

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 pterylae 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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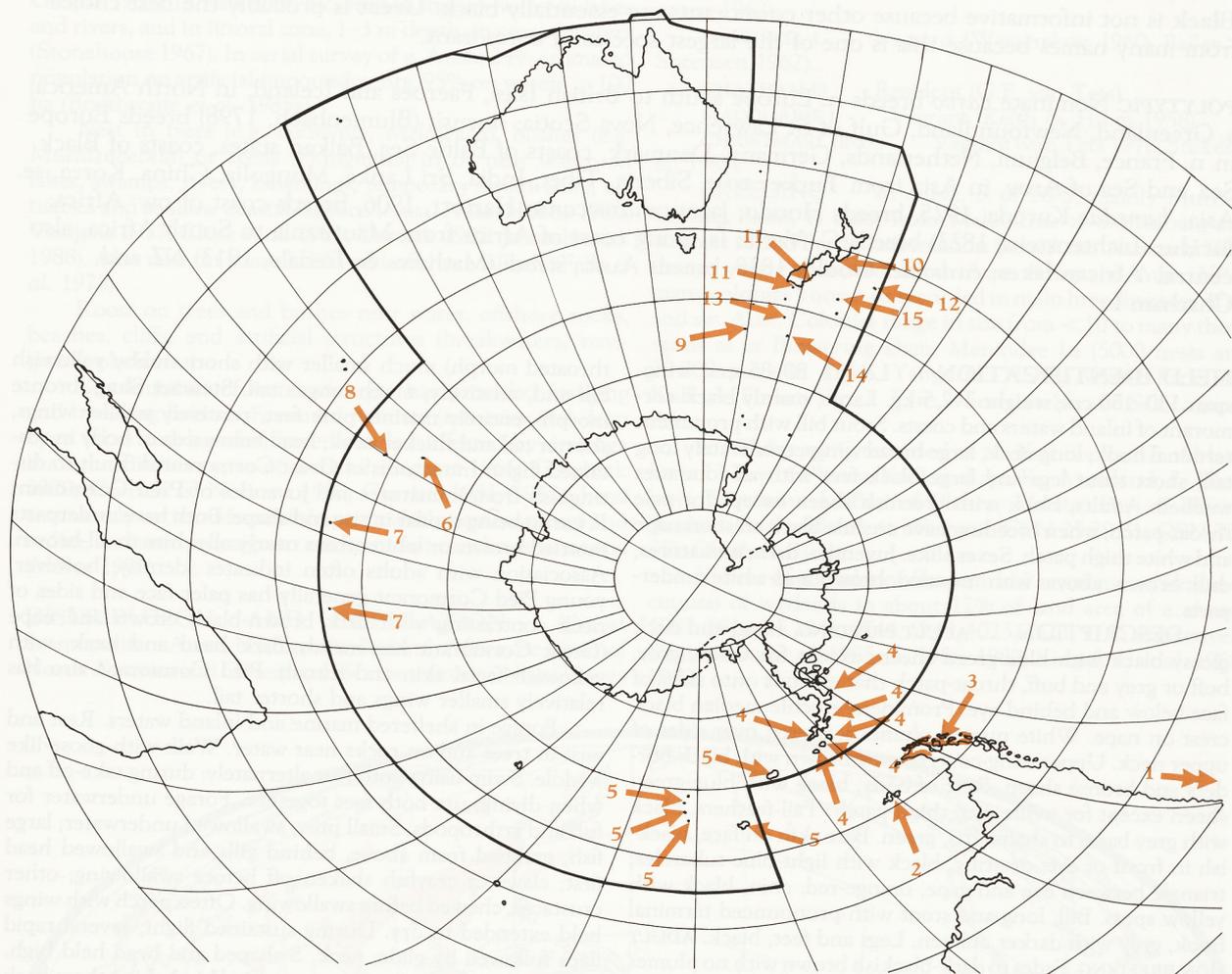


Fig. 1. Distribution of island forms of *Phalacrocorax*.

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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 ranfurlyi **Bounty Shag**

COLOUR PLATE FACING PAGE 932

Phalacrocorax ranfurlyi Ogilvie-Grant, 1901, *Bull. Br. Orn. Club* 11: 66 — Bounty Islands.

Named in honour of V.J. Ranfurly, 5th Earl (1856–1933), Governor of New Zealand (1897–1904), who arranged collection of first specimens for BMNH.

MONOTYPIC

FIELD IDENTIFICATION Length 71 cm; weight 2.5 kg. Only shag on Bounty Is. Large, black-and-white, typical marine shag of subantarctic, with reddish facial skin and no caruncles or blue eye-ring. Sexes alike; probably with seasonal differences in appearance. Immatures separable.

DESCRIPTION **ADULT BREEDING.** Head and hind-neck, black with blue sheen; black starts at lower edge of bare facial skin, leaving entire chin, throat and foreneck, white. Long black recurved crest on forehead. Scapulars and mantle, dark brown with green sheen and narrow indistinct black borders. Back, black with blue sheen. Remiges, black; upper wing-coverts, like scapulars and mantle. White alar patch prominent on most birds, poorly developed on others. No scapular patch, but some males have small white dorsal patches. Lower back, rump, thighs and upper tail-coverts, bluish black. Tail, black. Chin, throat, foreneck and rest of underparts, white. Underwing, black with white line along humeral area; some males have second white line behind this. Bill, brown or pink with dark culmen and pale tip. No caruncles at base of bill though varying orange-yellow base. Bare facial skin at base of bill and round eye, red, orange or purple; gular pouch, orange-red. Iris, light brown. Legs and feet, pink with grey smudges round top of tarsus and on toes; claws, dark brown. **ADULT NON-BREEDING.** Similar to adult breeding but lacks crest; colours less intense; bill, light grey-brown at sides. **JUVENILE.** Brown above and white below; blackish on wings, back and tail. No white alar patch. Chin, throat and underparts, white. Some brown spots on foreneck, or brown extends across foreneck as band. Iris, brown. Bill, pale brown. Facial skin, brown; gular pouch, grey. Feet, brownish flesh.

SIMILAR SPECIES No other shags or cormorants recorded from Bounty Is. Most similar to Auckland Shag, which is smaller with varying amounts of black on foreneck. Chatham Shag has prominent orange caruncles above base of bill, and bright blue eye-ring.

Forage in sea; rest and nest on ledges and in alcoves of cliffs and on skyline ridges. 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. Flight, bat-like; during sustained flight, head held below axis of body. Fly, rest and nest in small groups. Male calls are soft purrs and ticks; females silent.

HABITAT Marine. Forage in coastal waters. Nest on rocky islands with no vegetation except lichens and algae on sheltered rock faces. Most nest on ledges and alcoves of coastal cliffs; few on narrow ridges (Robertson & van Tets 1982). Suggested that lack of nesting space may limit numbers, because Shags compete with penguins and albatrosses for suitable sites (Falla *et al.* 1978); considered unlikely (G.F. van Tets). Diving depth when foraging not known.

DISTRIBUTION AND POPULATION Endemic to NZ, restricted to Bounty Is. Possible vagrant to Antipodes Is; two birds reported Nov. 1950 (Warham & Bell 1979) though identification not established according to Robertson & van Tets (1982). Distribution round islands not known but probably do not usually range far.

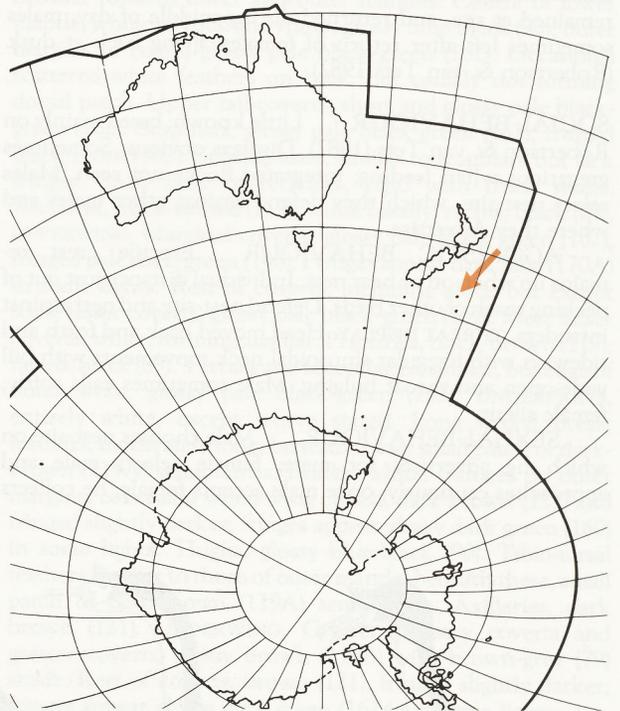
BREEDING Colonies, Nov. 1978, from Robertson & van Tets (1982).

West Grp: Proclamation, 40; Tunnel, 60; Depot, 22; Ranfurly, 132; Lion, 330; Spider, 24; Ruatara and Penguin, 0.

Centre Grp: Funnel, 132; Prion, 140; Coronet, 40.

East Grp: Molly Cap, 80; North Rock, 142.

Status, probably vulnerable; small population restricted to one island group.



MOVEMENTS Apparently sedentary, no confirmed records away from Bounty Is (see Distribution).

FOOD Fish and marine invertebrates. **BEHAVIOUR** Food caught by diving; to dive from surface, birds first jump higher than body-length above water. Feed in groups of up to 300. When nesting, females feed in morning, males afternoon (Robertson & van Tets 1982).

ADULT Stomachs (n=9; Robertson & van Tets

1982) contained fish 89% freq., snail shells 89, cephalopods 44, isopods 44, hermit crab 11, crab 11, sea urchin 11. Pellets contained beaks of small cephalopods, bones and otoliths of small fish, fragments of snail shells, snail shells containing hermit crabs and sea urchin spines. Also recorded taking a small red fish, though principal food purported to be small pelagic crustaceans (Oliver).

SOCIAL ORGANIZATION Little known; based mainly on Robertson & van Tets (1982) and information supplied by G.F. van Tets. Solitary or gregarious; congregate for feeding; nest colonially on cliff-side ledges and narrow ridges. During breeding season feeding group of c. 300 recorded; over half of which immature.

BONDS No systematic information. Courting recorded in Nov. Both parents incubate and tend young until contact lost some time after fledging.

BREEDING DISPERSION Colonial; nest along narrow ridges, cliffs and ledges safe from wandering seals, penguins and albatrosses; centres of adjacent nests c. 1 m apart. Territorial; nest-site chosen and defended by male and used for courtship; defended by male and female during nesting; roosting sites probably defended.

ROOSTING Diurnal loafing on ledges of cliffs and narrow ridges; roosts probably similar. No systematic information on arrival and departure times; in mated pairs at nest, female left, presumably to forage, in morning, while male remained at site, and returned during middle of day; males sometimes left after return of females, flying back at dusk (Robertson & van Tets 1982).

SOCIAL BEHAVIOUR Little known; based mainly on Robertson & van Tets (1982). Displays obvious. Sometimes gregarious when feeding; integrated flocks not seen. Males select nest-site, which they defend against other males and where they Advertise.

AGONISTIC BEHAVIOUR Erectile crest remains up when on or near nest. Individual distance just out of pecking reach of other birds. Defend nest-site and nest against intruders. **THREAT DISPLAY.** Head moved back and forth and sideways with irregular sinusoidal neck movements with bill wide-open and throat bulging. Male sometimes calls softly; female silent.

SEXUAL BEHAVIOUR Male chooses nest-site on which he advertises for mate; female selects male and approaches cautiously; once male accepts female, he collects

nest material and brings it to female who constructs nest. Males **ADVERTISE** at nest-site by **Gargling** (Fig. 1): head swung back through vertical arc until crown and nape touch rump; usually body becomes vertical and bill opened as head reaches rump; tail raised almost vertically and wings droop beside body; head then swung back to starting position and bill may snap shut as head returns to forward position. Bill may remain wide open to repeat display or to progress to **Gaping**. Male once heard calling softly; inaudible more than 1.5 m away. **RECOGNITION** displays include **Gaping**, **Nest-worrying** and **Head-lowering** and are performed on nest-site. **Gaping** (Fig. 2): bill held wide open, pointed forward or upward, and moved to and fro and sideways above front of body; tail raised above horizontal. Males call softly; females silent. **Nest-worrying:** with bill, bird worries nest-material or tail of mate beside the nest; by either sex, used as recognition, not threat, display. **Head-lowering:** bird raises and lowers head in front of body with bill closed and horizontal; usually body horizontal but tail held below horizontal. Often performed by male and female synchronically. **OTHER DISPLAYS AT SITE.** **Pre-take-off Posture** (Fig. 3). Adopted at departure: neck held high, almost vertically, but slightly bent, with head held high and forward; bill closed or partially open and pointed downward slightly. Abdomen and base of neck pulsate and males utter ticking sound; females silent. **Kink-throating** (Fig. 4). Main attitude when approaching nest-site, usually continuing after landing and also when birds manipulating nest material near nest-site; consists of forward protrusion of hyoid bones, giving throat characteristic kink; bill closed.

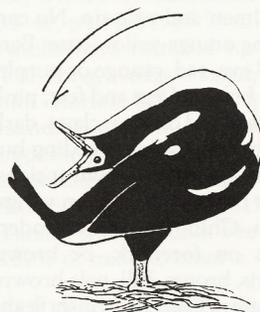


Fig. 1 Gargling

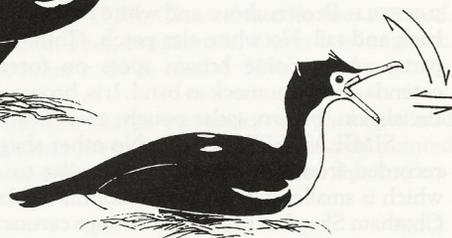


Fig. 2 Gaping

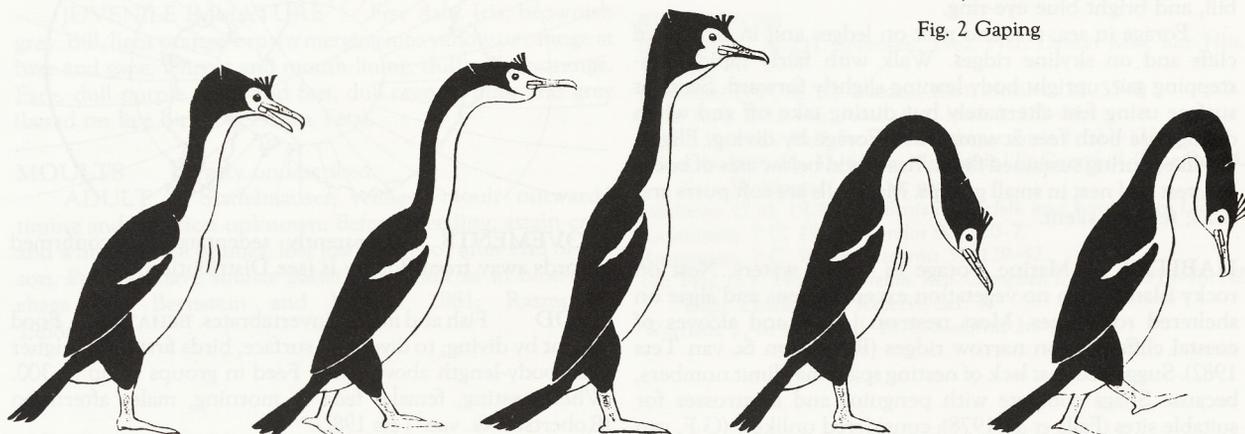


Fig. 3 Pre-take-off Posture

Fig. 4 Kink-throating

Fig. 5 Post-landing Posture

Fig. 6 Pre-hop Posture

Fig. 7 Penguin-walking

Near nest male calls softly, female silent. **Post-landing Posture** (Fig. 5). Exaggerated and ritualized recovery after landing, given during pair formation: head raised with bill horizontal and throat bulged; neck and body almost vertical and tail held below horizontal. Both sexes silent. **Penguin-walking** (Fig. 7). Done when walking through colony; especially performed by male gathering nest material and by female searching for mate. Bird walks with upper neck arched; closed bill pointed vertically down though somewhat away from breast; wings folded tightly on top of back and tail below horizontal. If leaving nest, sometimes preceded by Pre-hop Posture (see below); if ends near nest, may be followed by Kink-throating or Post-landing Posture. **Hop**. Given at or near nest-site; symbolic flight starting with Pre-flight Posture and ending with Post-flight Posture; varies from flying from one part of the colony to another, **Circle-flying** away and back to nest-site, to alternating between Pre- and Post-flight displays without feet leaving ground. **Pre-hop Posture** (Fig. 6) differs from Pre-take-off Posture in that neck arched and closed bill directed vertically downward; male sometimes calls softly; female silent. **Post-hop**. Like Post-landing Posture. **COPULATION**. Takes place at nest-site; no details. At change-over, when male about to rise from nest during incubation, gives ticking call and base of neck pulsates.

RELATIONS WITHIN FAMILY GROUP Female constructs nest from material brought by male. Both sexes incubate. During incubation, both sexes bring additional material to nest after change-over. No further information.

VOICE No studies and poorly known; some information from Robertson & van Tets (1982). Generally silent, except when breeding; no reports of calling at sea. Mostly call at nest-site, associated with breeding behaviour. Males make soft purring and ticking sounds, audible only from close range (1–2 m). Only males call; females are silent, though female once heard making almost inaudible puffing sound during copulation; probably involuntary during treading. No information on individual differences.

ADULT MALE When Threatening, males make soft *borrr-borrr-borrr*. . . **Gaping Call**: soft *he-he-he*. . . **Pre-take-off Call**: birds sometimes utter ticking *t-t-t*. . . **Kink-throating Call**: soft *herr-herr-herr*. . ., *corr-corr-corr*. . . or *horrr-horrr-horrr*. . . **Hop**: sometimes starts with ticking *t-t-t*. . . and ends with soft *aw-orgh*. Once bird heard to give soft *hargh* during Gargling.

YOUNG No information.

BREEDING Very poorly known; no detailed studies; observations by Robertson & van Tets (1982); contributed by G.V. van Tets. Nests colonially, unmixed with other species, on rough ridges and on sea-cliffs.

SEASON Laying in Oct. and Nov.; hatching first noted on 17 Nov. (Robertson & van Tets 1982). No further details.

SITE On ground on ridges; on ledges, in clefts and niches of sea-cliffs.

NEST, MATERIALS Open, flattened bowl about 35 cm across and 15 cm high, made mostly of brown seaweed *Marginariella*, a cone-like epiphyte that grows on it, some feathers, pebbles and debris. Seaweed collected by male diving to 10 m at least in rough water, where surge may help birds to loosen weed and so to gather it; when exposed, seaweed becomes sticky and helps to bind nest together and hardens. Centres of nests about 1 m apart. Male selects site; female

builds with material brought by male. Building continues during incubation and nestling periods.

EGGS Undescribed.

MEASUREMENTS. 64 (58–69;20) x 41 (39–46) (Robertson & van Tets 1982; G.F. van Tets).

CLUTCH-SIZE Said to be 2–3 (Oliver; Robertson & van Tets 1982). No further information on other aspects of nesting cycle.

PLUMAGES

ADULT BREEDING Age at first breeding unknown. **HEAD AND NECK**. Crown and side of head, glossy black-green (162) with blue-black (90) sheen. Small erectile crest on fore-crown; feathers 34–63 mm long and glossy pale black-green (162). Thin white nuptial plumes (as found on Auckland and Campbell Shags) not found on any specimens examined, but may occur. Anterior margin of cheeks, bare. Lores, largely bare, with small black-brown (119) papillae. Gular pouch, naked. Rest of neck, white; feathers on throat extend on to basal quarter of gular pouch, in sharp inverted V. Demarcation with dark feathering of neck, begins at base of lower mandible and extends below cheeks and down sides of neck. Feathers of head and neck have silky texture. **UPPER-PARTS**. Feathers of mantle, glossy pale black-green (162), fringed pale dark-green (146); fringes appear dark-blue (170A) in some lights. Fringes on mantle become progressively broader towards lower and outer margins. Centre of lower mantle, whole of back and rump, glossy blue-black (90); outer margins of rump, glossy pale black-green (162). Occasional scattered white feathers on back, but usually not forming dorsal patch. Upper tail-coverts, short and glossy pale black-green (162). Scapulars, glossy pale black-green (162), fringed black-green (162). Subscapulars, similar to scapulars but lack fringes. **TAIL**. Base of rectrices, rigid with thick shafts. Rectrices, black-brown (119), white basally; rachis, 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, but except 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**, entirely white, except where stated. Long lateral breast feathers, moderately long; beneath these, small patch of dark-brown (119A) semiplumes. Flanks, white; feathers on outer margins, concealed when wing closed, 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 those of outer mantle; beneath these, small 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, brown (121), fringed slightly darker; fringes appear glossy dark green (162A) in some lights.

ADULT NON-BREEDING Similar to adult breeding but no crest.

DOWNY YOUNG Undescribed; probably similar to Campbell Shag.

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. Throat, white; feathers extend on to basal quarter of gular pouch in inverted V and on to upper foreneck in elongate elliptical shape. **UPPERPARTS**. Mantle and scapu-

lars, dull glossy pale black-green (162), fringed dark brown (119A); fringes, broader towards outer and lower margins of mantle. Subscapulars, similar to mantle feathers, lack 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). UNDERPARTS, entirely white, except where stated. Demarcation of dark lower neck, at junction of upper breast, convex. Lateral breast-feathers, white, variably 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. Tibio-tarsal feathers, dull glossy pale black-green (162), fringed dark brown (119A); beneath these feathers, small patch of dark brown (119A) semiplumes. 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 becomes progressively broader and more prominent, from lesser towards greater coverts. Remiges, black-brown (119); all have pointed tips to webs. Humeral, short and black-brown (119). Secondaries and tertials, tipped brown (119B) to dull white; latter colour particularly on tertials. UNDERWING. Greater primary coverts and greater coverts, glossy brown-grey (79) with dark brown (119A) shade. All other coverts, dark brown (119A).

BARE PARTS Information based on photos in NZRD and NZDOC library, except where stated.

ADULT BREEDING Iris, brown (121C). Eye-ring, loral skin and anterior of cheeks, dull orange (94). Oliver describes eye-ring as purple; facial skin, scarlet with black spots; gular pouch, scarlet merging to orange near bill. At curvature of upper mandible to gape, sphincter pink (6) merging to dull orange (94). Tomia, dark brown (219A); tip, light grey-brown (119C). 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.

JUVENILE Few data. NZRD states: Iris, pale brown. Face and eye-ring, brown. Bill, brownish flesh-colour.

MOULTS See Auckland Shag.

MEASUREMENTS (1) Adult skins (OM, NMNZ, CM). (2) Adult skins; methods partly described (Robertson & van Tets 1982). Additional measurements in Oliver.

	MALES	FEMALES
WING	(1) 291.6 (4.35; 285-300; 8) (2) 294.0 (285-300; 11)	279.5 (4.89; 272-289; 7) * 278.0 (272-287; 10)
8TH P	(1) 165.8 (4.51; 161-173; 7)	157.0 (4.84; 149-162; 4) *
TARSUS	(1) 67.7 (2.03; 64.2-72; 8) (2) 69.0 (67-71; 10)	65.9 (2.00; 62.1-68.8; 8) 67.0 (65-70; 10)
BILL	(1) 58.2 (1.21; 56.2-60; 8) (2) 59.0 (56-62; 11)	55.1 (1.27; 53.2-57.3; 7) * 55.0 (52-59; 8)
TAIL	(1) 125.4 (4.83; 117-133; 7) (2) 127.0 (117-134; 11)	115.3 (0.94; 114-116; 3) * 116.0 (107-137; 8)
TOE	(1) 85.3 (1.53; 82.9-88.1; 8)	81.7 (2.02; 78.7-84.3; 8) *

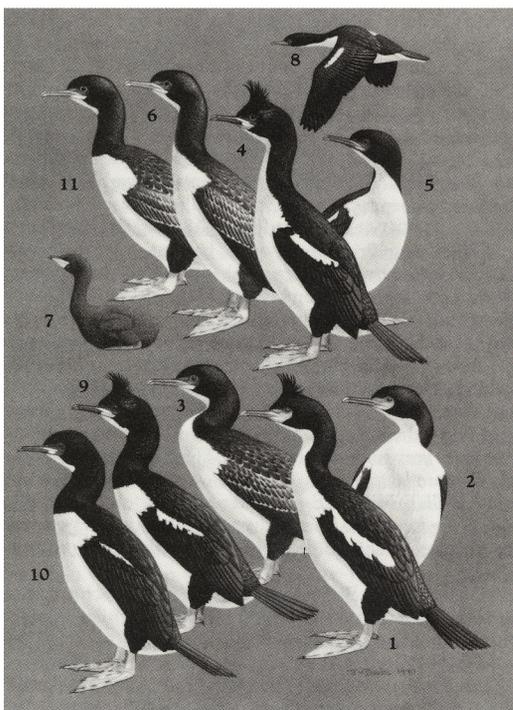
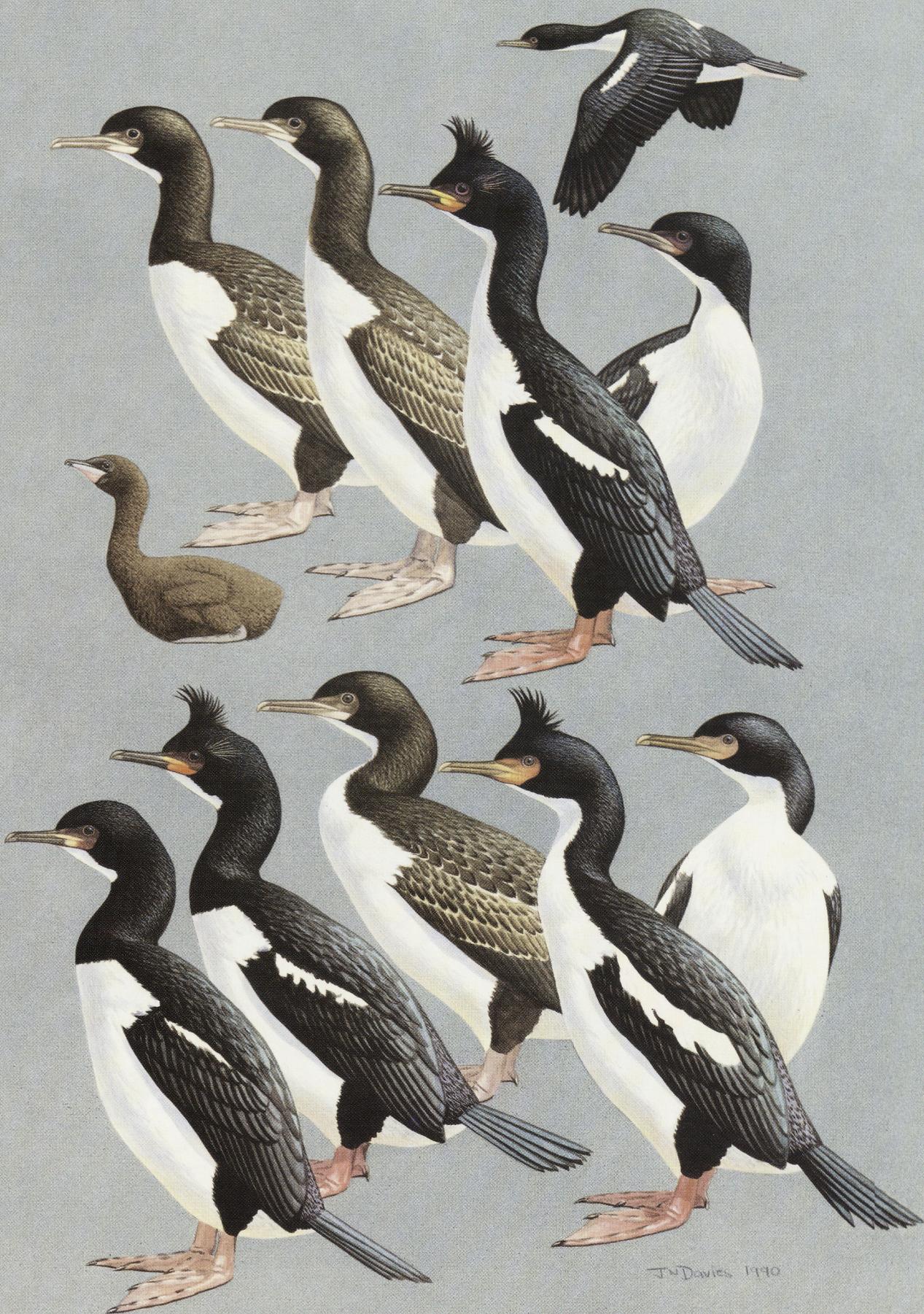
WEIGHTS From Robertson & van Tets (1982; label data from skins): males 2500 (2300-2900; 7), females 2500 (2000-2700; 6). No data on seasonal changes.

STRUCTURE Wing, broad. Eleven primaries: p8 usually longest, p10 3-20 mm shorter, p9 0-13, p7 0-30, p6 9-46, p5 26-62, p4 40-69, p3 52-82, p2 63-87, p1 73-88, p11 minute. Adults have rounded tips to remiges; pointed in juveniles. Tail, long and wedge-shaped. Twelve rectrices, t1 longest, t6 26-45 mm. Bill, long and 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. Pattern of throat in adults and juveniles illustrated in Mathews (1928). Claw of middle toe, serrated. Feet, totipalmate. Outer toe longest c. 140% of middle, inner c. 64%, hind c. 42%.

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