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AN AUSTRALIAN PELICAN *Pelecanus conspicillatus* BENEFITS FROM THE BEATING BEHAVIOUR OF A PIED CORMORANT *Phalacrocorax varius*: A POSSIBLE PRECURSOR TO KLEPTOPARASITISM

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Food parasitism on pelican species by many groups of birds, especially *Larus* and *Sterna* spp. is well known and documented. Although the Pelicanidae exhibit many behavioural and ecological traits known to facilitate parasitism, few accounts and studies of this feeding strategy by pelicans are known. The following report describes a series of inshore parasitic bouts by an Australian Pelican *Pelecanus conspicillatus* on a Pied Cormorant *Phalacrocorax varius* in Monkey Mia, Shark Bay, Western Australia. The pelican made no attempt to feed prior to the arrival of the cormorant and remained in association with the cormorant for well over a quarter of an hour. The observed behaviour was clearly one of interception of prey by the pelican and not merely of capitalizing on food which could not escape. Ecological and behavioural factors known to encourage parasitic behaviour, such as 'beating', are discussed in relation to these observations, as is the possibility of this feeding association leading to kleptoparasitism, or food theft. Potential costs and benefits of this association for both species are briefly discussed, as is the possibility that the association was precipitated by the protection afforded by the physical presence of humans and their structures.

INTRODUCTION

Many birds are known to take advantage of the feeding activities of other animals which frighten prey, a behaviour known as 'beating' (Rand 1954). Such feeding associations may lead to kleptoparasitism, or food theft, which is a fairly common foraging strategy occurring in many bird species (see Brockman and Barnard 1979 for review). In addition, parasitic behaviour can arise under a number of different ecological and behavioural conditions (Brockman and Barnard 1979). Although the parasitic and kleptoparasitic associations between Brown Pelicans *Pelecanus occidentalis* and their gull *Larus* spp. and tern *Sterna* spp. parasites has been well studied (Schnell *et al.* 1983; Carrol and Cramer 1985; Tershey *et al.* 1990; Shealer *et al.* 1997), kleptoparasitic behaviour in the Pelicanidae has been documented in only one species, the American White Pelican *Pelecanus erythrorhynchos* (Johnson *et al.* 1996). This species has been observed parasitizing and kleptoparasitizing conspecifics as well as Ospreys *Pandion haliaetus*, Double-crested Cormorants *Phalacrocorax auritus* and Great-blue Herons *Ardea herodias* (O'Malley and Evans 1983; Hart 1989; Anderson 1991; Johnson *et al.* 1996). We discuss the parasitic behaviour exhibited by an Australian Pelican *Pelecanus conspicillatus* on a foraging Pied Cormorant *Phalacrocorax varius*. We also dicuss the ecological and behavioural factors which can lead to this type of association and briefly introduce how this may lead to kleptoparasitism.

METHODS

Study site

Shark Bay (Fig. 1) is a large (13 000 km^2), shallow basin containing the largest seagrass meadows in the world (Walker 1989). In addition, the basin is home to many species protected through a World Heritage Site listing, including breeding colonies of the Australian Pelican and Pied Cormorant (Burbidge and Fuller 2000). However, although listed as a World Heritage Site, there exists a substantial human presence, especially at the dolphin resort in Monkey Mia (Fig. 1), located on the Eastern side of Peron Peninsula (72°00'S, 115°00'W). This is one of the few locations in Australia where the public may witness human-subsidized feeding and close-up encounters of wild Bottlenose Dolphins *Tursiops aduncus*. This activity, in addition to that of recreational fishers and boaters combined with small-scale commercial fishing in the area, draws many birds to the potential sources of food and shelter afforded by humans. In addition to the numerous Silver Gulls *Larus novaellandidiae* present year round, a group of 6–10 Australian Pelicans are usually in close association with the resort. These birds obtain some of their subsistence from distraction feeding by rangers targeting select dolphins for tourist interaction, as well as from handouts by recreational fishermen returning from trips and preparing their catches on shore. The pelicans' nearly continuous presence along the shoreline around human structures at the resort predisposes them to be able take advantage of other species foraging in the same area.

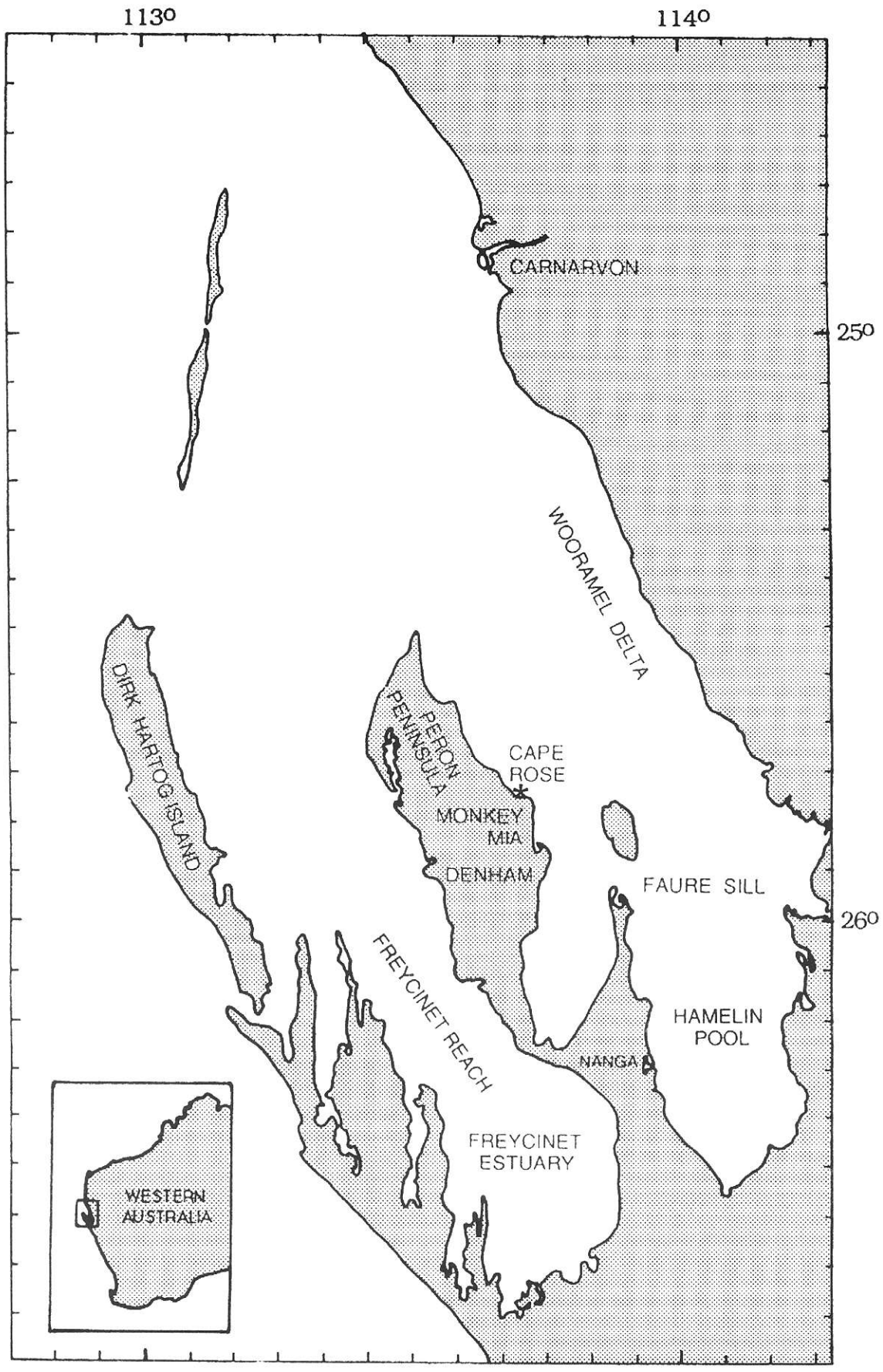

Figure 1. *Location map, showing the position of Shark Bay on the West Australian coastline and the observation site (*) Monkey Mia.*

Real-time field notes from surface observations were used as the basis for the following description which was recorded during another study in Shark Bay.

OBSERVATIONS

At approximately 1400 hrs, on the 25th of June 2000, a single Australian Pelican was observed 10 metres from the shoreline approaching a foraging Pied Cormorant off Monkey Mia Dolphin Resort. The tidal sequence at the time of observation was high-rising with a high-tide of 2.41 metres occurring at 1450 hrs. Soon after the observer's arrival, the pelican was observed following the Pied Cormorant which was engaged in underwater foraging behaviour in 50 centimetres of water, parallel to the shore. The pelican swam parallel to the cormorant in a water depth of 35 centimetres keeping 1–2 metres to the shore-side of it and angled slightly behind it. When the foraging cormorant located and chased a small school of fish towards the shoreline, the pelican quickly accelerated and swam in front of the cormorant, intercepting at least part of the catch. At this point, the cormorant surfaced for air and resumed its underwater foraging as the pelican followed. The cormorant would forage in this manner over a distance of approximately 35 metres at which time it would surface and turn 180° to begin another feeding bout in the opposite direction. As it did, the pelican also turned to stay between the foraging cormorant and the shoreline.

During this period, the pelican was seen to intercept the cormorant's potential catches 17 separate times and was observed swallowing prey during some of these occasions. The cormorant was observed swallowing prey on 10 occasions during the association, although it was difficult to note whether these were single or multiple-fish catches. All prey chased and captured by the cormorant appeared to be small (7–10 cm) bait fish, however, the small size of the prey items coupled with speed of the feeding bouts made it difficult to determine the exact number of prey both birds captured. The cormorant made a total of four foraging bouts in a north to south direction and three bouts in the returning south to north direction. On several occasions, the cormorant swam quickly at the surface of the water with its head and partial body out of the water, ending in a dive, perhaps in an apparent attempt to rid itself of the pelican, while remaining in the immediate foraging area. The pelican would speed up its swimming to remain in close association with the foraging cormorant. The observation period lasted for 18 minutes. The association ended when the cormorant surfaced and flew to a distance greater than 350 metres out into the bay. The pelican continued on its original path along the shoreline in a south to north direction to join a group of pelicans roosting and preening on the shore.

DISCUSSION

Birds can specialize within a range of socially parasitic behaviour (Brockman and Barnard 1979). One example of such specialization is when birds take advantage of the feeding activities of others which frighten prey, a behaviour known as 'beating' (Rand 1954). The pelican stole food chased and herded by the cormorant without the pelican attempting to feed on its own. Emlem and Ambrose (1970) observed this association in Snowy Egrets *Egretta thula* relying on flocks of Red-breasted Mergansers *Mergus serrator* to locate and obtain fish, where the egrets made no attempt to feed prior to the mergansers' arrival. Only when the mergansers approached the shoreline, driving schools of fish in front of them, did the egrets begin feeding.

As noted by Brockman and Barnard (1979) a number of ecological and behavioural factors in this pelican-cormorant association could facilitate parasitic behaviour. Firstly, the presence of large quantities of food, such as schools of fish herded by the cormorant near the shoreline, cannot be monopolized or protected by an individual foraging cormorant and hence the pelican is able to take advantage. Secondly, the habits of the host in this case are very predictable. The cormorant forages in more or less a straight line with side to side movement limited by the shoreline and the pelican. Thirdly, the diving and resurfacing behaviours of foraging cormorants are highly visible, reducing the chances of the pelican chasing a cormorant host which has not located food. This in turn reduces the amount of time and energy invested by the pelican. Finally, it has been noted by several authors that kleptoparasitism by many species increases during periods of food shortage, tides or during the winter months (Palmer 1941; Munro 1949; Snow 1958; Bergman 1960; King 1966; Hays 1970). These observations took place during Australia's winter and further study is needed to determine the influence of this factor together with food shortage on the observed behaviour.

Although kleptoparasitism in the strict sense refers to the stealing by one animal of food which has already been caught by another (Brockman and Barnard 1979; Vickery and Brooke 1994), the association documented above is more than casual opportunism and can be viewed as a precursor to the development of kleptoparasitism. Kleptoparasitic behaviour can develop as one species relies solely on food chased up or frightened by another, ceasing to forage independently while in that association. As stated by Brockman and Barnard (1979), one of the conditions facilitating the evolution of kleptoparasitic behaviour is the fixed location or predictability of the host's foraging habitat. Since Pied Cormorants have been seen to forage within a narrow band along the shoreline around Monkey Mia (Love, unpubl. data), especially in association with human settlements, they follow a predictable feeding pattern which creates ideal conditions for kleptoparasitism. The birds can further take advantage of human-made structures such as moorings and moored boats to corral their prey. In addition, the proximity of the shoreline and the presence of humans and their structures reduces most potential predators and competitors for large, aquatic foragers which can tolerate close human presence. Both pelicans and cormorants in the bay have been observed to utilize the shoreline close to human features to corral prey (Love, unpubl. data) and this may be an important present source of prey for these species. The close matching of the pelican to the cormorant's movements coupled with the cormorant ending the association would seem to indicate that the pelican was indeed benefiting during the association. There were no predatory or human disturbances

noted at the point at which the cormorant left the association. Furthermore, as the pelican joined the already foraging cormorant, it is possible that the association favours the pelican to an extent where it seeks out a shore-foraging cormorant. The pelican exerts no energy in searching for prey and can easily assess cormorants in good feeding areas due to their conspicuous foraging behaviours. Under certain circumstances, even when a pelican is present, it may pay for the cormorant to remain foraging. It is entirely possible that in this case the cormorant may have been benefiting from fish scared back to it by the parasitizing pelican. If conditions exist where increased competition both within and between these two species during a feeding association such as 'beating' occurs, kleptoparasitism may develop as resources and foragers become increasingly clumped (Brockman and Barnard 1979).

Further detailed observations are necessary to determine if this is a recurring behaviour and under which conditions either of the birds decides to join or to leave the foraging association. In addition, there is the need to quantify the degree of foraging success or failure for each of the participants in order to properly understand the balance of costs and benefits involved for each member. Since Pied Cormorants and Australian Pelicans are locally common in Monkey Mia, combined with their common practice of foraging close to shore in this area, the study of this association in Shark Bay is possible. In addition, a comparative study of the degree and success of parasitism and possible kleptoparasitism between sites close to human presence and those in more traditional habitats should be undertaken. This will determine whether this behaviour is in fact a natural tactic of the pelicans or has arisen due to the close presence of human counterparts.

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