

Order PELECANIFORMES

Medium-sized to very large aquatic birds of marine and inland waters. Worldwide distribution. Six families all breeding in our region. Feed mainly on aquatic animals including fish, arthropods and molluscs. Take-off from water aided by hopping or kicking with both feet together, in synchrony with wing-beat. Totipalmate (four toes connected by three webs). Hind toe rather long and turned inwards. Claws of feet curved and strong to aid in clambering up cliffs and trees. Body-down evenly distributed on both pteryxae and apteria. Contour-feathers without after shaft, except slightly developed in Fregatidae. Pair of oil glands rather large and external opening tufted. Upper mandible has complex rhamphotheca of three or four plates. Pair of salt-glands or nasal glands recessed into underside of frontal bone (not upper side as in other saltwater birds) (Schmidt-Nielson 1959; Siegel-Causey 1990). Salt-glands drain via ducts under rhamphotheca at tip of upper mandible. Moist throat-lining used for evaporative cooling aided by rapid gular-flutter of hyoid bones. Tongue rudimentary, but somewhat larger in Phaethontidae. Throat, oesophagus and stomach united in a distensible gullet. Undigested food remains are regurgitated. Only fluids pass pyloric sphincter.

Sexually dimorphic plumage only in Anhingidae and Fregatidae. Selection of nest-site and initiation of pair-formation by male, but in Pelecanidae female first leads several males in a male-selection (or persistence) chase as in ducks. Nest built by female with material brought to nest-site mainly by male. Copulation normally on nest-site. Both sexes take turns guarding nest-site, incubating eggs, and brooding and feeding chicks. Eggs unicoloured with chalky finish except for Phaethontidae. Webbed feet used to warm eggs. Chicks hatch naked (except in Phaethontidae) and blind. Later fully covered with down for several weeks. Newly hatched chicks take fluid food from tip of parental bill. Older chicks take partly digested food from parental gullet, except in Phaethontidae, in which parent inserts bill into gullet of chick. Chicks become independent usually within a few weeks after fledging and at fledging in gannets *Sula* spp. At nesting colonies severe loss of eggs and chicks may result from human disturbance, parents being forced off nests, so that eggs and chicks become cold or overheat or are taken by predators.

Anatomical and behavioural similarities suggest close phylogenetic affinities between Pelecaniformes and Ciconiiformes, which could perhaps be united. Cottam (1957) found skeletal characters that suggest that the Shoe-billed Stork *Balaeniceps rex*, only member of the African family Balaenicipitidae, ought to be in Pelecaniformes rather than Ciconiiformes. Linnaeus (1758) included all pelecaniform birds known to him, except those in *Phaethon*, in the genus *Pelecanus*, from which Brisson (1760) removed the genera *Sula*, *Anhinga*, *Phalacrocorax* and *Fregata*. Subsequently these genera became the bases of six families in the order Pelecaniformes, formerly known as the Steganopodes. Over the last 200 years there has been debate about whether *Phaethon* and even *Fregata* ought to be included, and whether *Anhinga* ought to be in the same family as *Phalacrocorax*. There is ample behavioural (van Tets 1965), osteological and palaeontological (Olson 1985) evidence to demonstrate that there are six distinct extant families in the Pelecaniformes.

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Family PHALACROCORACIDAE cormorants and shags

Medium-sized to large aquatic birds of marine and freshwater habitats. Worldwide, 30–40 species, depending on recognition of forms as full species or subspecies. Many isolated insular forms are sensibly regarded as full species. Here we recognize 19 species occurring in our region; after Peters, placed in a single genus *Phalacrocorax*. However, latest arrangements (Siegel-Causey 1988; G.F. van Tets) are more elaborate and divide the family into two sub-families: Phalacrocoracinae (cormorants) with two genera (*Phalacrocorax* or macrocormorants and *Microcarbo* or microcormorants) and Leucocarbininae (shags) with three genera (*Stictocarbo* or cliff-shags, *Nannopterum* or island-shags and *Leucocarbo* or trek-shags). The genus *Phalacrocorax* has two sub-genera: *Phalacrocorax* (s.s.) of two species, *carbo* occurring in our region, and *Hypoleucos* of five species, *varius* and *sulcirostris* occurring in our region. *Stictocarbo* has seven species, *punctatus* and *featherstoni* forming a superspecies in our region. *Nannopterum* has 15 or more species, 12 of which belong to our region; their distribution and association in superspecies is most easily shown on Fig. 1. *Leucocarbo* has six species but only *fuscescens* occurs in our region. Long broad head with patterns of tuft-like crests, which are the origin of the term 'shag'; rather long serpentine neck; broad elongate body; wings broad at base, less broad in outer part, with 11 primaries (p8 and 9 longest) and 17–23 secondaries, diastataxic; stiff wedge-shaped tail, short in shags and long in cormorants, 12–14 feathers. Bill, sub-conical, strong, medium-long, hooked, laterally compressed, without serration; nostrils closed. Gular skin, bare, varying in extent and colour in different species. Tarsus, thick; long toes with outermost longest, totalpalmate; middle toe, pectinate. Tibia, feathered. Oil-gland, feathered. Plumage, black, often with metallic sheen, or black above and white below. Sexes similar with some seasonal changes, mostly affecting crests and facial colours. Juveniles recognizable by colour-patterns of plumage; attain adult plumage when 1–4 years old.

Stance upright; gait waddling, legs being set far back towards tail; cormorants, but not shags, able to perch in trees, on wire and similar thin perches. Swim well, body low in water and even partly submerged, tail flat on water; on surface use feet alternately but under water use both feet together in unison. Plumage is permeable under water and sheds air so that buoyancy is reduced; out of water, plumage repels the water, traps air and increases thermal insulation. Thus, swimming in cold water limited to less than 30 min, otherwise hypothermia sets in. Some species reduce buoyancy further by swallowing pebbles (van Tets 1968, 1976). Indigestible matter regurgitated as pellet about once a day with repetitive *gock-gock-gock...* sound that attracts gulls *Larus* spp for scavenging. In some species, distinctive posture held with wings spread on either side of body during loafing when out of water; thought to be mainly for drying wings but plumage is thoroughly waterproof and oil gland often used when preening. Some hours each day may be spent flying between colonies or roosts and feeding areas. Flight powerful with alternating periods of wing-beats and gliding as in gannets; adopt V-formation in travelling flight. Where colonies far from feeding areas, females leave to feed in mornings, males in afternoon. Much of day spent loafing and so plenty of time for courtship rituals, which take up a major part of activities all year in some species. Feed mostly on fish, caught by surface-diving or pursuit-swimming; sometimes co-operatively and often in dense flocks. Migratory and dispersive; movements probably usually by day. However, island shags seem to be entirely sedentary.

Pair-bond monogamous, maintained mostly or entirely at nest-site. Male selects site and advertises for mate; once accepted, female builds nest with material brought by male. Copulation takes place on nest. Advertising displays by male specially well developed. Movements by both sexes associated with ritualized take-off, landing and locomotion postures and include Pre- and Post-take-off postures, Kink-throating, Circle-flying, Hopping with Pre- and Post-hop postures, and Penguin-walking, which is particularly noticeable in females in search of mate and in males seeking nesting material. Allopreening and entwining of necks occur, probably to maintain pair-bond. Calls are mostly unspecialized; males generally give a variety of croaks, grunts, and groans, whereas females hiss or are relatively silent; calling usually confined to breeding colonies. Bathing in groups may be spectacular and has been misidentified as display (van Tets 1965). Comfort-behaviour consists of gular fluttering to dissipate heat; direct head-scratching; true yawning and jaw-stretching.

Typically breed colonially. Defend small nest-territory. Nests often densely packed and associated with other species such as herons, ibises and spoonbills. Season extended but least so in temperate latitudes. Nests on ground, on cliffs and in trees; used from year to year; built of any available plant material, seaweed and debris to form substantial heap but sometimes nothing more than a scrape in the ground. Tend to continue building during incubation and nestling periods. Eggs, elongate oval, pale blue or green with white chalky coating. Clutch-size, usually 2–4 (1–7 extremes); single-brooded but replacements laid after loss. Incubation by both sexes in approximately equal shares; change-overs at least once or twice a day. Incubation starts with first egg; eggs incubated on feet. Incubation period, 27–31 days. Eggshells removed from nest. Hatching asynchronous. Young

altricial, nidicolous; hatched naked but develop a single coat of dense white, brown or black down. Cared for by both parents; brooded continuously while small; fed by incomplete regurgitation; in cormorants, but not in shags, adults may bring water to young in hot weather. Nestling period, c. 70 days at most but usually 48–53 days. Young attended and fed by both parents for 2–3 months or more after fledging.

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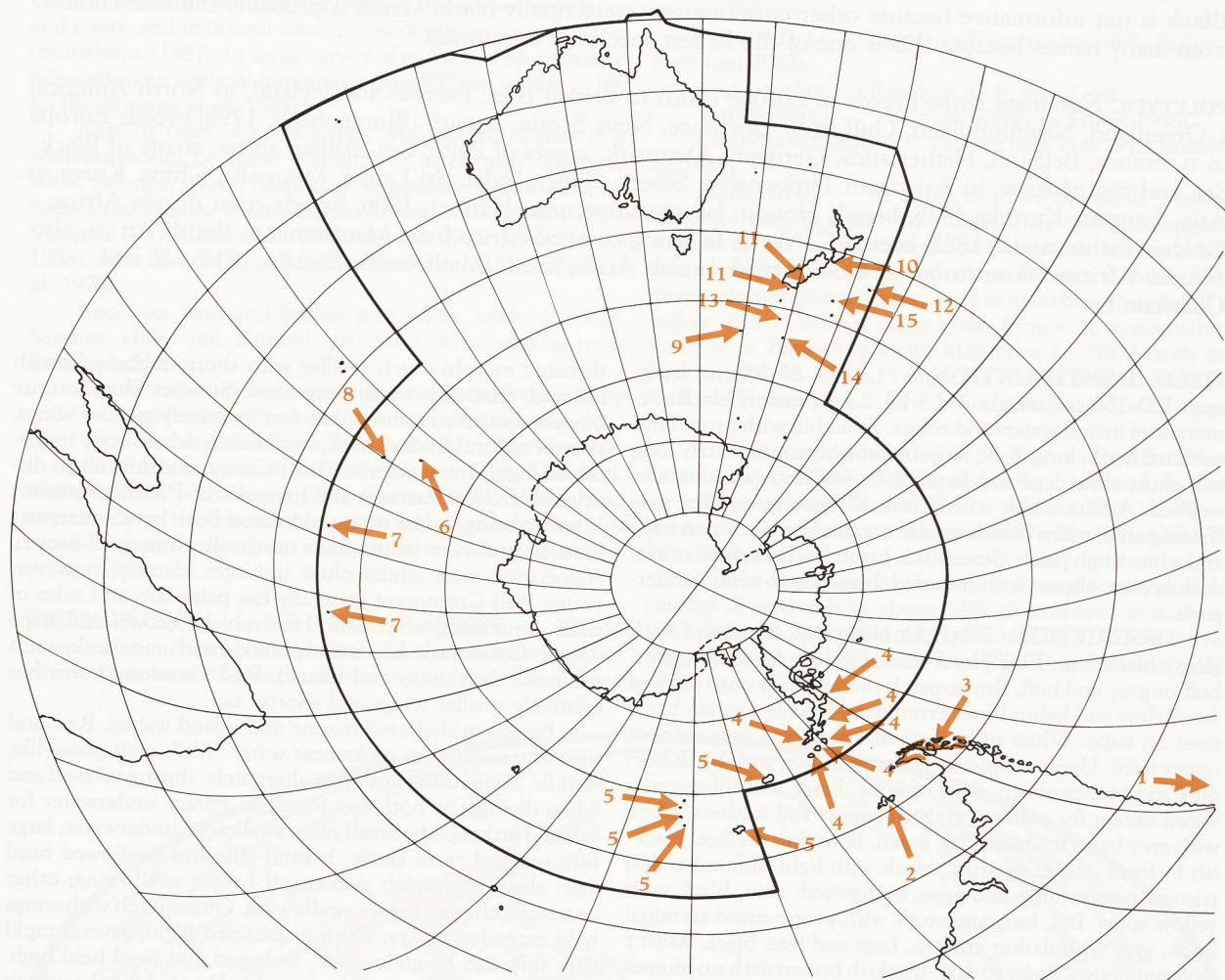


Fig. 1. Distribution of island forms of *Phalacrocorax*.

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|----|-------------------------------|----|------------------|
| 1 | <i>harrisi</i> (Galapagos Is) | 12 | <i>onslowi</i> |
| 2 | <i>albiventer</i> | 13 | <i>colensoi</i> |
| 3 | <i>atriceps</i> | 14 | <i>campbelli</i> |
| 4 | <i>bransfieldensis</i> | 15 | <i>ranfurlyi</i> |
| 5 | <i>georgianus</i> | | |
| 6 | <i>nivalis</i> | | |
| 7 | <i>melanogenis</i> | | |
| 8 | <i>verrucosus</i> | | |
| 9 | <i>purpurascens</i> | | |
| 10 | <i>carunculatus</i> | | |
| 11 | <i>chalconotus</i> | | |

Phalacrocorax onslowi Chatham Shag

COLOUR PLATE FACING PAGE 885

Phalacrocorax onslowi Forbes, 1893, *Ibis* (6) 5: 533 — Chatham Islands.

Named in honour of the 4th Earl of Onslow, Sir William Hillier (1853–1911), Governor of New Zealand, 1888–1892.

MONOTYPIC

FIELD IDENTIFICATION Length 63 cm; weight c. 2–2.5 kg. Only black-and-white shag or cormorant recorded from Chatham Is Grp. Similar to King Shag *P. carunculatus* and pied morph of Stewart Shag *P. chalconotus* but smaller. Sexes alike. Immatures separable.

DESCRIPTION ADULT BREEDING. Head and hind-neck, black with metallic blue sheen. Black-and-white border crosses sides of chin, making whole head appear dark. Long black crest on forehead and white filoplumes on neck. Upper wing-coverts, scapulars and mantle, dark grey-brown with metallic green sheen and indistinct black borders. White alar and dorsal patches prominent on some birds but usually small; rarely show white on scapulars. Lower back, rump, thighs and upper tail-coverts, black with purplish-blue sheen. Tail, black with white bases to shafts. Chin, throat, foreneck and rest of underparts, white. Underwing, dark with white along humeral area. Bill, grey-brown; prominent pair of orange-red caruncles above base of bill. Facial skin in front of eye, dark purple; gular pouch and bare skin at base of lower mandible, orange-red. Mouth-lining, bright red. Iris, brown. Eye-ring, purple-blue. Legs and feet, pink. **ADULT NON-BREEDING.** Crests and filoplumes absent. Dorsal plumage and bare parts, dull and faded. Facial caruncles, yellow; no orange-red at base of lower mandible. Eye-ring, blue. Face and mouth-lining, orange. **JUVENILE.** Upperparts, brown glossed with green, darkest on back and rump. Some have white alar patches and white or sandy brown dorsal patches. Underparts, white. Bill, pale bluish horn with darker culmen. No facial caruncles; facial skin, brown; eye-ring and gular pouch, pale blue. Iris, greenish brown. Legs and feet, pink.

SIMILAR SPECIES Only shag or cormorant at Chatham Is with white underparts and pink feet. Differs from King Shag in smaller size and orange-red base to lower mandible in breeding plumage. Pied-morph of Stewart Shag is larger.

Forage round rocky coasts and over foul ground. Rest and nest on bare rocks on tops of headlands and small islands. Walk with fairly rapid high-stepping gait, upright body leaning slightly forward. Swim on surface using both feet alternately; during take-off and when diving, use both feet together. Forage underwater for small fish. Flight bat-like; during sustained flight, head held below axis of body. Fly, rest and nest in small groups. Male utters ticking and bark-like calls; females silent.

HABITAT Marine. Forage in inshore waters, usually within few kilometres of coast, in bays and inlets and along sheltered shores. Nest on exposed rocks on tops of headlands and small islands; on broad cliff ledges, 15 m or more asl or level or sloping rocks just above high water and spray zone (Fleming 1939; G.F. van Tets).

DISTRIBUTION AND POPULATION Endemic to NZ; restricted to Chatham Is Grp and surrounding waters.

BREEDING (number nests).

Chatham I.

C. Fournier (Okawa): Nov. 1973, 80+ (Morris 1977)

Matarakau Point: Jan. 1975, 20+ (CSN 22)

Okawa: Nov. 1937 (Fleming 1939)

Tuparonga: Dec. 1937, c. 50 (Fleming 1939)

Pitt Is

Rabbit I.: Nov. 1980, c. 60 (Fleming 1939; CSN 29)

Star Keys (Fleming 1939); c. 530 (C.J.R. Robertson)

MOVEMENTS Sedentary, no records away from Chatham Is.

FOOD Small fish about 10 cm long ejected by birds at breeding colonies, the only record of diet (Fleming 1939).

SOCIAL ORGANIZATION Not well known; based mainly on observations at Matarakau Pt, Chatham Is, by G.F. van Tets. Solitary or gregarious; may congregate when feeding and roosting; nest colonially on rocky exposed headlands.

BONDS Probably sustained monogamous; no systematic information from banded birds. Little detail on annual cycle but laying between Sept. and Dec. Fleming (1939) considered season varied considerably between and within colonies. Both parents incubate and tend young until contact lost some time after fledging.

BREEDING DISPERSION Nest in small to medium-sized (50 nests) colonies on outlying stacks or headlands. Birds land on edge of colony and run gauntlet of sitting

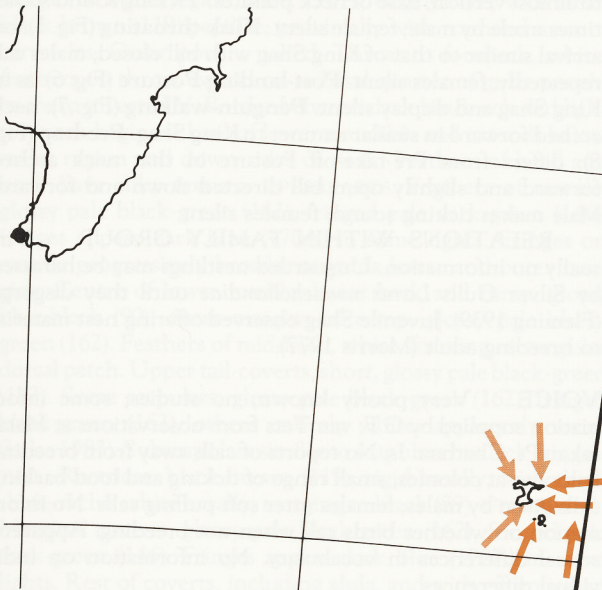




Fig. 1 Gargling

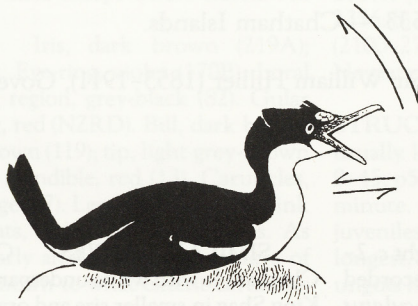


Fig. 2 Gaping

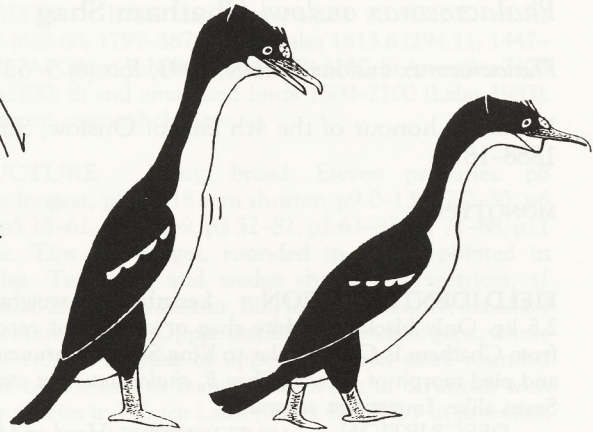


Fig. 4 Pre-take-off Posture

Fig. 5 Kink-throating

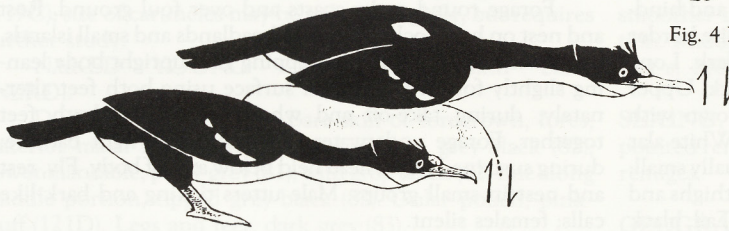


Fig. 3 Head-lowering

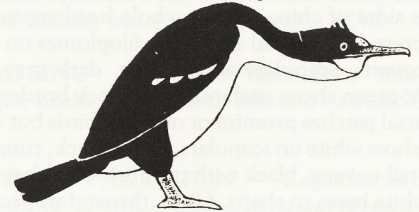


Fig. 6 Post-landing Posture

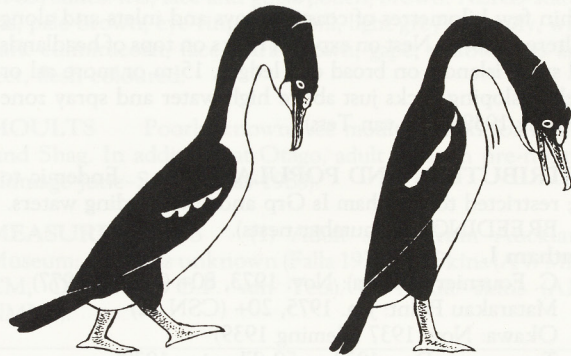


Fig. 7 Penguin-walking

Fig. 8 Pre-hop Posture

birds as they make their way down corridors between nests. Territorial; only nest-site defended. Usually found within a few kilometres from shore; probably restricted home range (Falla *et al.* 1981; Fleming 1939).

ROOSTING Solitary or in small groups on bare rocks. Rest and preen on rocks along coast (Fleming 1939). May have separate diurnal and nocturnal roosts, depending on locations of food and shelter. Does not mix with other species. No systematic information on times of departure and arrival.

SOCIAL BEHAVIOUR Little published information; based mainly on observations at Matarakau Pt, Chatham Is., by G.F. van Tets. Displays obvious and similar to King Shag. If colony alarmed, by human or other disturbance, birds stampede to edge of colony before they can take flight; many eggs can be broken or taken by Silver Gulls *Larus novaehollandiae*. Integrated flocks not seen.

AGONISTIC BEHAVIOUR Individual distance just out of pecking reach of each other. Threat displays similar to those of King Shag; males call but females silent.

SEXUAL BEHAVIOUR **ADVERTISING.** Male per-

forms **Gargling** (Fig. 1): head swung backwards to rump then forwards; similar to display of King Shag but body held nearly vertical as head reaches rump; bill held closed, slightly open or wide open; movement repeated rapidly, up to 13 times; head sometimes placed beside body. May call loudly as head moves back or remain silent. **RECOGNITION** by Gaping and Head-lowering displays. **Gaping** (Fig. 2): bill held wide open, directed forward and moved back and forth in front of body (similar to King Shag); male utters loud barking call and female, soft puffing. **Head-lowering** (Fig. 3): head lowered and raised in front of body as in King Shag. **OTHER DISPLAYS AT SITE.** **Pre-take-off Posture** (Fig. 4): as in King Shag but bill slightly open and pointed downwards and body more upright to almost vertical; base of neck pulsates. Ticking sound sometimes made by male; female silent. **Kink-throating** (Fig. 5): on arrival similar to that of King Shag with bill closed; males call repeatedly, females silent. **Post-landing Posture** (Fig. 6): as in King Shag and display silent. **Penguin-walking** (Fig. 7): neck arched forward in similar manner to King Shag. **Pre-hop** (Fig. 8): differs from Pre-take-off Posture in that neck arched forward and slightly open bill directed down and forward. Male makes ticking sound; females silent.

RELATIONS WITHIN FAMILY GROUP Virtually no information. Unguarded nestlings may be harassed by Silver Gulls *Larus novaehollandiae* until they disgorge (Fleming 1939). Juvenile Shag observed offering nest material to breeding adult (Morris 1977).

VOICE Very poorly known; no studies; some information supplied by G.F. van Tets from observations at Matarakau Pt, Chatham Is. No reports of calls away from breeding colonies; at colonies, small range of ticking and loud barking calls given by males; females utter soft puffing calls. No information on whether birds call when not breeding. Apparent sexual differences in vocabulary. No information on individual differences.

ADULT MALE **Threat Call:** a loud *ergh* call when threatened. **Gargling Call:** a loud *orgh*, *rogh* or *borr* given during display. **Gaping Call:** a loud, repeated barking *heh-heh-heh*. . . **Pre-take-off/Pre-hop Call:** a repeated ticking *t-t-t-t*. . . **Kink-throating Call:** a repeated *corr-corr-corr*. . .

ADULT FEMALE Only one call reported during Gaping Display, a soft puffing *ghff-ghff-ghff*. . .

YOUNG No information.

BREEDING Very poorly known; no detailed studies; observed by G.F. van Tets at Matarakau Pt, Chatham I. Nest colonial, away from other species, on exposed headlands and small islands.

SEASON Eggs laid from Sept. to Dec. (G.F. van Tets). No further information.

SITE On level and sloping bare rocks, not far above high-tide level and spray-zone.

NEST, MATERIALS Made of iceplant *Disphyma australe*, grass and other plants.

EGGS Elliptical, ovoid: mat, rough textured; pale blue with white chalky coating.

MEASUREMENTS: 61 (59–63; 4) x 39 (37–40) (Oates 1902); 61 (56–66; 8) x 39 (37–40) (Fleming 1939); 61 (58–64; 20) x 40 (34–44) (Schönwetter 1967).

CLUTCH-SIZE No quantified data. Said to be three (Oliver).

LAYING, INCUBATION. No information.

NESTLING Altricial, nidicolous; hatched naked; acquires smoky brown down with tufts of white filoplumes. No other information on parental care, growth, fledging, success.

PLUMAGES Age of first breeding unknown.

ADULT BREEDING **HEAD AND NECK.** Crown, sides of head and hindneck, glossy black-green (162) with blue-black (90) sheen. Oliver states that birds have white filoplumes on neck during breeding. Small erectile crest on forecrown; feathers elongate, c. 30–41 mm and glossy pale black-green (162). Unknown if these birds have thin white nuptial plumes above and behind eye. Crest attained in pre-nuptial plumage and moulted when birds on eggs. Anterior margin of malar region, bare. Lores, largely bare, with small black-brown (119) papillae; proximally with rounded mass of caruncles. Gular pouch, naked. Throat to foreneck, white; feathers on throat extend on to basal quarter of gular pouch, in sharp inverted V. Border between dark hindneck and light foreneck begins at base of lower mandible and extends below malar region and down sides of neck. Feathers of head and neck have silky texture. **UPPERPARTS.** Feathers of mantle, glossy pale black-green (162), fringed pale dark-green (146); fringes appear dark blue (170A) in some lights. Fringes on mantle progressively broader towards lower and outer margins. Centre of lower mantle, lower back and rump, glossy blue-black (90); outer margins of rump, glossy pale black-green (162). Feathers of mid-back, white, forming rectangular dorsal patch. Upper tail-coverts, short, glossy pale black-green (162). Some scapulars, glossy pale black-green (162), fringed black-green (162), others entirely white; apparently varies (Lalas 1983). Subscapulars similar to scapulars but lack fringes. **TAIL.** Rectrices, black-brown (119); rigid basally, with thick shaft; rachis white basally, merging to black (89). **UPPERWING.** Marginal coverts, glossy pale black-green (162), fringed pale dark-green (146). Fringes appear dark blue (170A) in some lights. Rest of coverts, including alula, and with exception of

some lesser coverts, glossy pale black-green (162). Most lesser coverts, white, forming alar bar. Primaries, black-brown (119); rachis, black (89). Tertiaries and secondaries similar, but edge of outer webs, glossy pale black-green (162). **UNDERPARTS,** mostly white. Long lateral breast-feathers moderately long; beneath these, small concealed patch of dark-brown (119A) semiplumes. Inner flanks, white; on outer margins, concealed when wing closed, feathers dark brown (121) and fringed slightly darker; fringes appear glossy dark-green (160) in some lights. Thighs, glossy blue-black (90). Tibio-tarsal feathers similar to feathers of outer mantle; beneath these, small concealed patch of dark-brown (119A) semiplumes. Axillaries, dark-brown (121). **UNDERWING.** Greater primary coverts and greater coverts, glossy brown (119B) with brown-grey (79) shade. Rest of coverts, dark brown (121), fringed slightly darker; fringes appear glossy dark-green (162A) in some lights.

ADULT NON-BREEDING Similar to adult breeding at later stages of breeding season; no crest; differences largely a matter of changes in colours of bare parts.

DOWNY YOUNG Smoky brown down with tufts of white filoplumes (G.F. van Tets).

JUVENILE **HEAD AND NECK,** dark brown (119A), tipped black-brown (119); tips, glossy pale black-green (162) in some lights. Facial feathers, wholly brown (119B). Gular pouch, naked. Caruncles, absent. Throat and rest of foreneck, white; throat-feathers extend on to basal quarter of gular pouch in inverted V. **UPPERPARTS.** Mantle and scapulars, dull glossy pale black-green (162), fringed dark brown (119A); fringes broader towards outer and lower margins of mantle. Subscapulars, dull glossy pale black-green (162), lacking fringes and tipped brown (119B). All scapulars and subscapulars have pointed tips to webs. Outer mantle-feathers, brown (28); when worn, fringed dull white. Back and rump, dark-brown (119A) tipped black brown (119); in some lights, tips appear glossy pale black-green (162). Upper tail-coverts short, dull glossy pale black-green (162). **TAIL,** black-brown (119); outer webs of rectrices, dull white when worn. **UPPERWING.** Marginal coverts, brown (119B), fringed dark-brown (119A). Lesser, median and greater coverts, brown (28), fringed dull-white through wear; from lesser coverts to greater coverts, fringing becomes progressively broader and more obvious. Remiges, black brown (119); all have pointed tips to webs. Humerals, short, black-brown (119). Secondaries and tertiaries, tipped brown (119B) to dull white; dull-white tips obvious on tertiaries. **UNDERPARTS,** mostly white. Long lateral breast-feathers, white, varying streaked dark brown (119A) on webs; concealed beneath these feathers, small patch of dark-brown (119A) semiplumes. On outer flanks, concealed when wing closed, feathers dark-brown (119A) glossed pale black-green (162); feathers fringed dark brown (119A). Axillaries, dark brown (119A). Thighs, dark brown (119A); some glossy blue-black (90) feathers invariably present. Tibio-tarsal feathers, dull glossy pale black-green (162), fringed dark brown (119A); beneath these feathers, small concealed patch of dark-brown (119A) semiplumes. **UNDERWING.** Greater primary coverts and greater coverts, glossy brown-grey (79) with dark-brown (119A) shade. All other coverts, dark brown (119A).

BARE PARTS Based on photos in NZRD and at NZDOC library, except where stated.

ADULT BREEDING Iris, brown (223A). Loral skin and distal malar region, grey-black (82). Caruncles, orange-red (15). Eye-ring, violet (170B). Gular pouch, red (10). At curva-

ture of upper mandible to gape, skin at gape, orange-red (15). Bill, dark grey (83). Legs and feet, dull pink (5) with brown-grey (79) joints and webs, and on hind tarsus.

ADULT NON-BREEDING Similar to adult breeding, but colours not intense; bill, light grey-brown (119C) at sides.

DOWNY YOUNG No data. Archey & Lindsay (1924) describe fledgeling as: iris, greyish brown; eye-ring, brownish; upper mandible, dark horn; lower, bluish white at base, horn at tip; gular pouch, pale bluish white; facial skin, blackish brown; feet, brownish black.

JUVENILE Archey & Lindsay (1924) describe iris as greyish brown; upper mandible, blackish horn, lower, bluish white at base, horn at tip; gular pouch, bluish white; facial skin and feet, slightly lighter than fledgeling. NZRD gives: iris, green-brown; face, brown; bill, pale blue-grey with dark culminicorn; eye-ring, pale blue; legs and feet, pink.

MOULTS Few details.

ADULT Primaries most likely moult outwards in staffelmauser; see moult section for Campbell Shag *P. campbelli* for other details.

POST-JUVENILE Undescribed.

MEASUREMENTS Few data. (1) Skins (AWMM, CM, NMNZ; G.F. van Tets). (2) Three adult skins, label data, except eighth primary (NMNZ). Additional measurements in Falla (1932).

		MALES	FEMALES
WING	(1)	286 (5; 278-292; 5)	271 (10; 261-284; 5)
8TH P	(2)	156.0	263.0
TAIL	(1)	116 (7; 109-124; 4)	108 (6; 99-116; 5)
BILL	(1)	53 (2; 51-56; 5)	53 (1; 52-55; 4)
TARSUS	(1)	65 (3; 62-69; 5)	64 (4; 58-69; 5)
TOE	(1)	82.6	80.1, 77.5

WEIGHTS Star Keyes, Chatham Is, adult skins, Sept.; label data (NMNZ): male 2525 (fat); females 2230 (fat) and 1790 g. Label data: male 2.4 kg (G.F. van Tets). No data on seasonal changes.

STRUCTURE Wing, broad. Eleven primaries: p8 usually longest. Accurate assessment of wing formula not made because three available adult skins in moult; further study required. Adults have rounded tips to remiges; pointed in juveniles. Tail, long and wedge-shaped; 12 rectrices, t1 longest, t6 29-35 mm shorter. Bill, long and slender; maxillary unguis, hooked at tip. Upper mandible extends to gape, where sharply ridged. Numerous fine striae at base of upper mandible. At base of bill, large moderately high rounded mass of caruncles; caruncles, absent in juveniles. For comparison of size of caruncles with similar species see figure in Lalas (1983). Bill, flaky in juveniles, smoother in adults. Middle claw, serrated. Feet, totipalmate. Outer toe, longest c. 141% of middle, inner c. 64%, hind c. 42%.

SEXING, AGEING Caruncles absent in juveniles. Juveniles have flaky bills and pointed remiges; smooth bills in adults, and rounded tips to remiges, and large caruncle mass.

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Plate 63

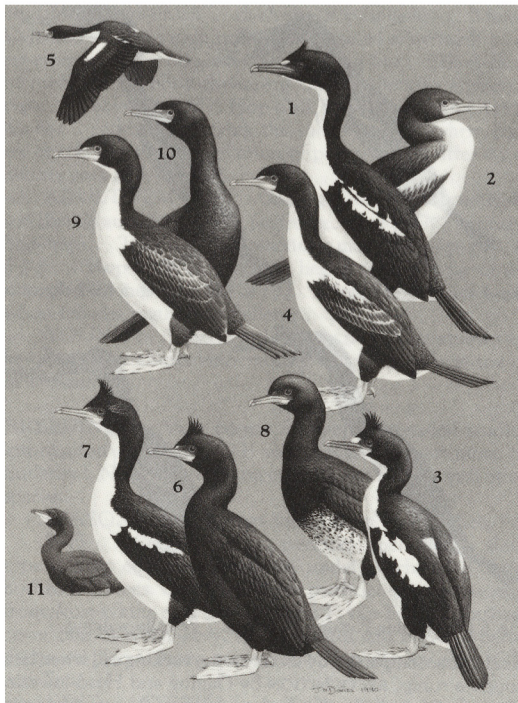
Macquarie Shag *Phalacrocorax purpurascens*
 1. Adult breeding
 2. Juvenile
 3. Adult non-breeding
 4. Downy young

Heard Shag *Phalacrocorax nivalis*
 5. Adult breeding
 6. Juvenile

Crozet Shag *Phalacrocorax melanogenis*
 7. Adult breeding courtship

Antarctic Shag *Phalacrocorax bransfieldensis*
 8. Adult breeding

Kerguelen Shag *Phalacrocorax verrucosus*
 9. Adult breeding
 10. Adult non-breeding
 11. Juvenile



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King Shag *Phalacrocorax carunculatus*
 1. Adult breeding
 2. Juvenile

Chatham Shag *Phalacrocorax onslowi*
 3. Adult breeding
 4. Juvenile
 5. Adult non-breeding, dorsal

Stewart Shag *Phalacrocorax chalconotus*
 6. Adult breeding, bronze morph
 7. Adult breeding, pied morph
 8. Adult non-breeding, intermediate morph
 9. Juvenile, pied morph
 10. Juvenile, bronze morph
 11. Downy young

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