

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 pterygiae 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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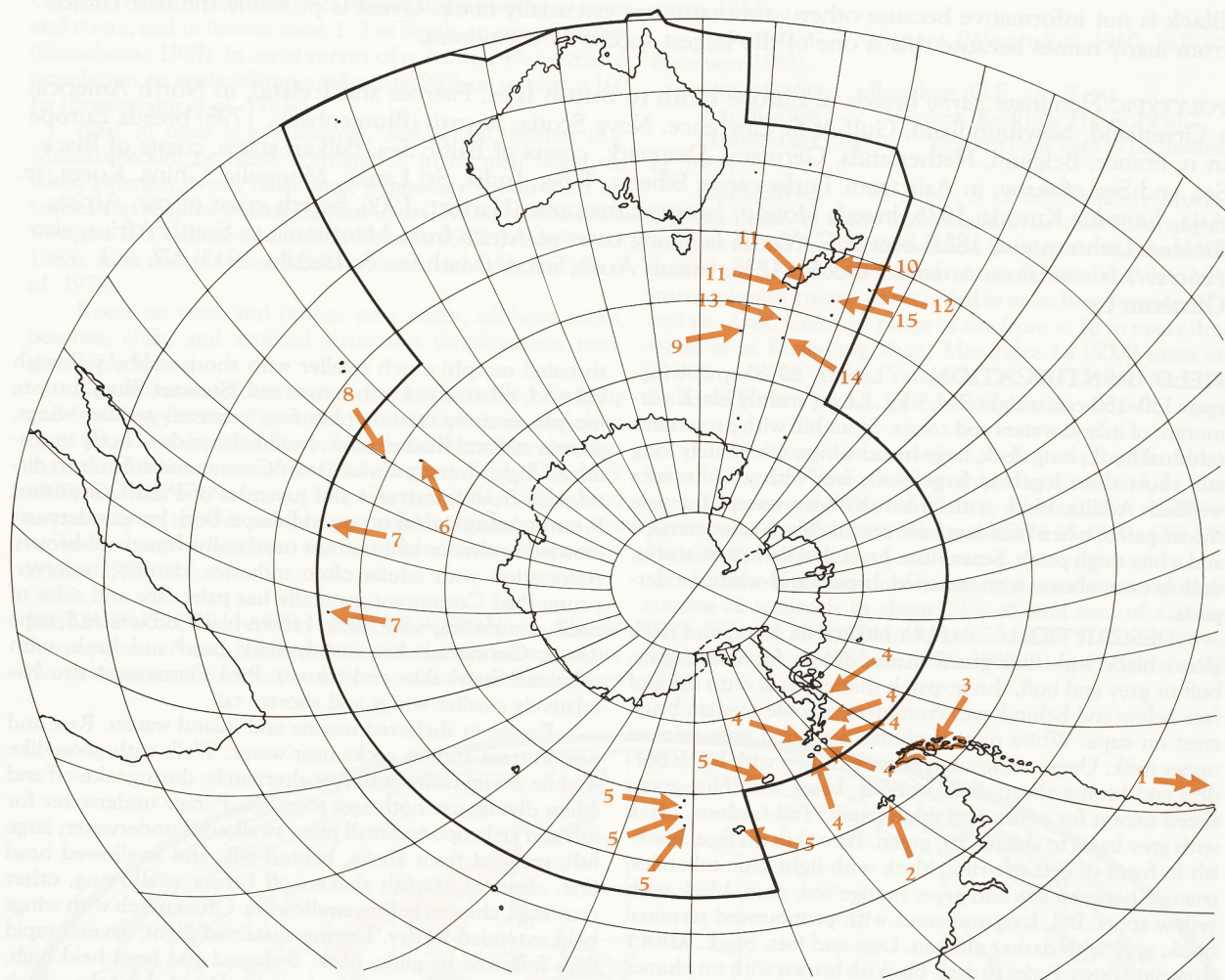


Fig. 1. Distribution of island forms of *Phalacrocorax*.

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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 campbelli Campbell Shag

COLOUR PLATE FACING PAGE 932

Urile campbelli Filhol, 1878, *Bull. Soc. Philomath. Paris* 7 (2): 132 — Campbell Island.

Named after type-locality.

MONOTYPIC

FIELD IDENTIFICATION Length 63 cm; wingspan 105 cm; weight 1.6–2 kg. Small black-and-white shag, with reddish facial skin but without caruncles or blue eye-ring; confined to Campbell I. Sexes alike. Seasonal changes in plumage. Juveniles separable.

DESCRIPTION **ADULT BREEDING.** Head and hind neck, black with greenish sheen. Small white patch on chin and throat. Long black recurved crest on forehead; long white filoplumes scattered on sides of head. Mantle, scapulars and upper wing-coverts, dark purple-grey with green sheen and indistinct black borders. White alar patch, prominent in some and poorly developed in others. No white on scapulars or back. Lower back, rump, thighs and upper tail-coverts, black with greenish sheen. Remiges, black. Tail, black with white shafts. Foreneck black, with blue sheen separating white throat and white breast by c. 8 cm and sharply defined in transverse line from white upperbreast. Rest of underparts, white. Underwing, black. Bill, dark orange-brown or grey-brown. No caruncles at base of bill, but line above gape and spot at base of lower mandible orange. Indistinct purple eye-ring; rest of facial skin, dark purple; gular pouch and mouth-lining, red. Iris, dark brown. Legs and feet, pink with dark grey smudges. **ADULT NON-BREEDING.** No crest. Gape line and spot, yellow. **JUVENILE, IMMATURE.** Upper surface, dark brown, darkest on lower back and thighs. No white alar patch. White below except for brown foreneck in similar pattern to adult. Bill, light orange-brown merging into yellow or orange at base and gape. Facial skin, dull purple. Gular pouch and mouth-lining, dull yellow-orange. Iris, brownish grey. Legs and feet, dull orange, pink and grey.

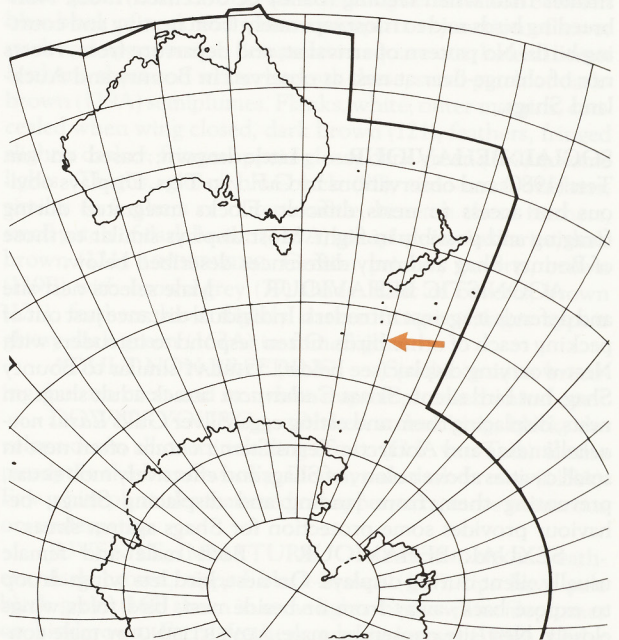
SIMILAR SPECIES **Little Cormorant** *P. melanoleucos*, which has bred at Campbell I., has face and foreneck white. **Great Cormorant** *P. carbo* is vagrant at Campbell I.; much larger with all-dark plumage. Cormorants have longer wings and tails, black feet; cormorants spread wings to dry, which subantarctic shags do not do. In sustained flight, cormorants hold heads above line of body, whereas shags have them below. Closely resembles **Auckland** *P. colensoi* and **Bounty** *P. ranfurlyi* Shags, but ranges do not overlap; Auckland Shag has more white on foreneck and distinctive orange eye-ring; demarcation between black and white on upperbreast mottled in darkest examples of Auckland Shag (straight and clean in Campbell Shag). Bounty Shag larger, with white foreneck.

Forage at sea and in marine inlets and bays, sometimes in thousands. Rest and nest mainly in large sea-caves and small alcoves of precipitous cliffs and along narrow cliff ledges with overhangs. After foraging, rest on intertidal rocks and on rocky headlands. Walk with fairly rapid high-stepping gait, upright body leaning slightly forward. Swim at surface using feet alternately but during take-off and when diving, use both feet at same time. Forage by diving. When feeding in large flocks, individuals fan out in line, dipping heads in water and beating with wings, before diving together; use 'jump dives'

(clearing the water) and swim long distances underwater before returning to surface, when group usually disperses. They then swim back towards each other before repeating the process. Foraging flocks attract petrels, gulls and terns. Flight, bat-like; during sustained flight, head held below line of body. Fly, forage, rest and nest in groups. Males rarely call but sometimes use bark-like call; females silent.

HABITAT Marine. Forage far out at sea or in inshore waters in bays and inlets. Nest on sea-facing cliffs on exposed rocky ledges or alcoves, or in sea-caves; 12–30 m asl. After breeding, adults and young assemble in sheltered inlets. Use updraughts off cliffs to rise high into air and to assist landing on nesting ledges. Rest on headlands and intertidal rocks (Bailey & Sorensen 1962; G.F. van Tets).

DISTRIBUTION AND POPULATION Endemic to Campbell I., NZ and adjacent waters. Possibly vagrant to Antipodes Is (Warham & Bell 1979; but see Bounty Shag). In 1975, estimated about 2000 nests and suggested total population about 8000 birds (van Tets 1980). Effect of introduced mammals (rats, cats, sheep, cattle) on populations not known; no apparent threats to population.



MOVEMENTS Sedentary. May be some seasonal movements round Campbell I; large flocks of adults and juveniles feeding together on 14 Aug., 1960 but, on 12 Oct., adults had left and only juveniles were being washed up dead on shore on (Bailey & Sorensen 1962).

FOOD Only shells and fish recorded. **BEHAVIOUR.** Feed alone or in flocks of 20–2000 birds. Flocks sometimes very tight but spread out as birds start to dive for food, first singly then in groups until all submerged together. Diving of large flocks can be entirely synchronic. After surfacing, flock re-groups, birds at outer edges flying in to join raft (Bailey & Sorensen 1962).

ADULT Stomachs of specimens collected by Filhol (1885) filled with small molluscs *Cantharidus*. One observed regurgitating pieces of fish (G.F. van Tets).

SOCIAL ORGANIZATION Little known; based on Bailey & Sorensen (1962) and information supplied by G.F. van Tets. Gregarious, sometimes solitary; congregate at roosts; forage co-operatively, forming large flocks of up to 2000 birds; nest in colonies of 1–157 nests on steep rocky cliffs. After breeding, adults and young assemble in rafts in sheltered inlets to feed; rafts of 300–400 birds recorded (Bailey & Sorensen 1962); in Nov. and Dec., foraging flocks usually more than 30 birds with adults and immatures present in about equal numbers (van Tets 1980); may be guided by gulls to find schools of fish.

BONDS No systematic information. Breeding cycle little known but birds said to lay from about Aug. to Dec. Both parents incubate and tend young until contact lost after fledging.

BREEDING DISPERSION Nest colonially along exposed, sheer cliffs where there is some protection from predation by skuas. Nests close together; on broad ledges one to five nests deep; 110 nests recorded at one colony in Dec. (van Tets 1980). Territorial; defending nest-site only.

ROOSTING Solitary or in small groups. After feeding, rest on intertidal rocks and barren headlands; groups smaller than when feeding (Bailey & Sorensen 1962). Non-breeding birds said to roost separately from nesting and courting birds. No pattern of arrival at, and departure from, roosts nor of change-over at nest as observed in Bounty and Auckland Shags.

SOCIAL BEHAVIOUR Little known; based on van Tets (1980) and observations by G.F. van Tets. Displays obvious but access to nests difficult. Flocks integrated during foraging and possibly in flight. Most displays similar to those of Bounty Shag and only differences described below.

AGONISTIC BEHAVIOUR Male selects nest-site and defends it against intruders. Individual distance just out of pecking reach of other birds. Often respond to intruders with Nest-worrying display (see below). **THREAT** similar to Bounty Shag, but bird silent. Skuas *Catharacta* attack adult shags on nests, displacing them and eating eggs; Silver Gulls *Larus novae-hollandiae* and Antarctic Terns *Sterna vittata* often nest in small cavities above colony of Shags and effectively mob skuas, preventing them from landing and displacing Shags; behaviour provides some protection for Shags against skuas.

SEXUAL BEHAVIOUR Both male and female usually silent during displays. On nest, bird lets wings droop to expose back; away from or beside nest, bird folds wings closely. Nest-site chosen by male. **ADVERTISING** by male consists of **Gargling** (Fig. 1): arches neck backwards until head touches rump, sometimes bouncing head on rump several times or moving head down beside body; body held horizontal, breast pressed down and rump lifted; breast may lift slightly when head reaches rump; bill, slightly to wide open; tail may be held down, or up and forward; wings droop and crest

pressed down on crown; birds silent. **RECOGNITION** consists of Gaping, Head-lowering and Nest-worrying. **Gaping** (Fig. 2): similar to Bounty Shag but waves bill not only back and forth, but also sideways and towards rear once or twice per second; plumage of head and neck sleeked; body held horizontal and wings droop. No sound made. **Head-lowering** (Fig. 3): similar to Bounty Shag; flash of red revealed as throat bulges in down position. When performed by pair, they either stand side by side with their heads going up and down in front of them or they face each other, and alternate between heads going up and down several times on one side and several times on the other side. No calls made. **Nest-worrying**: both sexes worry nest with their bills; used only as recognition and not as threat display. **OTHER DISPLAYS AT SITE.** **Pre-take-off Posture** (Fig. 4) similar to that of Bounty Shag but rarely like that of Auckland Shag. Head broadened; usually neck almost vertical with slight bend in upper-neck so head somewhat forward, occasionally neck horizontal but rarely arched higher than head. Abdomen and upper breast pulsate about twice per second but no sound made. **Kink-throating** (Fig. 5) on arrival similar to that of Bounty Shag with bill closed. Occasionally male calls; female silent. **Post-landing Posture** (Fig. 6) similar to that of Bounty and Auckland Shag. Head held forward, closed bill horizontal and upper neck bulged where there is white patch of feathers. Birds silent. Non-breeding birds, on arrival at roost, keep head and closed bill pointing downward for a few seconds before relaxing, after which raises head. **Penguin-walking** (Fig. 7) as in Bounty Shag, but position of closed bill varying from horizontal to c. 45° below horizontal. Note neck arched higher than head. **Pre-hop Posture** (Fig. 8) differs from Pre-take-off Posture in that neck arched and closed bill directed vertically downward, as in Bounty Shag. **Hop** by both sexes; performed silently.

RELATIONS WITHIN FAMILY GROUP No information.

VOICE Poorly known; limited observations by G.F. van Tets. Generally silent; no calls reported away from colonies; quiet at colonies. Males make barking call during Kink-throating display, silent at other times; females are silent. No information on individual differences.

ADULT MALE **Kink-throating Call**: a repeated barking *korrr-korrr-korrr*... during Kink-throating Display. No further information.

YOUNG No information.

BREEDING Very poorly known; no detailed studies. Information provided by G.F. van Tets. Colonial ground- or cliff-nesting, mostly inaccessible; in loose association with Silver Gulls and Antarctic Terns.

SEASON Adults in nuptial plumage in June (Bailey & Sorensen 1962). Fully grown chicks in Nov. 1975 (G.F. van Tets) suggest eggs laid in Aug.–Sept. Filhol (1878) reported start of laying in mid-Nov.; continues at least into Dec. (G.F. van Tets).

SITE On ground or on tussocks; in large caves and clefts, on ledges and steep cliffs; on stacks and islets. Generally quite inaccessible to humans (Bailey & Sorensen 1962; G.F. van Tets).

NEST, MATERIALS Open, flattened bowl-shaped structure, made of tussock grass, other plant material and debris. No further information on building, role of sexes, but no doubt similar to that of related species of shag.

EGGS Undescribed. Measurements in Oliver are

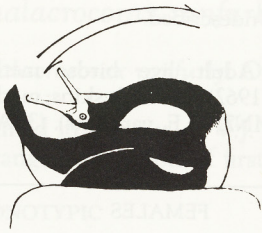


Fig. 1 Gargling

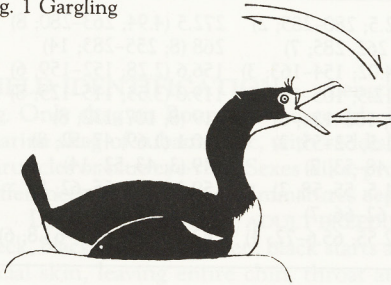


Fig. 2 Gaping

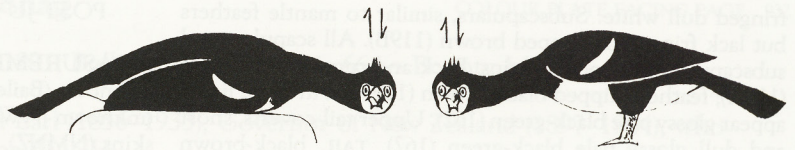


Fig. 3 Head-lowering



Fig. 4 Pre-take-off Posture



Fig. 5 Kink-throating

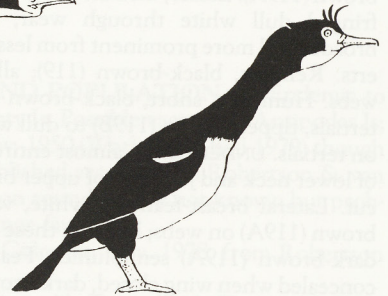


Fig. 6 Post-landing Posture

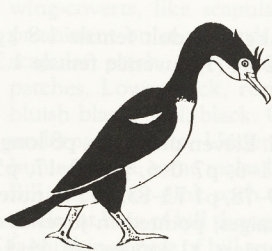


Fig. 7 Penguin-walking

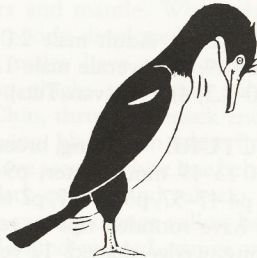


Fig. 8 Pre-hop Posture

suspect (Bailey & Sorensen 1962), eggs being of unknown origin. Two eggs in NMNZ measured 67 x 39, 62 x 39 (G.F. van Tets), collected 20 Feb. 1970 by Owens.

PREDATORS Eggs taken by skuas (van Tets 1980).

No further information on any aspect of breeding except that nestling hatched naked, black; throat and lower mandible, pink; develops grey down all over including crown (G.F. van Tets).

PLUMAGES Age at first breeding unknown.

ADULT BREEDING HEAD AND NECK. Feathers of crown and sides of head, glossy black-green (162) with blue-black (90) sheen; long crest, 37–71 mm, on forecrown. Crest feathers, glossy pale black-green (162). Above and behind eye, long (19–34 mm) thin white nuptial plumes lie in horizontal position. Anterior part of cheeks bare. Lores, covered in small black-brown (119) papillae and largely bare. From throat to foreneck, oval patch of white feathers; maximum width of patch, 22–35 mm, length 68–97 mm; white feathers on throat extend on to basal quarter of gular pouch; feathers terminate sharply in inverted V. Rest of neck, glossy blue-black (73); some white filoplumes and short white nuptial plumes on hindneck. **UPPERPARTS.** Mantle, glossy pale black-green (162), fringed pale dark-green (146); fringes appear dark blue (170A) in some lights and become progressively broader towards outer and lower margins. At centre of lower mantle, back, rump and upper tail-coverts, glossy blue-black (90); outer margins of rump, glossy pale black-green (162). Scapulars, glossy

pale black-green, fringed black-green (162). Subscapulars similar but without fringes. **TAIL.** Rectrices, black-brown (119) and rigid; rachis, black (89) and thick; calamus white. **UPPERWING.** Marginal coverts, glossy pale black-green (162), fringed pale dark green (146); fringes appear dark blue (170A) in some lights. Rest of coverts and alula, except some lesser coverts, glossy pale black-green (162). Most lesser coverts, white; form alar bar. Primaries and humerals, black-brown (119); rachis, black (89). Humerals, short. Tertiaries and secondaries, similar to primaries but edge of outer webs, glossy pale black-green (162). **UNDERPARTS.** Strong demarcation between blue-black of neck and white underparts at junction of lower neck and upper breast; demarcation square-cut. Lateral breast feathers, short and white; beneath these, small patch of dark-brown (119A) semiplumes. Flanks, white; outer margins, concealed when wing closed, dark brown (121); feathers, 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 feathers, small patch of dark brown (119A) semiplumes. Axillaries, dark brown (121). **UNDERWING.** Greater primary coverts, brown (119B) with brown-grey (79) shade. Rest of coverts, brown (121); feathers have slightly darker fringes; fringes appear glossy dark green (162A) in some lights.

ADULT NON-BREEDING Similar to adult breeding, but no crest and no white nuptial plumes behind eye.

DOWNY YOUNG Naked at hatching; black; develops down all over including crown (G.F. van Tets). Entire mesoptile thick and woolly. Down, pale dark-brown (119A). Few white plumules scattered on upperparts, more numerous on underparts.

JUVENILE, IMMATURE HEAD AND NECK. Feathers, dark brown, tipped black-brown (119); tips have pale black-green (162) sheen in some lights. Some white filoplumes on hindcrown. Facial feathers, wholly brown (119B). Gular pouch, naked. Throat, white; feathers extend onto basal quarter of gular pouch in sharp inverted V and onto upper foreneck in elongate elliptical shape. **UPPERPARTS.** Mantle and scapulars, dull glossy pale black-green (162), fringed dark brown (119A); fringes broader on outer and lower margins of mantle. Outer mantle feathers, brown (28); when worn,

fringed dull white. Subscapulars, similar to mantle feathers but lack fringes and tipped brown (119B). All scapulars and subscapulars have pointed tips. Back and rump, dark brown (119A); feathers, tipped black-brown (119) but in some lights appear glossy pale black-green (162). Upper tail-coverts, short and 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; fringing progressively broader and more prominent from lesser towards greater coverts. Remiges, black-brown (119); all have pointed tips to webs. Humeral, short, black-brown (119). Secondaries and tertials, tipped brown (119B) to dull white; latter particularly on tertials. UNDERPARTS, almost entirely white. Demarcation of lower neck and junction of upper breast, sharp and square-cut. Lateral breast-feathers, white, varying streaked dark brown (119A) on webs; beneath these feathers, small patch of dark-brown (119A) semiplumes. Feathers on outer flanks, concealed when wing closed, dark brown (119A) with gloss of 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. Tibiotarsal feathers, dull glossy pale black-green (162), fringed dark brown (119A); beneath these feathers, small patch of dark-brown (119A) semiplumes. UNDERWING. Greater primary coverts and greater coverts, brown-grey (79) with dark-brown (119A) shade. All other coverts, dark brown (119A).

ABERRANT PLUMAGES A dark feather on the upper breast noted by Falla (1932).

BARE PARTS Based on photos in NZRD and at NZDOC library.

ADULT BREEDING Iris, dark brown (119A). Eye-ring, grey-black (82). Loral skin and anterior of cheeks, dirty pink (4) with brown-grey (79) shade. Oliver describes eye-ring as purple; facial skin, brown with red dots and gular pouch as red. At curvature of upper mandible to gape, line of orange yellow (18). At base of lower mandible, orange (16). Tomia, dark brown (219A); tip, light grey-brown (119C). Legs and feet, dull pink (5) with brown-grey (79) joints and webs.

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

DOWNY YOUNG Few data. Throat and lower mandible, pink (G.F. van Tets).

JUVENILE IMMATURE Few data. Iris, brownish grey. Bill, light orange-brown merging into yellow or orange at base and gape. Throat and mouth-lining, dull yellow-orange. Face, dull purple. Legs and feet, dull orange, pink and grey (based on live birds; G.F. van Tets).

MOULTS Largely undescribed.

ADULT Staffeldmauser; remiges moult outwards; timing and duration unknown. Before breeding, attain crest and white nuptial plumes; lost just before, or after end of season. Possibly have similar pattern of moult as in blue-eyed shags (see Bernstein and Maxson 1981; Rasmussen 1988a,b).

POST-JUVENILE Undescribed.

MEASUREMENTS (1) Adult live birds; methods unknown (Bailey & Sorensen 1962). (2) Adult skins; methods unknown (AWMM, CM, NMNZ; G.F. van Tets). (3) Adult skins (NMNZ).

	MALES	FEMALES
WING	(1) 282.5 (2.5; 280-285; 2) (2) 275 (9; 262-285; 7)	272.5 (4.94; 263-280; 8) * 268 (8; 255-283; 14)
STH P	(3) 159.6 (4.02; 154-163; 3)	156.6 (2.28; 152-159; 6)
TAIL	(1) 117.5 (12.5; 105-130; 2) (2) 123 (10; 106-134; 6)	119.0 (3.53; 115-125; 8) 119 (8; 107-132; 8)
BILL	(1) 53.5 (1.5; 52-55; 2) (2) 50 (2; 48-53; 7)	50.1 (1.69; 47-52; 8) * 49 (3; 43-52; 14)
TARSUS	(1) 56.5 (1.5; 55-58; 2) (2) 63 (2; 62-66; 7)	59.1 (2.66; 55-62; 8) 62 (3; 57-66; 14)
TOE	(3) 67.9 (2.55; 65.6-72; 4)	62.5 (0.65; 61.9-63.8; 6) *

Additional measurements in Falla (1932), Oliver, and Bailey & Sorensen (1962). Bailey & Sorensen (1962) includes measurements of juvenile live birds.

WEIGHTS Adult male 2.0 kg (2); adult female 1.8 kg (0.1; 1.6-1.9; 8); juvenile male 1.2 kg (1); juvenile female 1.2 (0.1; 1.0-1.3; 4) (G.F. van Tets).

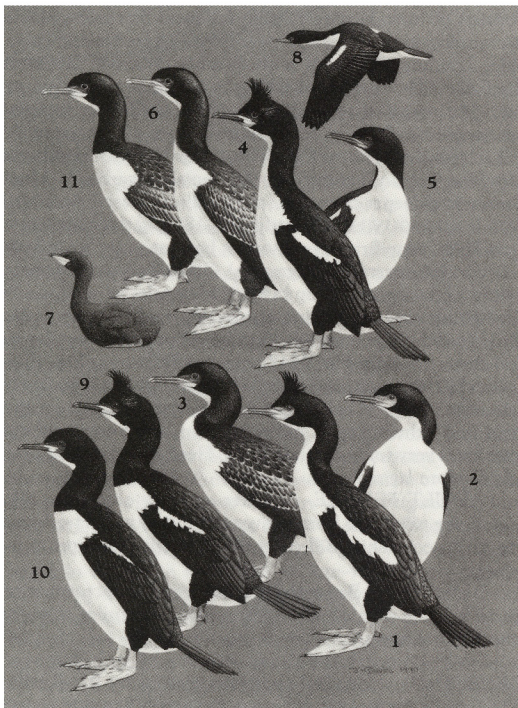
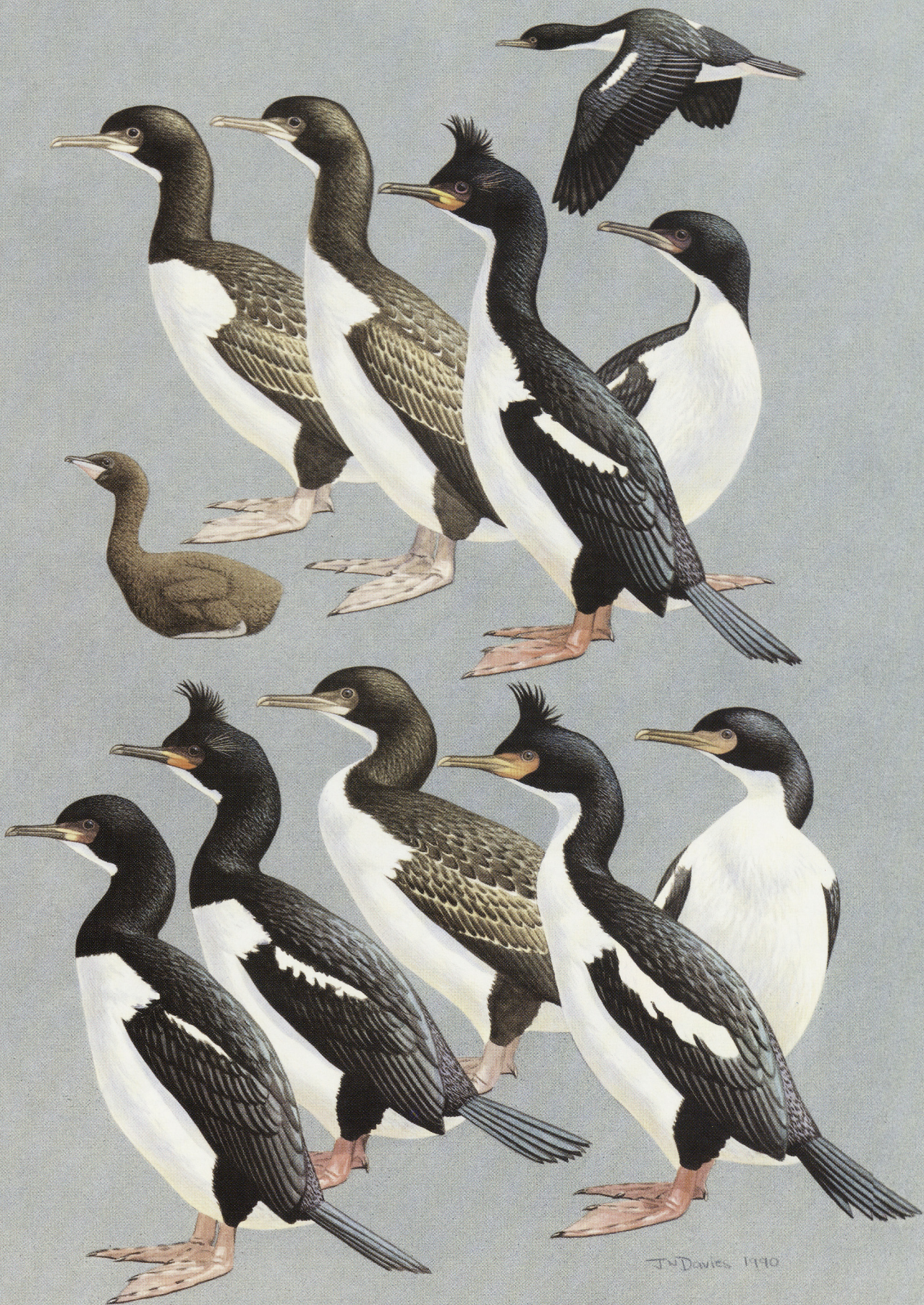
STRUCTURE Wing, broad. Eleven primaries, p8 longest, p10 13-19 mm shorter, p9 1-6, p7 0-6, p6 10-17, p5 33-42, p4 47-57, p3 59-67, p2 69-78, p1 73-83, p11 minute. Adults have rounded tips to remiges; pointed in juveniles. Tail, long, wedge-shaped; 12 rectrices, t1 longest, t6 34-42 mm shorter. Bill, long, slender; nail, hooked at tip. Upper mandible extends to gape, where sharply ridged. At base of upper mandible, numerous fine striae. Bill, flaky in juveniles, smoother in adults. Patterns of throat in adults and juveniles illustrated in Mathews (1928). Claw of middle toe, serrated. Tarsus, short, round. Feet, totipalmate. Outer toe longest c. 182% of middle, inner c. 85%, hind c. 52%.

SEXING, AGEING Age categories on plumages and bare parts (see above). Juveniles have flaky bills and pointed remiges; adults have smooth bills and rounded tips to remiges.

RMO

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Volume 1 (Part B), Plate 65

Bounty Shag *Phalacrocorax ranfurlyi*

- 1. Adult breeding
- 2. Adult non-breeding
- 3. Juvenile

Auckland Shag *Phalacrocorax colensoi*

- 4. Adult breeding
- 5. Adult non-breeding
- 6. Juvenile
- 7. Downy young
- 8. Adult non-breeding, dorsal

Campbell Shag *Phalacrocorax campbelli*

- 9. Adult breeding
- 10. Adult non-breeding
- 11. Juvenile

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