

## 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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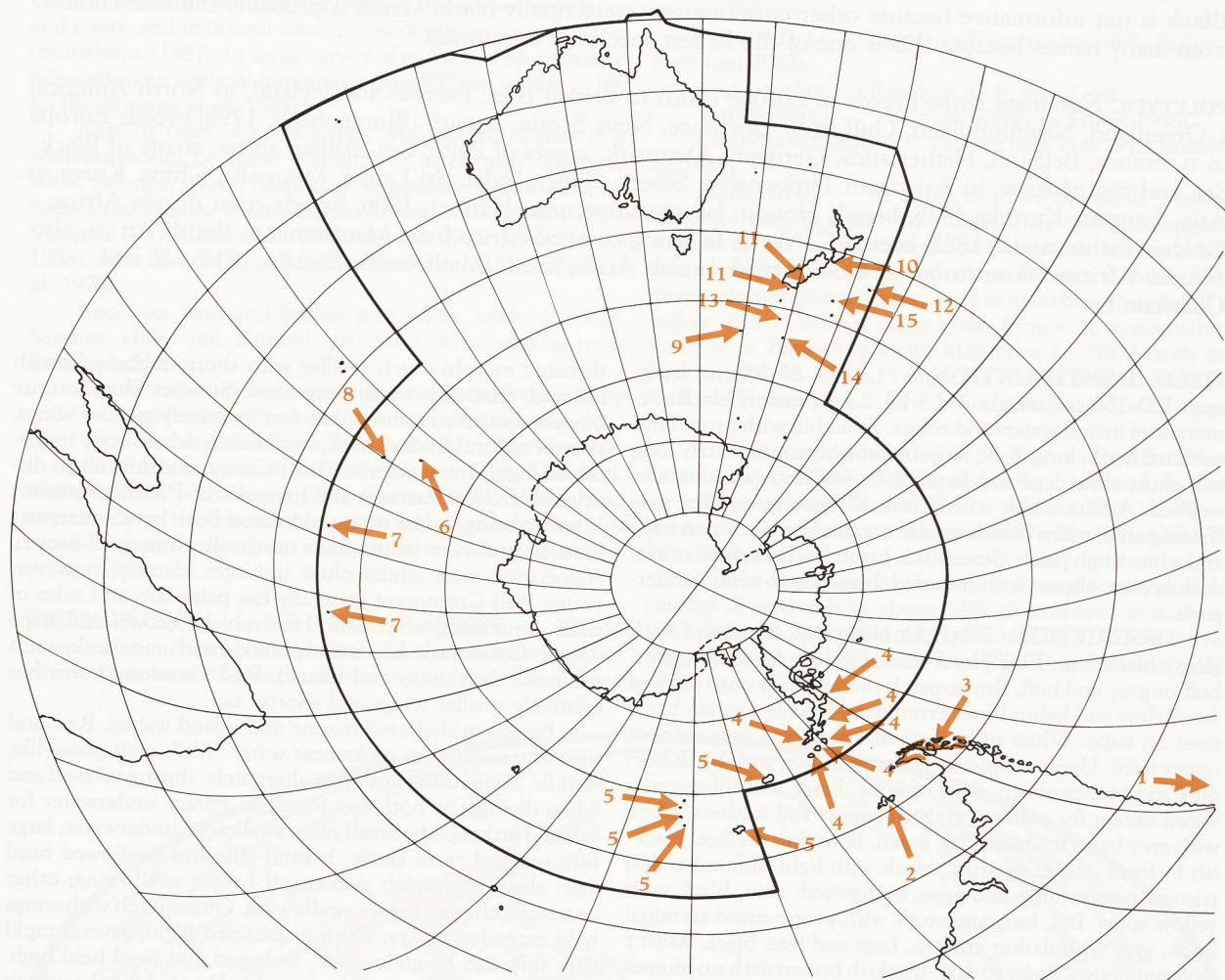


Fig. 1. Distribution of island forms of *Phalacrocorax*.

- |    |                               |    |                  |
|----|-------------------------------|----|------------------|
| 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 colensoi* Auckland Shag

COLOUR PLATE FACING PAGE 932

*Phalacrocorax colensoi* Buller, 1888, *Birds NZ*, ed. 2, 2: 161 — Auckland Island.

Named in honour of Rev. William Colenso, FRS, (1811–99) naturalist and missionary in New Zealand.

## MONOTYPIC

**FIELD IDENTIFICATION** Length 63 cm; wingspan 105 cm. Small black-and-white shag confined to Auckland Is. Sexes alike in plumage but differ in voice and courtship behaviour. Seasonal difference in appearance. Immatures separable.

**DESCRIPTION** **ADULT BREEDING.** Head and hind-neck, black with blue sheen; demarcation of black hindneck and white throat starts at sides of chin, leaving throat white. Long black recurved crest on forehead (becomes shorter during nesting). Upper wing-coverts, dark purple-grey with green sheen and narrow indistinct black borders. White alar patches vary from prominent to absent. White scapulars occasionally

occur. White dorsal patches on some males; not on females. Back, rump, thighs and upper tail-coverts, black with blue sheen. Tail, black with white bases to shafts. Colour of fore-neck varies, from thin white strip connecting white throat and breast to a complete broad black band, which may be spotted in some birds. Rest of underparts, white. Underwing, black. Bill, blackish grey with orange tip to lower bill. No caruncles at base of bill, but has long, slightly warty orange line from base of upper mandible to gape. Lower mandible has short line of orange skin at base. Eye-ring, shiny violet-purple; rest of facial skin, dark purple to dull red; gular pouch and mouth-lining, orange-red. Iris, dark purple or brown. Legs and feet, pink with dark-grey smudges; soles, dark grey; claws, black. **ADULT NON-BREEDING.** No crest; black plumage fades (in Dec. and Jan when eggs hatching) to brown. Bill, dark brown; gape lines, yellow; eye-ring, pink or pale shiny purple. **IMMATURE.** Upper surface, brown glossed with green; rump and thighs darker. Alar patches, sandy or off-white if present. Underparts, white except for brown band or spots across foreneck (in some birds). Facial skin, brown.

**SIMILAR SPECIES** **Little Pied Cormorant** *P. melanoleucos* and **Great Cormorant** *P. carbo* occur as vagrants at Auckland Is but have long wings and tail, black feet and no white on upper surface of wings. Distribution of white in plumage and colour of soft parts of Little Pied and Great Cormorants also very different. Auckland Shag closely resembles **Campbell Shag** *P. campbelli*, but latter has uniform black on foreneck and never shows white feathers on back. Demarcation between black and white on upper breast is straight and clean in Campbell Shag, but irregular in darkest examples of Auckland Shag.

Forage at sea and in marine inlets and bays. Rest and nest on tussocks and on ground under bushes and trees along edges of precipitous cliffs. Walk with fairly rapid high-stepping gait, upright body leaning slightly forward. Swim on 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 include ticking sounds and barks; females make soft, almost inaudible, puffing sounds.

**HABITAT** Marine. Forage far out at sea or in inshore waters in bays and inlets. Rest and nest in alcoves, on ledges, and on tops of very steep, coastal cliffs; on bare ground, among tussock grass or under bushes, trees or overhanging rocks. Nests may be destroyed by high tides or storm waves. When sheltering plants killed by guano deposition, site abandoned (G.F. van Tets).

**DISTRIBUTION AND POPULATION** Endemic to NZ; restricted to Auckland Is and adjacent waters. Breed on Auckland I. (population <2000; Robertson & Bell 1984), Enderby I. and C. Crozier (Oliver).

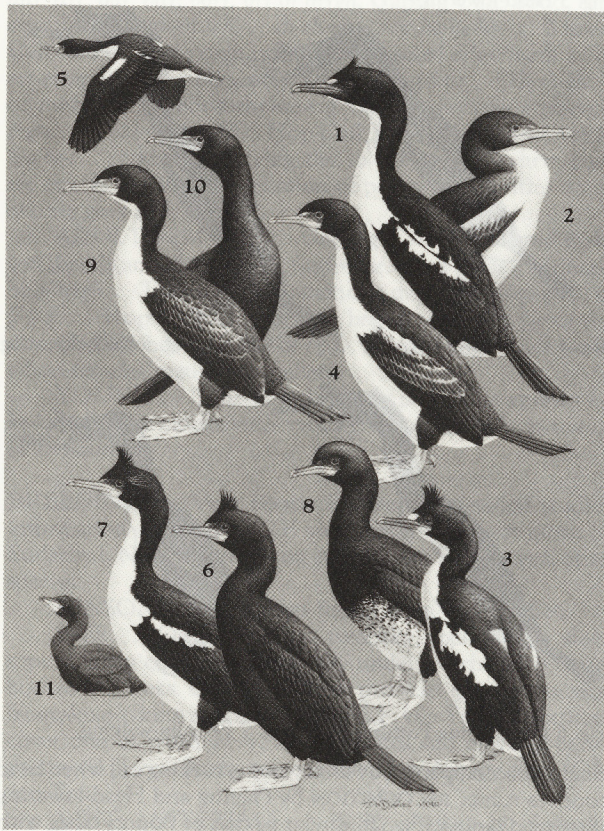


Plate 64

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



**MOVEMENTS** Sedentary, no records away from Auckland I.

**FOOD** Specimens from large flocks seen feeding offshore contained anomuran crustacean *Munida subrugosa* and fish bones (Waite 1909). Pilchards also recorded (Oliver).

**SOCIAL ORGANIZATION** Little information; supplied by G.F. van Tets. Solitary or gregarious; may congregate for feeding and roosting; nests colonially on ground.

**BONDS** No systematic information. Both parents incubate and tend young until contact lost some time after fledging.

**BREEDING DISPERSION** Nests in small groups and large colonies among tussocks, rock ledges and along tops of steep cliffs; does not mix with other species. Territorial, defending nest-site only.

**ROOSTING** Solitary or in small groups on bare grounds. No systematic information on times of departure and arrival. In mated pairs, during breeding season, females leave nesting area shortly after dawn to forage and return during middle of day; males leave shortly after return of their mate and arrive back before dusk.

**SOCIAL BEHAVIOUR** Little information; account based on observations by G.F. van Tets at Enderby I., Auckland Is. Displays obvious. Most displays similar to those of Bounty Shag; differences described below. In mated pairs, before departing to feed, gather nest material; also evacuate residual food remains and debris by regurgitating pink wrinkled pellet; before regurgitation, neck swells up and males utter accelerating sound and females, soft sound. Pellet usually eaten by Silver Gulls *Larus novaehollandiae* scavenging round colony.

**AGONISTIC BEHAVIOUR** Nape line and erectile feathers of head and neck like Bounty Shag. Individual distance just out of pecking reach of other birds. Defend nest against intruders. **THREAT.** Similar to Bounty Shag but males make either single or repeated call, females silent or call softly. Nest maintained by pecking and tugging at it with bill, thus fluffing it up to provide more insulation.

**SEXUAL BEHAVIOUR ADVERTISEMENT.** Male performs **Gargling** (Fig. 1): head swung backwards and body held almost vertical as head reaches rump; wings droop beside body and tail raised above horizontal; bill open, slightly open or closed; display repeated many times at slow irregular rate.

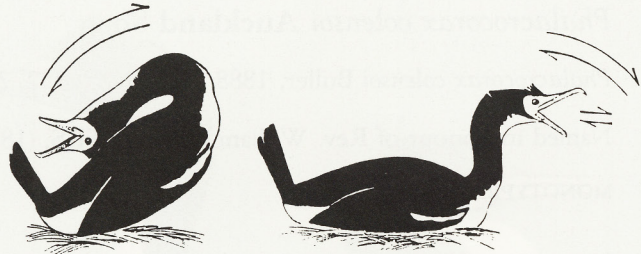


Fig. 1 Gargling

Fig. 2 Gaping

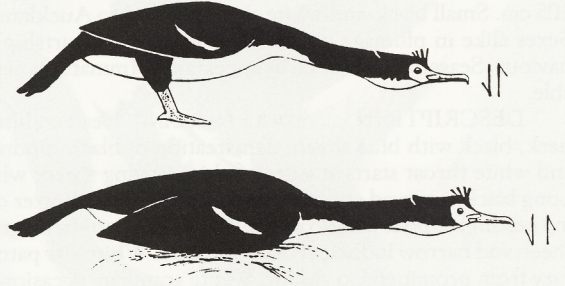


Fig. 3 Head-lowering

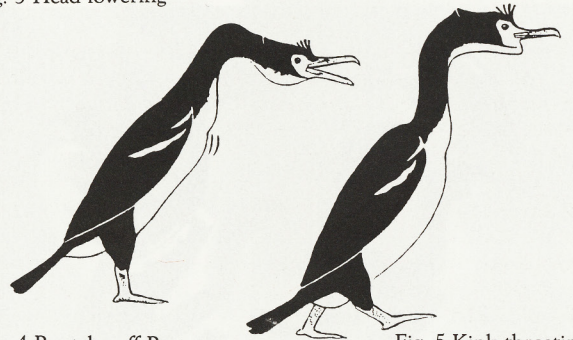


Fig. 4 Pre-take-off Posture

Fig. 5 Kink-throating

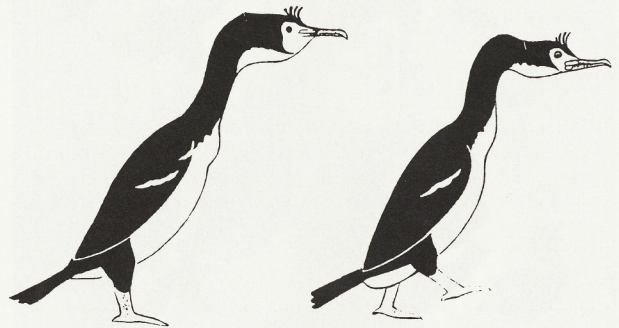


Fig. 6 Post-landing Posture

Fig. 7 Penguin-walking

Silent or accompanied by loud varying barking call when head touches rump. **RECOGNITION** by Gaping and Head-lowering displays. **Gaping** (Fig. 2): similar to that of Bounty Shag with bill moving back and forth in front of body. Area at base of neck and breast pulsates and males utter loud raucous barking and female soft, barely audible puffing sounds. **Head-lowering** (Fig. 3): similar to that of Bounty Shag; birds usually silent. Once, male made ticking sound, repeated 21 times, when mate took long time to relieve him at nest; possibly an incipient Pre-take-off Call. **Pre-take-off Posture** (Fig. 4): bird stands erect with neck arched higher than head; slightly to half-open bill directed forward and downward. After launching itself with kick, feet sometimes touch above tail. Breast

and base of neck pulsate and male utters ticking sound, females are silent. **Kink-throating** (Fig. 5): similar to Bounty Shag with bill closed; male calls repeatedly, female silent. **Post-landing Posture** (Fig. 6): very similar to that of Bounty Shag. Head held high, bill closed and horizontal, throat bulged and body vertical. No sound made. **Pre-Hop Posture**: does not differ from Pre-take-off Posture; males make ticking sound and females a soft sound. **Post-hop Posture**: similar to Post-landing Posture; males make varying barking sound and females a soft single or repetitive call. **Penguin-walking** (Fig. 7) similar to that of Bounty Shag, but closed bill held horizontal or, on occasions, slopes downwards slightly.

**RELATIONS WITHIN FAMILY GROUP** No information.

**VOICE** No detailed studies; information supplied by G.F. van Tets from observations at Enderby I. Generally silent; no report of calls away from nest-sites. Males have range of barking and ticking sounds; females make very soft, almost inaudible, puffing sounds. No information on individual differences or geographical variation.

**ADULT MALE** **Gargling Call.** Loud and varying *ahr, arr, ohr, bar, borrr, orr* or *orrh*. **Gaping Call.** Loud, raucous barking *ah-ah-ah... eh-eh-eh... or he-he-he... Threat Call.* Either single *argh* or *ergh* or repeated *erh-erh-erh... or err-err-err... Pre-take-off Call.* Ticking *t-t-t... eh-eh-eh... or hu-hu-hu... Kink-throating Call.* Repetitive *ergh-ergh-ergh... or oh-orgh-orgh... Hop Call.* Display begins with ticking *t-t-t...; ends with varying aho, au-erh, aurgh, owrrrr, ergh, err* or *orh*. During regurgitation of pellets, males utter accelerating *gock-gock-gock...*

**ADULT FEMALE** **Gaping Call:** sometimes make soft, barely audible *ff-ff-ff... fee-fee-fee... eh-eh-eh... or hegh-hegh-hegh... Threat Call.* Sometimes make soft *gf-gf-gf... or ff-ff-ff... Hop Call.* Hop display begins with soft *fee* or *e-e-e...; display ends with hee* or *f-f-f... Soft ff-ff-ff... also heard when females regurgitate pellets.*

**YOUNG** One-day-old chicks beg with a squeaky *ke-ke-ke...; older chicks with varying te-twee, twe-ah, zz-twe-ah* or *terr-zwe-ah*.

**BREEDING** Very poorly known; no detailed studies; information supplied by G.F. van Tets from observations on Enderby I. Nests colonially on ground, not mixing with other species.

**SEASON** Fresh eggs found from Nov. to Feb.

**SITE** On ground, on tussocks, rock ledges, along tops of steep coastal cliffs; usually under overhang or under bushes and trees. Overhead cover provides some protection from skuas taking eggs and chicks (G.F. van Tets); if overhead cover dies or worn away, abandon sites and move to better protected places. Storm waves sometimes destroy nests (G.F. van Tets).

**NEST, MATERIALS** Bulky shallow bowl-shaped structure, made of tussock grass with some twigs, seaweed, peat and debris. Centres of nests about 75 cm apart. Probably use same nests each year (G.F. van Tets).

**EGGS** Elliptical ovoid; mat, with rough texture; pale blue with smooth chalky coating.

**MEASUREMENTS:** 62 (55–66; 32) x 39 (36–49) (G.F. van Tets & H. Best).

**CLUTCH-SIZE** No quantified data. Mode, three.

**LAYING** At intervals of 48 to 96 h (G.F. van Tets).

**INCUBATION** By both sexes. Relief soon after dawn when female leaves to feed; she returns about mid-day when male leaves and returns before dusk. **INCUBATION PERIOD.** First eggs: 28, 28, 29 and 32 days; for one second egg, 26 days (G.F. van Tets).

**NESTLING** Altricial, nidicolous; hatched naked, grey or black skin; acquires grey down; throat and lower mandible, pink (G.F. van Tets). Fed by both parents by incomplete regurgitation and guarded till large enough to defend themselves. Mode of broods, two (G.F. van Tets). No further information on aspects of breeding cycle, fledging, maturing or success.

**PLUMAGES** Age at first breeding, unknown.

**ADULT BREEDING HEAD AND NECK.** Crown and sides of head, glossy black-green (162) with blue-black (90) shade. Long erectile crest 53–63 mm long on forecrown. Above and behind eye, long thin white nuptial plumes. Lores and front part of malar region, bare; lores covered with sparse black-brown (119) papillae. On some birds, long elliptical patch of white feathers from throat to foreneck: maximum dimensions 20–40 x 102–114 mm; varying; white feathers often continuous with underparts, and width of continuous line varies. Gular pouch, bare. On gular pouch, throat-feathers extend on to basal quarter and terminate sharply in an inverted V. Rest of neck, glossy blue-black (73). Feathers of head and neck have silky texture. **UPPERPARTS.** Mantle, glossy pale black-green (162), fringed pale dark-green (146); fringes appear dark blue (170A) in some lights. Fringes become progressively broader from upper mantle towards lower and outer margins. Centre of lower mantle, whole of back and rump, glossy blue-black (90). On back, varying sized patch of white feathers but in some birds none. On outer margins of rump, feathers glossy pale black-green (162); upper tail-coverts similar, short. Scapulars, glossy pale black-green, fringed black-green (162); subcapulars similar but duller and lack fringes. **TAIL.** Rectrices, black-brown (119). Rachis rigid, 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 except some lesser coverts, glossy pale black-green (162). Most lesser coverts, white; form alar bar. Primaries and short humerals, black brown (119); rachis, black (89). Tertiaries and secondaries similar to primaries, but edge of outer webs, glossy pale black-green (162). **UNDERPARTS.** When elliptical throat patch occurs, demarcation between white and dark feathering at junction of upper breast and lower neck, convex. Underparts, white except where stated. Lateral breast feathers moderately long; beneath these feathers, small patch of dark-brown (119A) semiplumes. Flanks white; feathers on outer margins concealed when wing closed, dark brown (121), 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 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 and no white nuptial plumes above and behind eye.

**NAKED YOUNG** Hatched naked with grey or

black skin (G.F. van Tets).

**DOWNY YOUNG** Down, grey (G.F. van Tets); no further information.

**JUVENILE, IMMATURE** **HEAD AND NECK**, dark brown (119A), feathers with black-brown (119) or glossy pale black-green (162) tips in some lights. Facial feathers, wholly brown (119B). Gular pouch, naked. Throat, white; feathers of throat extend on to basal quarter of gular pouch in inverted V. White feathers of throat extend to upper foreneck in elongate elliptical shape. Shape of pattern varies but always present; in most specimens, white feathering extends to upper breast in narrow margin and often not prominent. **UPPERPARTS**. Mantle and scapulars, dull glossy pale black-green (162), fringed dark brown (119A); fringes broader towards outer and lower margins of mantle. Subscapulars similar to mantle feathers, without 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 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 becomes progressively broader and more prominent, from lesser coverts towards greater coverts. Remiges, black-brown (119); all have pointed tips to webs. Humerals, short, black-brown (119). Secondaries and tertials, tipped brown (119B) to dull white; latter colour particularly on tertials. **UNDERPARTS**, entirely white, except where stated. Demarcation of dark lower neck, at junction of upper breast, convex. 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. Tibio-tarsal 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, 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, dark brown (219). Eye-ring, dull orange (94). Loral skin and anterior of cheeks, dark grey (83). Oliver describes eye-ring as purple, facial skin dark brown with red gular pouch. At curvature of upper mandible to gape, similar to loral skin. At base of lower mandible, 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** Throat and lower mandible, pink (G.F. van Tets); no further information.

**JUVENILE** Few data. Iris, dark-brown (221).

**MOULTS** Largely undescribed.

**ADULT** Staffelmauser; remiges moult outwards; timing and duration unknown. Before breeding (about Oct.–Nov.) attains crest and white nuptial plumes; plumes lost after pair-formation and crest wears away during breeding season. Possibly pattern of moult similar to that of Antarctic Shag (see Bernstein & Maxson 1981; Rasmussen 1988a,b).

**POST-JUVENILE** Undescribed.

**MEASUREMENTS** (1) Adult skins (NMNZ). (2) Skins (CM, OM, AM; G.F. van Tets). Additional measurements in Oliver.

	MALES	FEMALES
<b>WING</b>	(1) 282.6 (9.04; 265–291; 5) (2) 269 (8; 255–283; 12)	268.2 (3.63; 262–271; 4) * 263 (13; 237–278; 15)
<b>8TH P</b>	(1) 161.0 (2.54; 158–165; 4)	162.0 (2.0; 160–164; 2)
<b>TAIL</b>	(1) 120.7 (3.96; 116–127; 4) (2) 117 (4; 112–126; 12)	110.5 (5.40; 104–119; 4) 115 (7; 103–126; 15)
<b>BILL</b>	(1) 51.2 (2.64; 48.9–56.1; 5) (2) 51 (2; 47–54; 10)	48.0 (0.97; 46.7–49.0; 3) 49 (2; 45–53; 15)
<b>TARSUS</b>	(1) 61.9 (2.37; 57.7–63.9; 5) (2) 63 (3; 57–67; 12)	60.0 (1.78; 57.3–62.3; 4) * 61 (2; 59–65; 15)
<b>TOE</b>	(1) 80.4 (2.7; 77.7–83.1; 2)	77.8 (1.1; 76.7–78.9; 2)

**WEIGHTS** No data.

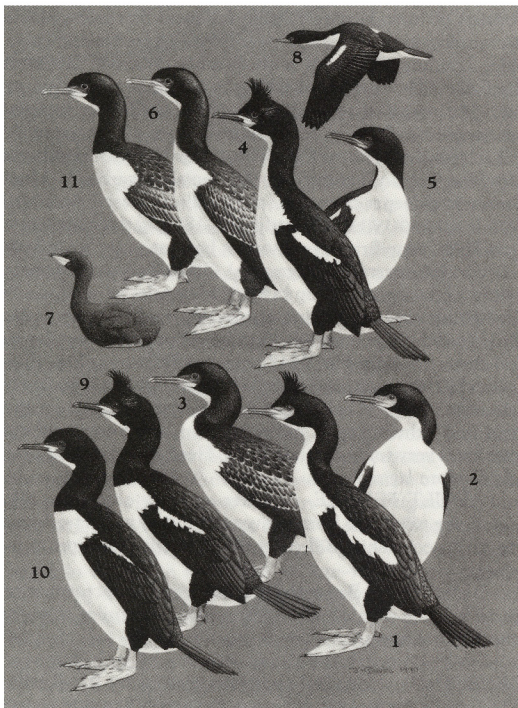
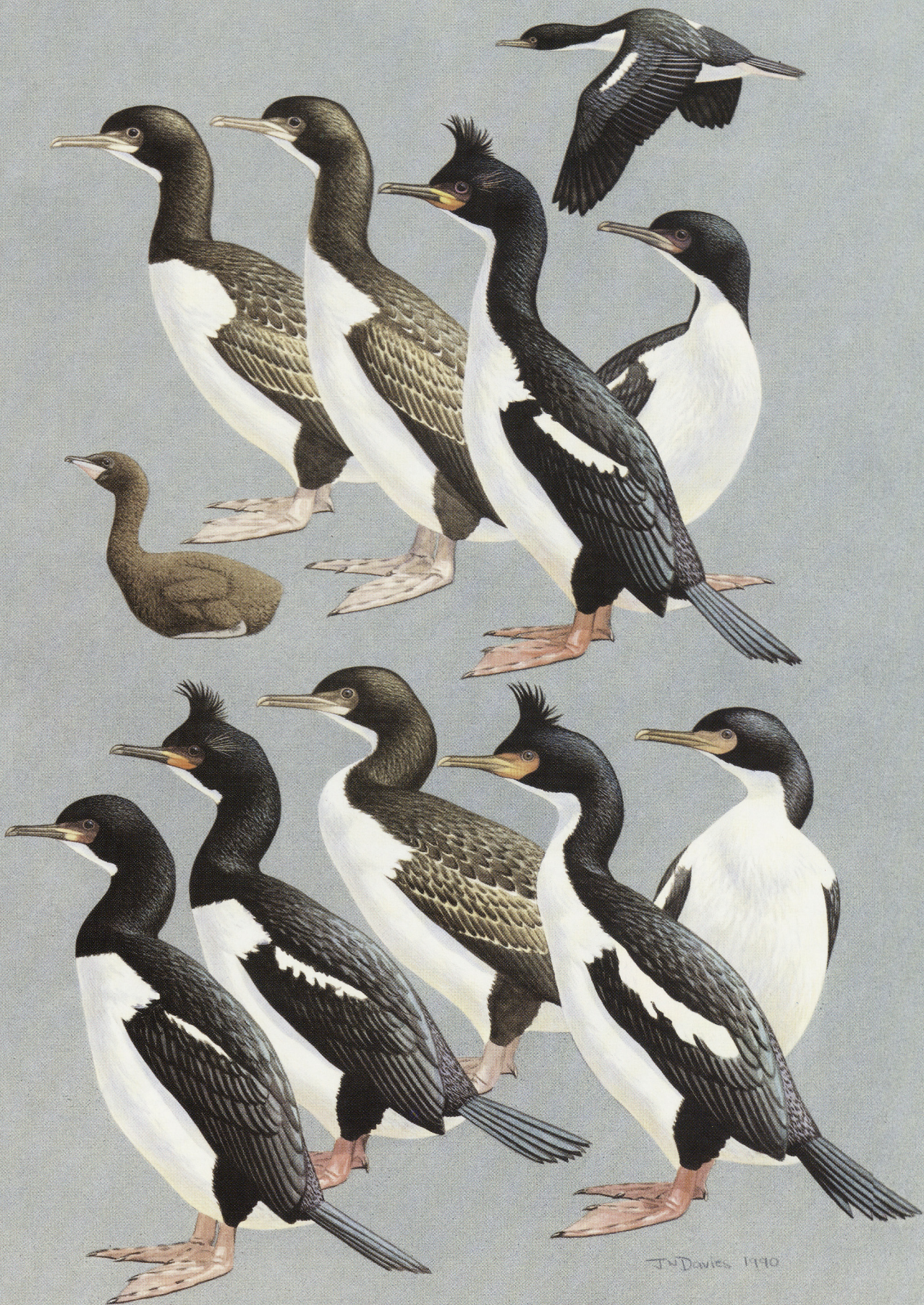
**STRUCTURE** Wing, broad. Eleven primaries, p8 usually longest, p10 10–16 mm shorter, p9 2–4, p7 0–3, p6 11–14, p5 36–44, p4 50–56, p3 58–68, p2 70–79, p1 78–89, p11 minute. Tips of remiges, rounded in adults; pointed in juveniles. Tail, long, wedge-shaped. Twelve rectrices, t1 longest, t6 34–47 mm shorter. 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. Throat patterns in adults and juveniles illustrated in Mathews (1928). Claw of middle toe, serrated. Feet, totipalmate. Outer toe longest c. 139% of middle, inner c. 66%, hind c. 41%.

**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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