which had escaped an unsuccessful attack by the predator appeared quickly to recognise the threat, and began swimming away rapidly or taking flight at the approach of a whale (Williams *et al.* 1990).

Perhaps positive recognition of potential predators is a learned rather than an innate behaviour in the Cape Cormorant. Thus, individuals experiencing a possible predator for the first time may not react appropriately to avoid capture. According to Curio (1976) the motivation underlying the initiation of killing may be a specific hunger, especially given that otariid seals are true generalist predators rather than specialist hunters. However, we speculate that seabirds are not attacked for food only, although degloving and abdominal bites appear to be motivated by hunger since in both cases a large proportion of soft tissue is removed. Pectoral and neck bites do not appear to be feeding related since little if any tissue is removed. These observations raise the question as to whether the predatory behaviour of seals also occurs without hunger as in the case of 'surplus killing' by a number of carnivores. Either way, the current study clearly indicate that Cape Fur Seals can be a significant predator of seabirds in South African waters.

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