BEHAVIOUR AND AFFINITIES OF THE MAGELLANIC CORMORANT

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ABSTRACT

The pair-bonding, recognition, defence, and courtship behaviour of the Magellanic Cormorant *(Phalacrocorax magellanicus)* is described. Its displays indicate that its closest relatives are the Pelagic and Red-faced Cormorants of the North Pacific, and that its similarities to the Guanay *(P. bougainvillii)* are only superficial. The affinities of the Magellanic Cormorant appear to lie with the cliff shags as a member of the *Stictocarbo* complex, rather than with the blue-eyed shag *(Leucocarbo)* complex.

INTRODUCTION

The Rock Shag or Magellanic Cormorant *(Phalacrocorax magellanicus)* is an important member of the Fuego-Patagonian avifauna. Its breeding colonies are throughout the region encompassing the Falkland Islands (Islas Malvinas), the Argentine Patagonian coastline, and Tierra del Fuego. A few colonies have been found on the Pacific coast as far north as Isla Chiloe, Chile, but this species seems to prefer the colder Atlantic waters (Murphy 1936, Johnson 1965).

The Magellanic Cormorant has broad preferences in nest sites, building nests on a range of slopes from steep cliffs to small tops of isolated rocks (Reynolds 1932, Murphy 1936, Johnson 1965, Jehl *et al.* 1973). Colonies are limited in size by available habitat, and some are small isolated groups of nests (Reynolds 1935, de la Peña 1980). The scanty data available indicate that there is moderate post-breeding dispersal in winter. Adults and juveniles are found as far north as Peninsula Valdez on the Atlantic coast (Boswall & Prytherch 1972, Jehl *et al.* 1973). What happens after breeding to the Falkland Island birds is not known.

Except for some cursory notes on morphology, distribution, and natural history (see Humphrey *et al.* 1970 for a review), little has been published about the Magellanic Cormorant. As part of a larger study on the biogeography and systematics of the Magellanic Cormorant, I observed the courtship behaviour during the mid and late breeding season, and in this paper I compare it with that of other members of the Phalacrocoracidae in order to reach a better understanding of its systematic position within the family.

METHODS

From 23 to 27 January 1985, I observed the courtship behaviour of the Magellanic Cormorant in a colony of about 80 breeding pairs on Isla Escobar

near Puerto Melo, and a colony of about 120 breeding pairs on Isla Blanca near Camarones, both in Chubut Province, Argentina. During February 1985, I made much fuller observations in a colony of about 130 breeding pairs on Isla Elena, near Puerto Deseado, Santa Cruz Province, Argentina. Observation periods ranged from 1 h to 5 h; the total amount of time spent observing behaviour in the colonies was about 4500 bird-hours.

Observations were made with 7 x 50 binoculars and a 45 x telescope, and I recorded behavioural acts in shorthand and on 35 mm slide film. I sexed birds by body size and behaviour and by the position of individuals during copulation. Behavioural terminology follows van Tets (1965), except where noted.

BEHAVIOUR

Locomotion: On level ground, the Magellanic Cormorant walks with a high-stepping waddle, moving in this way for up to 20 m. On moderate slopes (up to 30°), adults only walk upslope, with their wings outstretched and their neck and body upright. To negotiate small rocks and fissures, they hop with the feet together.

Juveniles try walking down slopes, usually before they are capable of flight, but they often fall forwards on to the ground. On steeper slopes (up to 60°), juveniles fly-walk, using their bill for purchase. They often fall downslope and may even roll into the water. Adults usually fly to move 3 m or more on steep slopes.

The cormorants use both feet together in taking off and in swimming underwater, but in nearshore paddling on the surface they use their feet alternately. Cawkell & Hamilton (1961) described the motion of Magellanic Cormorants underwater as sinuous, possibly because of using alternate strokes, but van Tets (1965) stated that cormorants use simultaneous paddle strokes underwater.

Nest building: Nests are composed of filamentous and lamellar algae (e.g. *Desmarestia, Gigartina*) taken from tidal drifts on beaches and woven into a tight nest cup, cemented on the outside by guano (see also Reynolds 1932, Murphy 1936, Johnson 1965, Jehl *et al.* 1973). Nest material is collected only by the male during courtship and mating, but females often bring in small amounts until egg-laying. Before the male begins advertising, he places a small amount of algae on a suitable ledge and stands on it. Often he uses many sites before selecting a permanent one. Once a mate has been selected and courtship has begun, he will land at the nest with about 100 g of material, presenting it to the female during the post-landing display. She grasps the algae and, both holding it, they place the algae on the nest rim, often repeating the movement. Only rarely does the male place the algae on the nest rim directly and fly off for more material. Repeated mutual Nest-indicating (van Tets 1965) is more common.

Regurgitation: Before leaving the nest site to feed, Magellanic Cormorants often regurgitated a pellet of food remains and pebbles with rhythmic neck movements accompanied by a rising *gock-gock-gock* . . . sound, followed by the rattle of pebbles and pellet down the cliff face. I heard these sounds continually in the colonies at mid-morning and mid-afternoon, when most

nest incubation shifts seemed to occur. The Bounty Island Shag *(Leucocarbo ranfurlyi)* is the only other cormorant known to utter sounds when regurgitating pellets (see Robertson & van Tets 1982), but the calls are difficult to identify and they may have escaped the notice of investigators of other species.

Take-off: Van Tets (1965) separated this behaviour into three components: Look, Crouch, and Leap. The Magellanic Cormorant usually does all three movements. In emergency flight or to terminate courtship, one bird simply leaps into the air away from the nest. Otherwise, adults Look by bringing the neck and head down to the horizontal with the body held upright and the neck pointed away from the cliff. The plumage and wings usually are sleeked to the body, but in about 25% of the observations, the neck feathers were erected and the wings held slightly away from the body. The gular pouch is always depressed by the hyoid (Kink-throating of van Tets 1965). The bird then Crouches by lowering its breast abruptly to the ground, and Leaps upwards away from the nest. Once in the air, it utters a rising then quickly falling cry.

On three occasions, when changing incubation shifts, males performed an additional display before Take-off. In this posture, the neck is almost vertical while the head is pointed slightly downwards. The breast and adomen pulsate without any sound being uttered. This display seems similar to the Pre-take-off posture described for the Bounty Island Shag (Robertson & Van Tets 1982).

Landing: Magellanic Cormorants, when approaching an occupied site, fly up towards the cliff from below the nest and utter a rising call three or four times. At about 3 m from the nest, the landing adult begins "back-flapping" to reduce speed and brings the feet up above its neck with the soles faced towards the landing site (see Fig. 1a). When landing at an unoccupied site alone, it makes only perfunctory calls and does not bring its feet above the neck. As the soles and webs of the feet are pink, contrasting with the black toes and legs, and as no other species of cormorants is reported to display the feet in such a manner, I believe that this movement in the Magellanic Cormorant has signal value to birds on the ground.

Once landed, the new arrival stretches out its neck and head horizontally, erects its neck feathers, and depresses the gular by the hyoid. It holds this position for about 3 s and rarely (10% of observations) utters a low croak. Afterwards, the bird slowly straightens up, usually (85% of observations) looking away from the landing site (see Fig. 1b). This movement is used both as a recovery after landing and as an appeasement display (van Tets 1965). This display closely resembles the Landing-gape described for the European Shag *P. aristotelis* (Snow 1963), and Post-landing described for the Pelagic, Red-footed, and Red-faced Cormorants, *P. pelagicus, P. gaimardi,* and *P. urile* (van Tets 1965, Siegel-Causey 1986b).

Hop: This display is thought to be a symbolic flight (van Tets 1965), usually done in place but often including short flights back and forth from the nest. In the Magellanic Cormorant, the display begins with the body upright, neck arched and bill brought down towards the ground pointed at the feet. The gular pouch is depressed by the hyoid, and then the bird pushes its body

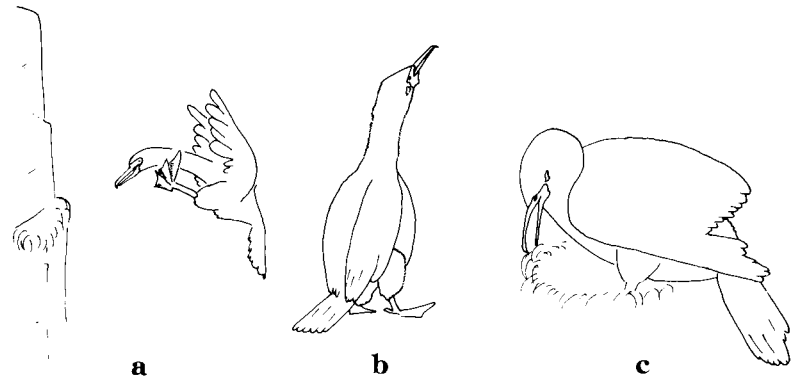

FIGURE 1 — Appeasement displays of the Magellanic Cormorant. (a) Landing display given approaching a nesting cliff; (b) Post-landing, or Hopping; (c) Nest-worrying after a threat display. Figure (a) redrawn from field notes, (b) and (c) from photographs.

vertically off the ground. It brings its feet up in front of its body, as in the Landing display, keeping its head pointed down, and its tail normally leaves the ground. Often (35% of observations) only one foot leaves the ground, and there appeared to be a fair amount of variation in head and tail position, possibly related to steepness of the terrain.

After Hopping, the bird does a Post-landing display, but this display is shorter than when used after landing. Both sexes use this display as part of the general recognition behaviour, but only the female uses it during the courtship sequences. I could detect no difference between sexes in this display, which seems like that of the Pelagic and Red-faced Cormorants (van Tets 1965).

Stepping: This deliberate, high-stepping walk is used when the Magellanic Cormorant moves near other nests, generally as a submissive appeasement against attack. The bird points its head straight ahead, holding its neck at about 45°; it erects its head and neck plumage and the gular pouch is depressed by the hyoid. Both adults and juveniles used this walk when leaving the nest, and although neighbours threatened when closely approached, attacks were very rare.

Threat displays: Magellanic Cormorants used similar displays in repelling unwanted juveniles, intruding adults, and potential nest predators. Beginning each sequence, and presumably the lowest-intensity threat, was the Stare. The bird holds its head and neck in line, pointed motionless at the intruder. In a similar posture (the Upright Aware display of Snow 1963), it holds its body and neck erect and moves its head up and down; this is the display people commonly encounter when walking through a colony. The Stare is combined usually with Snaking (Siegel-Causey 1978), where the bird points its bill at the intruder, slightly shaking its head sideways. With increased aggression, the nest defender raises its tail, erects its neck feathers, and Thrusts out towards the intruder; Snaking continues but is periodically interrupted by Nest-worrying (see Fig. 1c).

In the rarest form of threat display, presumably highest in intensity, the defender gapes widely, Thrusting strongly out and downwards, and uttering a hoarse croak. These displays differ little from those described for the Pelagic, Red-footed, and Red-faced Cormorants (Siegel-Causey 1986b and pers. obs.).

Male advertising: The male Magellanic Cormorant uses two displays during courtship, Darting and Wing-waving, that I did not see females use. The male Darts, holding his body nearly horizontally, erects his back coverts, slightly spreads his wings and holds his neck and head semi-erect. From this position he draws his head back along the midline and then Darts it forward and down in a quick deliberate movement; he opens his bill slightly at the most forward position (see Fig. 2a, b). Throughout the movement, he cocks his tail upwards and depresses the gular with the hyoid. Rarely, he utters a faint click.

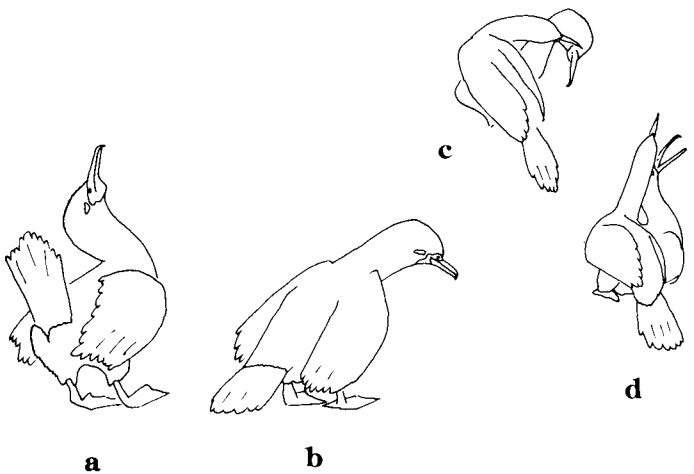

FIGURE 2 — Courtship displays of the Magellanic Cormorant. (a) Beginning and (b) ending phase of Darting by the male; (c) Beginning and (d) ending phases of Throat-clicking by a pair. All figures are redrawn from photographs.

The male Wing-waves usually as the female approaches. He holds his body horizontally with his breast close to the ground and lays his neck along his back with the neck plumage erected and the closed bill pointed up near the tail (see Fig. 3). With the gular still depressed, the tips of the slightly opened wings are lifted irregularly 2-4 times a second in pulses of 1 s each. The males were silent during Wing-waving.

These advertising displays of the Magellanic Cormorant closely match those observed for the Pelagic and Red-faced Cormorants (van Tets 1965, Siegel-Causey, pers. obs.) and agree in outline with those of the Red-footed Cormorant and the spotted shags *P. punctatus* and *P. featherstoni* (van Tets 1974, Siegel-Causey 1986b).

Recognition: Magellanic Cormorants use many displays in pair-bonding, nest-relief, and greeting, but few were used only for those purposes. Throat-clicking (Snow 1963) was a mutual display initiated by either sex. The initiating bird taps or touches the other's bill near the tip and then waves its open bill horizontally at the other's face (see Fig. 2c, d). This display commonly is repeated, and it often grades into Head-wagging.

In this display, both birds face the same direction with their bodies held roughly level with the ground and their necks erect. The initiating bird places its neck over that of its mate, and then both move their heads laterally away from the initiator. This display is usually repeated only once; instead, another display such as Nest-worrying, Throat-clicking, Allopreening, and sometimes Hopping, is done by one of the pair.

Nest-relief: As the incoming mate approaches the nest, the sitting bird holds its neck vertically and its head nearly horizontally with the bill opened. Snow (1963) described a similar display of the European Shag *(P. aristotelis)* as the Sitting-Gape. Unlike the European Shag, the Magellanic Cormorant does not move its head laterally during the display. Once on or near the nest, the bird taking over initiates Throat-clicking, then Hops and makes a sharp falling cry. The sitting bird usually Nest-worries after this call. The sequence beginning with the Sitting-gape often is repeated 2-3 times before the "out" bird switches places with its mate on the nest. On a few occasions, when the sitting bird had been on the nest for 3-6 hours, it terminated these repetitious preliminaries abruptly by leaving the nest and flying off.

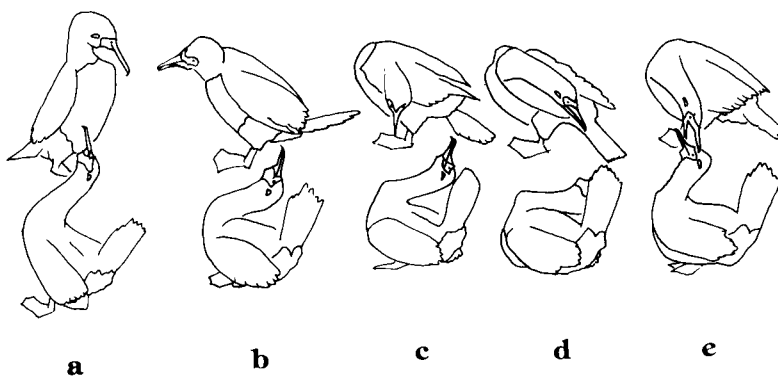

FIGURE 3 — *Pairing displays of the Magellanic Cormorant.* (a) Initial phase of Wing-waving by the male on the nest after approach by the female, (b) Beginning phase of Hop by female; male is Wing-waving. (c) Conclusion of Hop by female followed by Nest-indicating. (d) Full neck extension by male during Wing-waving; female Gaping. (e) Bill-biting by female and possibly Bowing by male. All figures are redrawn from photographs; the male is on the nest sited on a ledge below the female. This sequence terminated in copulation.

Courtship: The courtship sequence begins with the male selecting a site, then Darting and Wing-waving. Eventually, a female approaches, lands near the male, and provokes him into making a series of short calls synchronised with each Wing-wave. The female approaches more closely, Gapes, and then

gently nibbles the base of the bill and gular pouch, possibly to induce more Wing-waving (see Fig. 3). After this, at the conclusion of 3-5 Wing-waves, the female Hops. She holds the post-landing display longer than usual with her neck outstretched out over the male. He approaches, arches his neck (the Bowing display of van Tets 1965), and makes a sharp call sounding like *"Ow!"* This cycle can be repeated many times before the male either drives the female away with thrusts or sidles alongside her flank, Head-wags and then mounts. Nest-worrying is interspersed throughout this sequence by the male; in fact, the lack of this display usually (81% of observations) preceded the male driving away the female. This supports Tinbergen's (1953) and Berry's (1976) conclusion that Nest-indicating and Nest-worrying are redirected agonistic behaviours. Bernstein & Maxson (1982) thought otherwise because both partners do this in concert after nest defence, possibly indicating that it was an ownership display. However, van Tets (1965) suggested that many displays evolved from threat to greeting, and thus the use of the same display late in the breeding season as an adjunct to both threat and pair recognition displays may demonstrate the mixed function of the display.

DISCUSSION

For most authorities, the Magellanic Cormorant is clearly a member of the blue-eyed shag complex (see Murphy 1936, Voisin 1973). The external appearance of adult Magellanic Cormorants is superficially similar to the Guanay *(P. bougainvillii)*, which also is considered a member of the complex, and juveniles appear similar to those of the Kerguelen Shag *P. verrucosus* (Voisin 1970). Researchers have regarded the Magellanic Cormorant variously as a primitive member of the complex (Voisin 1970), as an intermediate form between the Guanay and the Campbell Island Shag *P. campbelli* (Oustalet 1891), or as related to Imperial Blue-eyed Shag *P. atriceps* (Dorst & Mougin *in* Peters 1979).

Such confusion may be a result of inferring phylogeny from similarities in external characters. For example, Falla (1937) and Voisin (1973) summarised the features that distinguish the blue-eyed shags from other cormorants: a fleshy ring of blue (or green) skin around the eye, the presence of dorsal or alar patches of white during breeding and post-breeding periods, flesh-coloured feet, and a metallic sheen to the underparts. They also agreed that the Magellanic Cormorant does not show evidence of the first two features and that many species, including the Magellanic Cormorant, share the other two. Thus, the external similarities between the Magellanic Cormorant and Guanay are left as the rationale for inclusion in the complex. However, such similarities in overall appearance can arise as a result of convergence, sexual selection, or other means. Other modes of investigation may offer more illuminating conclusions.

In most aspects of communication behaviour, the Magellanic Cormorant's affinities lie not with the blue-eyed shags, but with the cliff shags. Unlike the King and Imperial Blue-eyed Shags *(P. albiventer* and *P. atriceps)*, male Magellanic Cormorants do not use Gaping during Wing-waving and have no counterpart to the cyclic Pointing/Darting display of the *Leucocarbo* complex (Siegel-Causey 1986a). Furthermore, the form of

the Wing-waving display used by the Magellanic Cormorant is quite like that of the Red-faced Cormorant (van Tets 1965) and unlike the abbreviated form, Gargling, used by blue-eyed shags (van Tets 1974).

The sequence and form of displays used by the Magellanic Cormorant in courtship and pairing support van Tets' (1974) contention that the Red-footed, Pelagic, and Red-faced Cormorants, and the European and Spotted Shags are all members of the *Stictocarbo* complex.

Qualitative comparison of osteological characters of the Magellanic Cormorant with those of the rest of the family unambiguously places it as a member of the *Stictocarbo* complex (Siegel-Causey, pers, obs.). Lucas (1890) thought that its skeleton was most closely similar to that of the Red-faced Cormorant, and Peters (1931) followed this by placing the Magellanic Cormorant between the Red-faced Cormorant and the Guanay. More work on the morphology, ecology, and osteology is required to give a more precise phylogenetic relationship of the Magellanic Cormorant with the rest of the family. I conclude that the Magellanic Cormorant does not belong in the blue-eyed shag complex but instead is a member of the *Stictocarbo* group, the cliff shags.

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SHORT NOTES

Asiatic Black-tailed Godwit harried by Bar-tailed Godwits

On 7, 11 and 21 June 1986 we observed an Asiatic Black-tailed Godwit *(L. limosa melanuroides)* at the ARA Ponds, Mangere. The bird was in partial breeding plumage with rufous neck, throat and breast and dark barring on the lower breast and sides.

On all three occasions it was persistently harried by members of a flock of 300 Bar-tailed Godwits *(Limosa lapponica)* whenever it tried to roost among them or near them. On two of our three visits it was eventually forced to fly from the roost, chased a considerable distance by three or four Bar-tailed Godwits, and did not return.

Falla *et al.* (1979, *The New Guide to the Birds of New Zealand*, Auckland: Collins) state that this species "may be looked for wherever Bar-tailed Godwits occur" and Heather & Brathwaite (1985, in *Complete Book of New Zealand Birds*, Sydney: Reader's Digest) state that "the species may associate with the bar-tailed godwit". Although the two species may associate there may clearly be considerable antagonism towards solitary Black-tailed Godwits, behaviour that does not seem to have been recorded.

We also noted that the bird had a narrow but distinct white tip to its tail, a feature recorded by Heather & Brathwaite (1985, page 192) for both the Hudsonian Godwit *(L. haemastica)* and *L. l. melanuroides* but by Falla *et al.* for Hudsonian only. Various foreign guides we consulted confirmed that both races of *L. limosa* also have a narrow white tail-tip.

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