

## Order ANSERIFORMES

Medium-sized to large aquatic, marine and terrestrial birds. Three families: (1) Anhimidae (screamers), (2) Anseranatidae (Magpie Goose) and (3) Anatidae (true wildfowl); Screamers confined to South America, Magpie Goose confined to Aust. and New Guinea, and rest cosmopolitan. Suggestion that the order is distantly related to Phoenicopteriformes and Ciconiiformes (see Sibley & Ahlquist 1972) now seems unlikely. Claims for some anatomical similarities with gamebirds such as Cracidae, suggesting distant affinity with Galliformes via Anhimidae and Anseranatidae (Simonetta 1963; Johnsgard 1968; Bock 1969), strongly rejected by Olson & Feduccia (1980).

All members of the Anseriformes are web-footed (in some semi-palmate) swimming (some now almost terrestrial) and diving birds that are filter-feeders or are derived from aquatic filter-feeders. They differ from Galliformes in almost every anatomical feature (see Olson & Feduccia 1980). The unique filter-feeding mechanism is diagnostic of the order. Two groups of filter-feeding birds probably evolved from some charadriiform origin; in one, the specialized mechanisms for filtering evolved in the lower mandible (flamingoes); in the other, the upper mandible housed the specialized tongue used to provide the pump-action for filtering. The complex structure of the bill and its operation during filter-feeding in a typical duck has been investigated recently (Zweers 1974; Zweers *et al.* 1977; Kooloos 1986; Kooloos & Zweers 1989; Kooloos *et al.* 1989). Sensory apparatus of the bill associated with this filtering function is likewise complex (Berkhoudt 1980). The typical bill, representing the fundamental apparatus unique to the order, acts as a double-action suction-pump in which fluid is drawn in at the tip and expelled past filter plates at the sides and rear. The tongue and internal shape of the bill provide the elaborate piston effects and the lamellae or fine plates, common to all members of the order, act as the sieves. Lamellae trap the food, which is then brushed free and swallowed by the combined actions of tongue and lamellae. Vestigial lamellae occur in screamers (Olson & Feduccia 1980). Filtering is the original feeding method and departures from it towards adaptations for grazing in geese, serrated edges for catching fish in 'saw-billed' ducks (mergansers and allies) or superficially fowl-like bill of screamers, are all derived features (Olson & Feduccia 1980). Anhimidae, however, being extralimital, are not considered further.

The innovative modern classification of the ducks, geese and swans, and the systematic order proposed by Delacour & Mayr (1945, 1946) and Delacour (1954-64), was modified by Johnsgard (e.g. 1965a, 1968) in the light of further studies, particularly on behaviour and social signals, and new information on little known species. Woolfenden (1961) and Livezey (1986) have prepared phylogenetic analyses of the order based on morphological characters, and the classification by Livezey has been followed by some recent works (e.g. Madge & Burn 1988). Madsen *et al.* (1988) provide important additional information from DNA studies and give a partial classification of the order. We have adopted the classification of Johnsgard in Peters with some modification concerning only those species within our area. Our reasons for these changes are as follows but the arrangement of species fits closely the proposed classification of the order given by Sibley *et al.* (1988) and Madsen *et al.* (1988). The arrangement is consistent with the persuasive argument presented by Olson & Feduccia (1980) concerning the origin and evolution of the order. The fossil *Presbyornis* (Eocene; North America) and the endemic *Stictonetta* (Freckled Duck) and *Malacorhynchus* (Pink-eared Duck) of Aust. have special significance in this respect (see Olson & Feduccia 1980).

Special features of *Stictonetta* are: reticulated anterior face of tarsus; lack of a syringeal bulla; no speculum; unpatterned downy young (see Frith 1964a,b). Structure of the trachea and syrinx described by Ramsey (1878) and in more detail by Campbell (1889) and in Campbell demonstrate the lack of any development of a swollen bulla in drake. Claim by Frith (1964a, 1965, 1967, 1982) that tracheal loop occurs in mature drake is unconfirmed in many hundreds of birds examined (G.F. van Tets). Long neck. Uropygeal wax esters like those of some swans (Edkins & Hansen 1972) but chemotaxonomy difficult to interpret because similarities also shown with *Cereopsis*, *Branta*, *Cairina*, *Tadorna*, *Mergus* and *Melanitta* (Jacob & Glaser 1975). Brush (1976) has shown that the feather-proteins are unique. Verheyen (1953) on skeletal characters (cranial & post-cranial) concluded that it was sufficiently distinct to be separated from other waterfowl. Clearly it shows a large number of 'primitive' characters. Olson & Feduccia (1980) emphasize several features of the cranium that are unique in living ducks: the markedly recurved rostrum and mandible and the expanded lachrymal. Livezey (1986), largely from osteological characters, supports traditional conclusions that it is the last branch of the waterfowl with reticulate tarsi and places it after the geese and swans. Faith (1989) has shown that many of these skeletal characters might be explained on divergence between diving, dabbling and grazing adaptations. Recent DNA studies (Madsen *et al.* 1988) lend some support to an earlier suggestion, based on behaviour and some morphological features, of possible similarity with Oxyurinae (Johnsgard 1965b). Fullagar *et al.* (in press) add support to idea that *Stictonetta* has several behavioural similarities with stiff-tails. The uniqueness of this species has been widely supported, but in the past the absence of information about its behaviour and ecology ensured that it remained doubtful to which other group of

wildfowl it was most closely related. Many of these deficiencies have now been resolved (see text elsewhere) and the argument for a link with stiff-tails has become more compelling. Plumages, social signals and vocalizations are all in some way most readily comparable to *Oxyura* and *Biziura* but specially to *Heteronetta*. A seasonally colourful bill in the male most closely matches the condition found in *Heteronetta* but also in most stiff-tails; sequence of moults follow unusual pattern found in at least some, if not all, stiff-tails but not known in other wildfowl, notably the presence of a post-juvenile moult including wings. Many characteristics of breeding biology (nest-construction and choice of site; small clutch-size; predisposition to dump laying; appearance and quantity of down used in lining nest; unpatterned ducklings) are features shared with most stiff-tails. In particular the unusual copulation involving greatly elongated pseudopenis is most closely comparable with features shown only by stiff-tails.

Major recommended works of reference are: **Comprehensive accounts:** Delacour (1954-64); Todd (1979); Phillips (1922-26) [ducks]; Scott (1972) [swans]; Owen (1980) [geese]. **Regional accounts:** Palmer (1976) [Nearctic]; BWP [w. Palaearctic]; Bauer & Glutz von Blotzheim (1968-69) [Europe]; Frith (1982) [Aust.]. **Field guides:** Scott (1988); Madge & Burn (1988). **Special studies:** Hochbaum (1955, 1973) and Sowls (1955) [migration and habits]; Johnsgard (1965a) [complete review of behaviour]; Hochbaum (1944); Driver (1974) and Kear & Berger (1980) [species monographs].

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Family **ANATIDAE** wildfowl

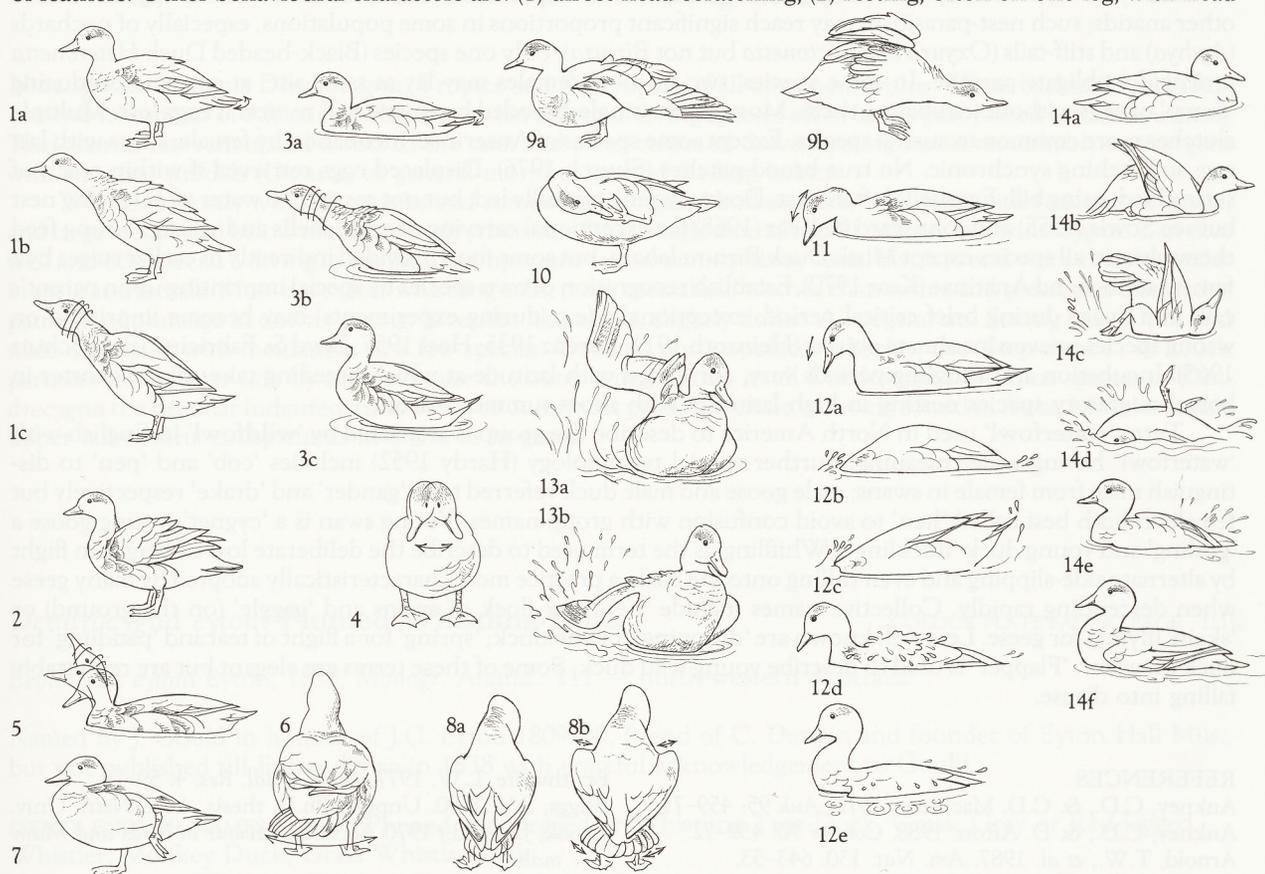
Waterbirds (some more or less terrestrial) with rather short legs and front toes connected by webs; hallux elevated and reduced. Though considerable adaptive diversity in outward appearance, size, colours of plumage, behaviour, and ecology, homogeneous in many characters, as attested by numerous, often fertile, interspecific hybrids reported, chiefly in captivity (see Gray 1958). About 160 species in six sub-families: (1) Dendrocygnae (whistling-ducks); (2) Oxyurinae (stiff-tails and Freckled Duck); (3) Anserinae (swans and geese); (4) Tadorninae (shelducks, sheldgeese and steamer-ducks); (5) Anatinae (dabbling ducks and allies); (6) Merginae (eiders, scoters, mergansers and allies).

Body, broad and rather elongated in many, though more rotund in some, especially diving species. Plumage, thick and waterproof; contour-feathers distributed over distinct feather-tracts with underlying coat of down. Neck, medium to long. Wings generally rather small; mostly pointed, fairly broad in many, but narrower in some highly migratory species. Small claws on first and second digits occur in most. Spurs—horny sheathed bones—occur in several species as projections near carpal joint; attached either to radial carpal or the metacarpal. Wing-spurs are found in the Tadorninae and *Sarkidiornis*, *Plectopterus* and *Merganetta* in the Anatinae. Eleven primaries; p9 nearly always longest, p11 minute. Wide range in number of secondaries, from 12 to 24, innermost (tertials) often long and brightly coloured; diastataxic. Many species, particularly in Tadorninae, Anatinae and Merginae have a specialized, contrastingly coloured patch (speculum) on upper surface of inner wing, important for sexual and social signalling. Most fly fast and have large, high-keeled sternum. Tail, short and square or slightly rounded in most; long in some diving species (serving as rudder), pointed or with elongated central feathers in some others. Tail-feathers, 14–24 but varying even in single species. Bills show much adaptive variation but typically of medium length, broad, often flattened centrally and distally but high at base, and rounded at tip with horny nail at tip, producing slight terminal hook; covered with soft skin. Edges of mandibles with rows of lamellae, showing different development in various ecological types and taxonomic groups; most highly specialized in surface plankton-feeders, least so in species (such as scoters *Melanitta*) that swallow molluscs whole. Tongue, thick and fleshy; epithelium covered with papillae and horny spines. Lower part of tibia and tarsus bare; front toes connected by webs (reduced in a few species), hind toe elevated. Gait, striding or waddling. Oil gland, feathered. Aftershaft, reduced or absent. Special intromittent copulatory organ present in males; vascularized sac everted from wall of cloaca, protruded by muscular action; facilitates sexing by examination (Hochbaum 1942), even of small young. Salt-secreting nasal glands subject to adaptive variation in size, even in same species; enlarged in forms inhabiting saltwater or brackish habitats, modifying profile of head considerably. In many species, males have remarkably lengthened, bent, or locally widened trachea forming resonating tubes; also syngo-bronchial sound-boxes (bullae), either fully ossified or with membranous fenestrae. These vocal structures highly characteristic of species or larger taxonomic units (see Eyton 1838 and, especially, Johnsgard 1961, 1971). Considerable diversity in types of plumage: male and female similar, nearly similar, or show extreme sexual dimorphism. In all species, except some sheldgeese, flight-feathers moulted simultaneously, producing period of flightlessness lasting 3–4 weeks. Two body-moult per cycle. Young precocial and nidifugous, covered with thick down; pattern often cryptic and characteristic of taxonomic groups within sub-families. Able to swim soon after hatching.

Cosmopolitan, but absent from continental Antarctica and some islands. Usually on or close to water. Highly vulnerable to human pressures on habitats. Labrador duck *Camptorhynchus labradorius* extinct during last century, and three more (Crested Shelduck *Tadorna cristata*, Pink-headed Duck *Rhodonessa caryophyllacea*, Auckland Merganser *Mergus australis*) probably so this century. A few species domesticated: Swan Goose *Anser cygnoides*, Greylag Goose *A. anser*, Muscovy Duck *Cairina moschata*, and Mallard *Anas platyrhynchos* (Goodwin 1965); some populations of a few more (Mute Swan *Cygnus olor*, Canada Goose *Branta canadensis*, Egyptian Goose *Alopochen aegyptiacus*) kept in semi-domesticated or feral conditions.

N. forms often highly migratory and tied to Arctic or high latitudes for breeding, exploiting brief but productive period each year to raise young; for many of these species autumn movements preceded by marked moult-migrations by males to special areas for period of flightlessness. More sedentary in warmer latitudes, specially in equatorial regions. The term 'boreal' for these n. wildfowl is useful to draw attention to the marked differences between the breeding ecology of n. high-latitude wildfowl compared with many s. hemisphere species for which the term 'austral' has been used (Fullagar *et al.* 1988). In general, most austral species are more sedentary and certainly lack spectacular migrations. Regular movements in most s. hemisphere species are at best only local. Occasional much wider dispersal is often initiated by factors such as flooding rains and drought (specially in Aust.). Many austral ducks exploit seasonally persistent or occasional, extremely propitious conditions by responding with an extended breeding season. In reality, most are seasonal breeders but productivity of some will vary greatly according to rainfall and flooding; most notable with many species in Aust. For further details see Fullagar *et al.* (1988).

Wide range in diet, from totally vegetable to totally animal, and in feeding habits, from terrestrial grazing to bottom diving; correlated with conspicuous adaptations in structure of bill, musculature of head, length of neck, and in general proportions of body. Terminology of feeding methods in species accounts mainly after Szijj (1965) and Bauer & Glutz (1968, 1969); see also Olney (1963). Typical filtering action of most members of the order, described earlier, best termed 'suzzling'. Most species gregarious, feeding, loafing, roosting, and travelling in cohesive flocks, integrated by calls and special pre-flight signals. Generally solitary breeders nesting in concealed sites, though some species colonial, either habitually or, more often, as alternative to dispersed nesting, usually in protected areas such as islands. Degree of territorialism when breeding and relation between territory and nest-site vary between species and larger taxa; some strictly territorial; others occupy wholly or largely undefended home-ranges. Monogamous pair-bond in most species but much variation between taxonomic groups in duration of bond and degree of male promiscuity (if any). Social systems and displays correlated with formation and maintenance of pairs; complex (see classic work of Lorenz 1951-53) and largely dissimilar in six sub-families (see below). Copulation on water in all species (except some Anserinae and Tadorninae), typically with male grasping female's nape in bill. Vocalizations varied but generally simple (mainly honks, grunts, quacks, coos, and whistles); often different between sexes when linked with anatomical differences in vocal apparatuses (syringeal bullae). Non-vocal sound-signals produced in some species. Calls of downy young are: (1) Contact or Greeting Call (also termed Pleasure and Contentment Call) and (2) Distress Call (see Kear 1968). Comfort-behaviour well known. Bathing frequent and elaborate. Typically performed while swimming in water too deep for standing; involves head-dipping, wing-thrashing, somersaulting, and diving. Followed by oiling (with use of bill and head) and preening. Full description of comfort movements, the behaviour patterns of shaking, stretching, preening, bathing and related activities given by McKinney (1965). The diagrams (Figs 1 to 14) based on those from McKinney illustrate most of these actions, all of which are common to all wildfowl. Some essentially aquatic species (genera *Thalassornis*, *Oxyura* and *Biziura*) have other, slightly specialized, preening and shaking actions peculiar to them because they are performed on water. No elaborate thermoregulatory responses except erection of feathers. Other behavioural characters are: (1) direct head-scratching; (2) resting, often on one leg, with head



Figs 1-14. Comfort movements of Anatidae (based on Grey Teal): (1a-c) Body-shake; (2) Wing-shake; (3a-c) Swimming-shake; (4) Head-shake; (5) Head-flick; (6) Tail-wag; (7) Foot-shake; (8a,b) Wing-shuffle and tail-fan; (9a) Wing-and-leg Stretch; (9b) Both-wing Stretch; (10) Foot-pecking; (11) Bill-cleaning; (12a-e) Head-dipping; (13a,b) Wing-thrashing (14a-f) Somersaulting.

turned back and bill inserted in scapulars on same side as lifted leg (Heinroth & Heinroth 1954), latter being characteristically stowed away in waterproof flank 'pocket'.

Breeding strictly seasonal in boreal, migratory species and populations; less so or opportunistic at warmer latitudes. For most wildfowl, censuses of breeding numbers extremely difficult. Although breeding habitat and nest-sites show considerable diversity, nests usually placed over water or on or near ground. Well hidden in vegetation or sometimes concealed in other dark places such as burrows and tree holes (or nest-boxes); some species also use old nests of other birds or cliff ledges. Often near water but some species may at times nest far away from it. Nests made only of vegetation, or other materials, within reach of sitting bird, using side-building method (see Harrison 1967). In spite of limited scope of this method materials are often collected from large area by repeated movements of this form. Nest usually lined with down plucked from female's belly (often cryptic and grown specially for this purpose). Value of down for insulation and for concealing nest examined for arctic geese by Thompson & Raveling (1988). Eggs, large, immaculate; surfaces greasy. Clutches often large. Regulation of clutch-size in Anatidae has been the subject of much investigation in n. hemisphere (Rohwer 1984, 1988), but has received little attention in s. Proximate (physiological and psychological [Lack 1974]) factors that may regulate clutch-size include availability of food, condition of birds, weather, age or experience of the breeding birds, ability to incubate, and, of the female, to acquire resources for production of eggs, time of breeding, hormonal levels and interactions between two or more of these (Bengston 1971; Johnsgard 1973; Braithwaite 1977; Ankney & MacInnes 1978; Drent & Daan 1980; Duncan 1987; Ankney & Afton 1988; Kingsford 1989; Briggs 1990). Ultimate (evolutionary [Lack 1974]) factors that may regulate clutch-size are availability of food, condition of birds, length of breeding season, weather, predation and viability of eggs, ability to incubate and rear brood, time of breeding, trade-offs between annual reproductive effort and residual reproductive value, and interactions between two or more of these (Williams 1966; Lack 1967; Ryder 1970; Johnsgard 1973; Braithwaite 1977; Pellis & Pellis 1982; Toft *et al.* 1984; Lessells 1986; Arnold *et al.* 1987; Briggs 1990). Both proximate and ultimate factors can act together to influence clutch-size. Eggs laid at intervals of 24 h in most species but longer in some. Clutch covered by down in most species during recess of adult. Some species may lay some or all of their eggs in nests of other anatids; such nest-parasitism may reach significant proportions in some populations, especially of pochards (*Aythya*) and stiff-tails (*Oxyura* and *Stictonetta* but not *Biziura*); only one species (Black-headed Duck *Heteronetta atricapilla*) obligate parasite. In some species, two or more females may lay at same site, at extreme producing 'dump' of eggs without incubating them. Most species single-brooded but many will re-nest if eggs lost. Multiple clutches more common in austral species. Except some species of Anserinae, incubation by female; starts with last egg; so hatching synchronic. No true brood-patches (Skutch 1976). Displaced eggs retrieved if within reach of sitting bird, using bill. Eggshells left in nest. Downy young typically led, but not carried, to water after leaving nest but see SOWLS (1955) and Johnsgard & Kear (1968) for exceptional carrying of eggs, shells and young. Young feed themselves in all species except Musk Duck *Biziura lobata*, but some food provided indirectly in earlier stages by a few Anserinae and Anatinae (Kear 1970). Establish recognition of own species by special imprinting upon parent's calls and image during brief critical period; exceptionally (e.g. during experiments) may become imprinted on wrong species or even inanimate objects (Heinroth 1911; Lorenz 1935; Hess 1957; Boyd & Fabricius 1965; Schutz 1965). Incubation and fledgling periods vary, correlated with latitude at which breeding takes place; shorter in boreal migratory species nesting in high latitudes with short summer season.

Term 'waterfowl' used in North America to describe the group is restricted by 'wildfowl' in English with 'waterfowl' having wider meaning. Further special terminology (Hardy 1952) includes 'cob' and 'pen' to distinguish male from female in swans; male goose and male duck referred to as 'gander' and 'drake' respectively but female in both best called 'hen' to avoid confusion with group names. Young swan is a 'cygnet'; young goose a 'gosling' and young duck 'duckling'. 'Whiffling' is the term used to describe the deliberate loss of height in flight by alternate side-slipping and even rolling onto the back; a practice most characteristically adopted by many geese when descending rapidly. Collective names include 'herd' for flock of swans and 'gaggle' (on the ground) or 'skein' (flying) for geese. Less well known are 'dropping' for shelduck; 'spring' for a flight of teal and 'padding' for duck on water. 'Flapper' is used to describe young wild duck. Some of these terms are elegant but are regrettably falling into disuse.

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## Sub-family DENDROCYGNINAE whistling-ducks

Nine species in genus *Dendrocygna*, Tropics and Subtropics of all continents, plus White-backed Duck *Thalassornis leuconotus* of Africa and Madagascar (an aberrant diving species often in the past placed with Oxyurinae). *Thalassornis* has reticulated fronts of the tarsi and plain-coloured downy young but is remarkably convergent with the true stiftails (*Oxyura*) in general morphology and feeding habits.

Wildfowl mostly with long necks and somewhat elongated bodies, fairly long tarsi with reticulated fronts, and large feet placed below middle of body when standing. Single annual moult, at least in *Dendrocygna*. Can dive well and one species a diving specialist. No important sexual dimorphism; visual displays and voice closely similar in male and female. Most have clear whistling calls, more specialized trachea than swans and geese, and distinctive patterns of plumage in downy young. Juveniles like adults, slightly duller. All vegetarian. Strong pair-bonds and male may assist with incubation in a few species. Unusual post-copulatory display, the 'Step-dance', in which partners tread water side by side and raise the outer wing, occurs in all *Dendrocygna*. In some species of *Dendrocygna* the peculiar indented inner vanes to outermost primaries cause whirring sound in flight. Most have pale upper tail-coverts conspicuous in flight, as in geese.

### *Dendrocygna eytoni* Plumed Whistling-Duck

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*Leptotarsis eytoni* Eyton, 1838, *Monogr. Anatid.*: 111 — north-western Australia.

Named by J. Gould in honour of J.C. Eyton 1809-80, friend of C. Darwin and founder of Eyton Hall Mus., but not published till Eyton did so in 1838 with grateful acknowledgement to Gould.

OTHER ENGLISH NAMES Eyton's Plumed, Red-legged or Whistling Tree-Duck, Grass, Grey or Red-legged Whistler, Monkey Duck, Grass Whistle-Duck.

Plumed is appropriate and too well-established to be replaced by Grass.

MONOTYPIC

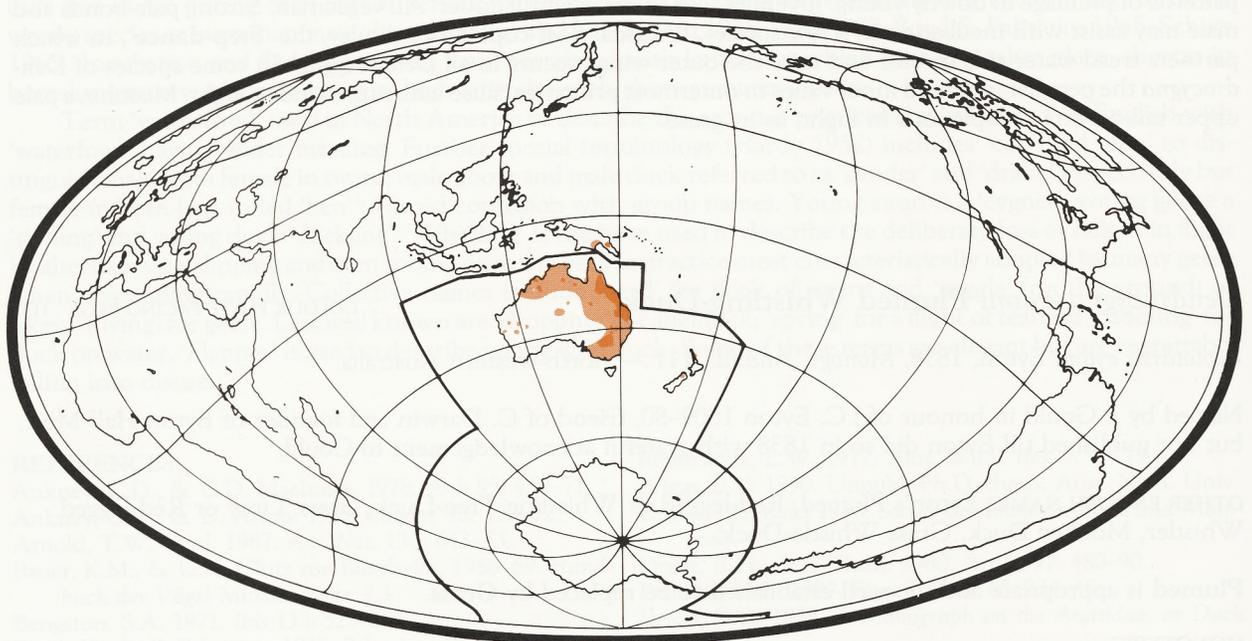
**FIELD IDENTIFICATION** Length 40–60 cm; wing-span 75–90 cm; weight 600–1400 g. Small pale goose-like duck with long legs and neck, upright stance, pink bill and legs. Most obvious feature, elongated buff flank-plumes, projecting above body line. Sexes similar but male slightly larger; within known pairs, males tend to have longer plumes (Madge & Burn 1988). No seasonal plumage changes. Immature like adult but paler, duller.

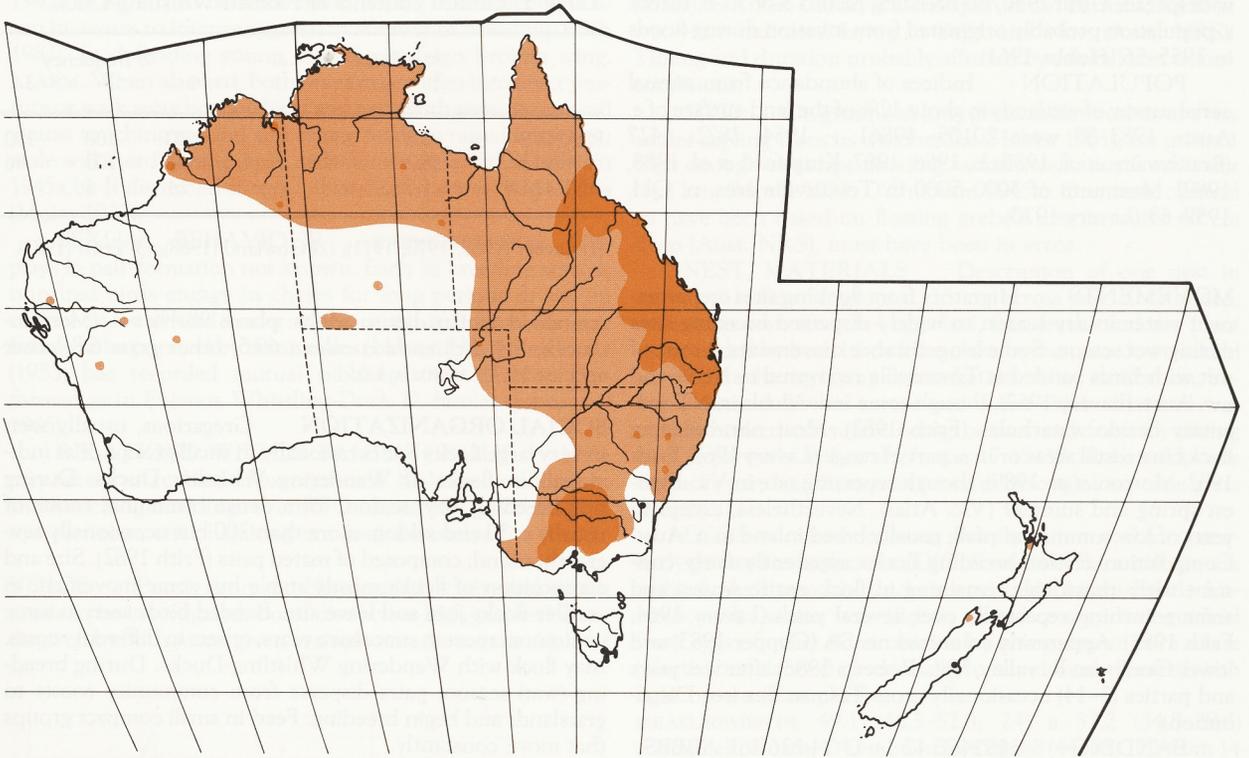
**DESCRIPTION** **ADULT.** Crown and hindneck, olive-brown with cinnamon wash; slight tuft at hindcrown; cheeks, buff; chin and throat, dull white merging to pale brown on lower foreneck. Mantle, back and scapulars, dark brown, margins of feathers buff. Rump, black-brown. Upper tail-coverts, brown and buff. Tail, dark brown. Upper wing-coverts, brown; flight-feathers, dark brown. Breast, pale cinnamon barred dark brown; outer breast to mid-flanks, cinnamon with broad dark bands. At mid-flanks characteristic, long buff lanceolate plumes edged black-brown. Abdomen and undertail, dull white. Under wing-coverts, barred brown-olive; axillaries, barred white-buff and dark brown. Iris, orange-yellow. Bill, pink, mottled black on upper mandible. Legs and feet, pink. **DOWNY YOUNG.** Crown, dark brown; eye-stripe and stripe from cheek to hind neck, dark brown; buff stripe above eye; nape, dull white; mantle, back, tail and flanks, dark brown; face, chin, throat and underparts, dull white; leading- and trailing-edge of wing, buff. Bill, dark grey with yellow tip. Legs and feet, green-brown. **IMMATURE.** Generally paler and duller with indistinct barring on breast; flank-plumes, short. Iris, dark. Legs, slate with pink wash.

**SIMILAR SPECIES** Whistling-ducks are generally distinguishable by upright stance and profile with long neck and legs; in flight vocal, humped silhouette and whistling wings. **Wandering Whistling-Duck** *D. arcuata* is smaller and darker than Plumed with dark bill and legs and without prominent flank-plumes; in flight has dark abdomen and uniform dark underwing; also more aquatic than Plumed (see Wandering Whistling-Duck).

When not breeding, seen by day loafing in small parties to flocks of thousands at edges of wetlands near open short-grass plains. At dusk and during night graze on short grasslands, dabble at swamp fringes. When breeding, seen in pairs on grassy plains. On land, graceful, head and neck held erect; perch awkwardly, seldom in trees. On water only after alighting from flight; swim high and slowly, with flank plumes upturned; may dive if wounded. In flight, head lower than back and dangling legs gives diagnostic hunched appearance; wing-beats and flight slow. Distinctive wing-whistle and twittering of flying flocks diagnostic of genus. Voice, high-pitched whistle as single note or multi-syllabic twitter heard in roosting and flying flocks.

**HABITAT** Associated with tropical and temperate grasslands, coastal and inland, with stronghold in open grasslands of w. Qld (Frith 1982). Graze on native grassland or pasture on dry or moist land, but also dabble in shallow water at edges of wetlands; activities centred round waterbody, which provides open banks for roosting close to feeding grounds. Recorded from Mitchell Grass (*Astrelba*) plains, monsoonal floodplain grasslands (*Oryza*, *Hymenachne*, *Pseudoraphis*), irrigated or flooded fields, ploughed fields, ricefields and grain-crop stubble (Jarman 1945; Roberts 1983; Gowland 1988; Schulz 1989). In monsoonal regions, concentrate in dry season round permanent wetlands and nearby meadows and short-grass plains; in wet season disperse over damp or inundated tall grasslands and meadows, feeding in open areas (Lavery 1971; Frith 1982). Wide range of freshwater habitats used; nature of waterbody unimportant as not used for feeding, and birds found in or beside billabongs, pools, watercourses, swamps, flooded depressions, lakes, farm dams, floodwaters and sewage ponds (Lavery 1966; Vestjens 1977; Gosper 1981; Roberts 1983; Schulz 1989); uncommonly recorded from tidal wetlands (Schulz 1989). In semi-arid and arid zones, birds readily use permanent dams and waterholes, and move onto watercourses, lakes and depressions filled by rain-





fall or flooding over plains or sand-dune country (McGilp 1931; Mules 1932; Hobbs 1956; Cupper 1983). As birds prefer bare open banks for roosting (Frith 1982; Schulz 1989), wetlands in scrubland and forest usually avoided, but birds recorded from densely vegetated floodwaters in ne. SA (Cupper 1983) and creek in rainforest in Atherton, Qld (Bravery 1961). May roost up to 30 km from feeding sites (H.J. Lavery). Where banks unsuitable, birds may use fallen timber or islands for roosting. Small wetlands favoured; in aerial transects over e. Aust., 74% estimated total population on wetlands of <100 ha (Braithwaite *et al.* 1985a).

Breed mainly inland, in tall grasslands associated with wetlands; almost any permanent or temporary water-filled depression acceptable. Nest may be placed some distance from water on ground out of reach of flooding (Hobbs 1956; Coleman 1981; Frith 1982; Gowland 1988). Fly slowly, often in flocks, often at considerable height. Rarely swim, except to avoid predators (H.J. Lavery).

Breeding range has expanded into se. Aust. since 1950s (Aust. Atlas); agricultural and pastoral activities have provided new feeding grounds in pasture, irrigation areas, grain-crops and stubble; grazing stock and mowing (e.g. round airfields) maintain short grass-cover preferred by Plumed Whistling-Ducks. Construction of farm dams, sewage farms and reservoirs provides roosting sites and breeding habitat, allowing extension of range, particularly into semi-arid and arid zones (Frith 1982; Gowland 1988). Conflict arises when birds feed in ricefields, but do not usually attack mature crops unless poor quality or neglected (Gowland 1988).

**DISTRIBUTION AND POPULATION** Endemic to Aust., mainly in n. and e. parts. Vagrant to New Guinea (de Vis 1897; Hoogerwerf 1962) and NZ.

**AUST.** Widespread from Broome district, WA, through NT, Qld, NSW and Vic.; for most part, N of 20°S latitude in WA, NT and w. Qld, and E of 143°E longitude in Qld, NSW and Vic.; also scattered records (perhaps vagrants) in area of Gascoyne and Murchison Rs, WA; Tanami Desert, Alice Springs and Ayers Rock-Amadeus district, NT (Aust. Atlas). In area of Diamantina-Cooper Ck, Qld-SA, probably quite regular, at least during wet periods; also fairly often reported in se. SA (Aust. Atlas; Parker *et al.* 1985). Tas.: vagrant; one bird, Muddy Plains (now Ross), 1853; one, Richmond, Mar. or May 1871; one, Bridgewater, June 1872; several specimens, Sorell, c. 1872 (Littler 1910; Sharland 1958, 1981).

**NZ** Vagrant. One, shot, Thames, May 1871; 14 (three shot), Ls Tuakitoto and Kaitangata, Otago, June 1871; three, Ashburton Domain, 1894-96 (Oliver); 12, Little Wanganui, near Karamea, nw. Nelson, Jan. 1975 (Ellis 1975; Kinsky 1975); nine, Waikato R., near Puni, 6-8 Apr. (possibly till May) 1982 (Lawrie 1984). Also several unconfirmed sightings in May 1982: four, Lower Waipa R., 29 Mar. 1982; five, Waipa, Waikato R. junction; two, Kinleith and one shot, Te Aroha (CSN 1984; Lawrie 1984).

**BREEDING** Apparently throughout area from just N of Townsville, Qld, to Grafton, NSW, and inland to about Hughenden, Emerald, Springsure and Roma. Also probably regular breeding in area of Murray-Murrumbidgee valleys, NSW-Vic., from about Albury to Echuca districts. Scattered breeding records elsewhere in WA (Wyndham; S of Halls Ck), NT (Barkly Tablelands, Camooweal area), NSW (near Sydney, Tamworth, in Macquarie Marshes and near Wilcannia) (Aust. Atlas, Vic. Atlas) may indicate widespread nesting throughout main range but occurrence of breeding probably much affected by flooding in wet years, when likely to be most

widespread. Until 1950, no breeding record S of 30°S; recent s. population probably originated from invasion during floods in 1955–56 (Hobbs 1961).

**POPULATION** Indices of abundance from annual aerial survey of wetlands in about 12% of the land-surface of e. Aust., 1983–88 were 20105; 19861; -, 1954; 2872; 4427 (Braithwaite *et al.* 1985a,b, 1986, 1987; Kingsford *et al.* 1988, 1989). Maximum of 3000–5000 in Townsville area, n. Qld, 1959–63 (Lavery 1970).

**MOVEMENTS** Migratory from flocking sites on permanent water in dry season to widely dispersed breeding sites during wet season. Some long-distance movements at start of wet with birds banded at Townsville recovered n. NSW and nw. Aust. (Lavery 1967), though some individuals in NT sedentary beside waterholes (Frith 1982). Most non-breeding flocks in coastal areas or in s. part of range (Lavery 1967; Frith 1982; Morton *et al.* 1989), though reporting rate in Vic. highest spring and summer (Vic. Atlas). Nevertheless, except in years of low summer-rainfall, usually breed inland in n. Aust. Composition of non-breeding flocks apparently fairly constant with individuals remaining in flock entire season and some returning repeatedly over several years (Lavery 1964; Frith 1982). Apparently colonized ne. SA (Cupper 1983) and lower Goulburn R. valley, Vic. (Roberts 1983) after wet years and parties (3–14) occasionally cross Tasman Sea (see Distribution).

**BANDING** 34S146E 12 1+ U 14 226 161 ABBBS.

**FOOD** Almost entirely herbivorous. **BEHAVIOUR.** Usually pluck sward on land with goose-like bill but also take food from water by dabbling from surface. On land usually feed in compact, constantly moving groups but in water more dispersed. Most feeding at night (Lavery 1971).

**ADULT** Summarized Table 1. **N. Qld.** (351 gizzards; Lavery 1967, 1970, 1971) plants incl. Fabaceae 4.9, 49 (*Aeschynomene indica*, *A. villosa*, *Stylosanthes humilis*), *Nymphoides indica* 4.3, 3.9, Polygonaceae 1.4, 16, Potamogetonaceae 1.5, 9 (*Potamogeton pectinatus*), Cyperaceae 21.6, 66 (*Cyperus*, *Fimbristylis*, *Eleocharis*, *Scleria*, *Scirpus litoralis*), Poaceae (*Brachiaria miliiformis*, *Dactyloctenium aegyptium*, *Digitaria ciliaris*, *Echinochloa colona*, *Eleusine indica*, *Panicum*, *Paspalum flavidum*, *Paspalum orbiculare*, *Oryza australiensis*, *Pseudoraphis spinescens*), Marsileaceae 1.1, 26, others 5.2, 56; animals mostly beetle larv. (*Berosus*). At inland sites *Fimbristylis* seed, 42.3% vol., particularly important with seed of *E. colona* 18.6% vol., 86% freq.; near coast *E. colona* 47.1, 84.

In wet season at **Adelaide R.**, n. NT (34 gizzards; Frith 1982) Poaceae (*Brachiaria*, *Cynodon*, *Echinochloa*, *Oryza*, *Paspalum*), Fabaceae, Cyperaceae and herbs 4% freq.; in dry season (102 gizzards) mostly Cyperaceae (*Cyperus*, *Eleocharis*).

On **Ord R. Irrigation Scheme, WA** (34; Gowland 1988) plants were *Cochlospermum fraseri* 0.1, 2.9, *Cleome viscosa* 7.0, 17.7, commercial sunflower 0.3, 8.8, *Potamogeton tricarinatus* tr., 2.9, *Fimbristylis* 0.1, 5.9, *Brachiaria pubigera* 0.3, 14.7, *Digitaria* 2.3, 11.8, *Echinochloa* 12., 32.4, commercial millet 70.3, 26.6, rice 1.6, 5.9, sorghum 1.8, 20.6, unident. seed 1.1, 26.5, unident. plant matter 2.2, 17.7; animals insects.

**Other records:** seeds (nw. Aust.; Mathews 1910) incl. *Polygonum*, Amaranthaceae, *Trifolium* (Vestjens 1977).

**YOUNG** Flightless young (25 gizzards; Lavery 1971)

**Table 1.** Gizzard contents of Plumed Whistling-Duck.

	% volume		% frequency		
	1	2	1	2	3
PLANTS	98.3	100	100	100	100
<i>Poaceae</i>	58.2	89.5	91	100	96
ANIMALS	1.7	tr.	14	6	

(1) Lavery (1967, 1970, 1971); (2) Gowland (1988); (3) Frith (1982).

contained similar diet to adults: plants 98.4% vol. (Menthaaceae 5.4, *Echinochloa colona* 69.5, other grass 6.8, other species 16.7), animals 1.6.

**SOCIAL ORGANIZATION** Gregarious, usually seen in very large flocks but occasionally in small groups or as individuals in flocks of Wandering Whistling-Ducks. During non-breeding (dry) season, form dense communal roosts of usually c. 50 and seldom more than 200 but occasionally several thousand; composed of mated pairs (Frith 1982). Size and composition of flocks mostly stable but some movement as smaller flocks join and leave site. Banded birds seen in same communal roost in successive years, others in different roosts. May flock with Wandering Whistling-Ducks. During breeding (wet) season, pairs disperse from community roosts to grasslands and begin breeding. Feed in small compact groups that move constantly.

**BONDS** Monogamous. Pair-bonds probably lifelong (Frith 1982). With onset of wet season, display among males in flocks, more frequent. Both male and female incubate and tend young. Ducklings stay with adults until mature (Frith 1982).

**BREEDING DISPERSION** Solitary. Extent of territorial defence unknown, but immediate area round nest defended against intruders (D'Ombain 1945a). Home-range large, with some pairs making excursions to feeding grounds several kilometres away.

**ROOSTING** During breeding season, both sexes incubate in 24 h shifts. Not known where off-duty bird roosts. In non-breeding season, flocks of up to several thousand roost in traditional sites on open bare dry banks of shallow ponds and lakes or among nearby vegetation, sometimes with Wandering Whistling-Ducks (Church 1924). Some roosts used for only 1 or 2 years before being abandoned. Occasionally perch in trees (Lavery 1967). May sleep very close together (Campbell). Roosting occurs only during day; from late afternoon to after dark, small parties leave roost to feed. Birds returning to roosts, c. 2 h before sunrise, spiral down to water, swim quietly to shore and run up bank (Lavery 1967; Frith 1982).

**SOCIAL BEHAVIOUR** No detailed studies. D'Ombain's (1945a,b) reports were of one wild pair and brood that were captured and later observed in captivity. Feeding birds always alert, difficult to approach and constantly whistle (Frith 1982).

**AGONISTIC BEHAVIOUR** **THREAT.** **Head-back** and **Head-low-and-forward** recorded (D'Ombain 1945a; Johnsgard 1965). **Head-low-and-forward:** while facing intruder, extend neck, almost to ground, bow low and call; performed by both sexes. When defending nest, female raises feathers, hisses and darts neck at intruder (D'Ombain

1945a,b). FIGHTING between males during non-breeding season increases to intense aggression at onset of breeding (Frith 1982). In defending young, drake may feign broken wing. ALARM. When alarmed, both sexes may stiffen into erect posture or walk away bowing head and neck with sometimes head almost touching ground and crown feathers raised into crest; male will 'herd' young away with female in lead (D'Ombra 1945a,b). If disturbed at roost, flies short distance and alights (Mules 1932).

**SEXUAL BEHAVIOUR PAIR-FORMATION.** Displays in pair-formation not known. Early in breeding season, unpaired birds engage in chases for long periods in air, on surface of water and under water, when it is usual for one female to be pursued by many males (Lavery 1967). McKinney (1953) has recorded mutual nibbling. **COPULATION.** Performed as in Fulvous Whistling-Duck *D. bicolor* (Johnsgard 1965).

**RELATIONS WITHIN FAMILY GROUP** Male may take greater share of parental care. Male seen walking on and knocking ducklings over (D'Ombra 1945b). Young led to water soon after hatching but feed themselves.

**VOICE** Poorly known. No detailed study and much needs to be investigated. Loud distinctive high-pitched whistle given by both sexes; given as single note (sonagram A), loud



A N. Robinson; captive, Canberra, ACT, April 1965; B555

*wa-chew* or multisyllabic twitter (Johnsgard 1978; Frith 1982). Frequently heard during daytime roosting and nocturnal flying. Roosting flocks emit loud continuous twitter interspersed with shrill whistles. At nest, pairs quiet, only using soft whistles when changing incubation shifts but female said to hiss in nest defence (D'Ombra 1945b). Whistling similar to calls of Wandering Whistling-Duck but more penetrating and less interrupted (Lavery 1967). Wings whistle in flight. Calls of young unknown.

**BREEDING** Poorly known; description of one nest of captive pair (D'Ombra 1945b); c. 10 Aust. NRS cards. Information compiled by J.M. Peter. Breed solitarily in simple pairs, on ground in rank grass and other vegetation, often far from water.

**SEASON** Probably some variation from W to E and from N to S of range, but data inadequate. In NT, clutches begun in Feb.-Apr. or May; perhaps mostly in Feb.-Mar. (Campbell; North; Frith & Davies 1961); in Qld, Nov.-Apr. (Lavery *et al.* 1968); in NSW, fresh eggs at Macquarie Marshes 15-22 Sept. (North), 'breeding' at Moree and at Blighty, Riverina, Oct.-Jan. (Morse 1922; Hobbs 1961 *contra* Frith 1982), at Maitland laying first half Jan. (D'Ombra 1945b). Broods

(three) seen near Cobar, at Deniliquin and at Barham, NSW in wet years indicated laying in Sept. and Nov. (Aust. NRS). Timing and duration probably affected by rainfall and water-conditions.

**SITE** On ground in long grass, under bushes or even under sapling trees in windbreaks (Hobbs 1961); on ground high enough to escape flooding, usually well away from water (> 1 km) (Morse 1922; D'Ombra 1945a). One nest, claimed to have been based on floating grebe's nest in water 60 cm deep (Aust. NRS), must have been in error.

**NEST, MATERIALS** Description of one nest in captivity: hollow in ground, 25 cm across and 10 cm deep, unlined at first; after 3-4 eggs laid, fern leaves and dry plant stems added by both birds from close by nest; no down added at any time during laying or incubation. After incubation, lining measured 25 cm across and 5 cm thick. Material was mostly broken off surrounding bushes and ferns by sitting bird, apparently in late afternoon 17:45-19:30. In wild, runs or tracks may lead from nest to water through long cane-grass (North).

**EGGS** Oval, tapering sharply to one end (or 'peculiarly pointed at both ends'; D'Ombra 1945b); small for size of bird; shell smooth, thick, surprisingly hard, slightly lustrous; milky white, very slightly tinged cream; distinguished from eggs of other Aust. anatids by being almost pure white (North) but claimed occasionally to be minutely spotted with light brown (Campbell).

**MEASUREMENTS:** 49.1 (46.5-52.3; 24) x 37.2 (34.8-39.6) (Campbell; North; D'Ombra 1945b); 48 (44-51; 112 from 14 clutches) x 36 (33-38) (Frith 1982).

**CLUTCH-SIZE** No quantitative, critically assessed data. Frith (1982) erroneously quotes North as 10-12 eggs; his own observations ranged from eight to 14. Captive female laid eight eggs in one nest.

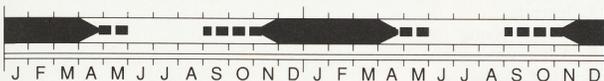
**LAYING** In captivity, between 17:50 and 19:30; at intervals of 48 h (eggs 1-2), 144 h (2-3), 24 h (3-4), 72 h (4-5) and 24 h (5-6, 6-7, 7-8).

**INCUBATION** In captivity, after sixth egg laid, female stayed on nest overnight and during next morning but full incubation did not start till after eighth egg laid (inferred from indefinite remarks; D'Ombra 1945b). Both adults shared incubation in about equal shifts of 24 h, changing over at 18:00-19:00. **INCUBATION PERIOD.** Not closely determined (D'Ombra 1945b) but c. 28 days; Johnstone (1970) gives as 30 days.

**YOUNG** Precocial, nidifugous; ducklings very small (D'Ombra 1945b). In captivity attended by both parents but more by male than female. No further information.

## PLUMAGES

**ADULT HEAD AND NECK.** Crown, brown (119B) with buff (124) and light brown (39) shades; feathers form slight tuft at hindcrown, erected aggressively (Lavery 1967). Lores and sides of head, light grey-brown (45) with buff (124) shade. Chin to foreneck, dull white, merging to light grey-brown (119D) near lower foreneck, merging to light brown (223C) at base of foreneck. Sides of neck, light grey-brown (45). From nape to mid-hindneck, progressively more light brown (39), merging to pale olive-brown (129) at base of hindneck. **UPPERPARTS.** In fresh plumage, upper mantle, pale olive-brown (129); rest of mantle and back, dark brown (119A). Feathers of mantle and back have subterminal brown-grey fringes (79); also buff (124) terminal fringes (progressively wider from upper to lower mantle), which become narrower



with wear. Rachis of mantle-feathers, dark brown (119A). Scapulars, dark brown (121) with broad buff (124) fringes; lowermost scapulars, broad with rounded tips and narrower fringes. Feathers of inner-rump, black-brown (119) with dark-brown (119A) concealed bases; outermost rump-feathers, buff (124), edged blackish brown (119); most of rest of rump, buff (124) with black-brown (119) band at tip. Upper tail-coverts, similar to inner rump, but narrowly fringed buff (124). **TAIL**, dark brown (121). **UPPERWING**. Remiges and alula, dark brown (121); with wear, tips, lighter dark-brown (119A). All coverts, dark olive-brown (129) to dark brown (119A); rachis, dark brown (119A). **UNDERPARTS**. Middle of upperbreast, buff (124); sides of breast and upper breast, brown (119B), with buff (124) fringes to feathers. Towards centre of breast, feathers basally light grey-brown (119D) merging to pale rufous-brown (139) with dark brown (119A) bars c. 1 mm wide; width of bars increases (c. 3 mm on lowermost) towards middle of breast. Feathers of breast, buff (124) or dull white with brown (119B) barring, sometimes incomplete. Lower breast to vent, dull white. Lower thighs and under tail-coverts, dull white with buff (124) shade. Long lanceolate plumes on mid-flanks, buff (124–118) edged dark brown (219); uppermost plumes more rounded at tips; in males, 87–127 mm long (n=8), in females, 95–113 (n=6); on resting birds, plumes are conspicuous, resting against closed wing. Concealed beneath plumes are light grey-brown (119D–119C) semiplumes. Back of thighs, light grey-brown (119D) at base, rest dull white with dark-brown (119A) edges or single spots on each web. **UNDERWING**. Greater and median primary-coverts, glossy glaucous-brown. Greater coverts similar but tipped pink-buff (121D); tips slight on inner webs of outermost feathers, progressively broadening towards inner coverts. Median, lesser and marginal coverts, barred pale dark olive-brown (129) and light brown (223D) to pink-buff (121D). Outermost axillaries alternately barred dull white or pink-buff (121D) and dark brown (119A); barring progressively lighter towards innermost axillaries, merging to 'pea-pod' shape, with innermost having pink-buff (121D) shaft-streak only.

**DOWNY YOUNG** **HEAD AND NECK**. Crown, dark brown (119A). Narrow buff (124) supercilium, ending before hindcrown. Dark-brown (119A) eye-stripe connects with hindcrown. Sides of face, dull white, joining as narrow bar across upper nape. Large dark-brown (119A) crescentic patch on cheeks and ear-coverts. Chin to lower throat, dull white. Hindneck, like crown. Foreneck, buff (124) with brown (119B) at base. **UPPERPARTS**. Mantle, back and rump, dark brown (119A); down longest on back. On either side, 4–5-mm-wide band of buff (124) down, extends from back to rump. **TAIL**, short and indistinct. **UPPERWING**. Trailing-edge and narrow leading-edge of upperwing, buff (124). **UNDERPARTS**. Belly, abdomen and vent, dull white. Flanks similar to back, except at mid-flanks, small dull-white patch. **UNDERWING**, buff (124).

**JUVENILE** Similar to adult, differences described here only. **HEAD AND NECK**. Crown and hindneck, paler. **UPPERPARTS**. Feathers of mantle, shorter with well-rounded webs, narrowly fringed light brown (119C); rachis, black-brown (119). Feathers of mid-back, dark brown (119A) with little fringing; rachis, black-brown (119). Small buff (124) feathers, broadly edged black-brown (119), along sides of back; become progressively larger towards, and connect with, rump, forming horse-shoe shape pattern on dorsum. Rump and upper tail-coverts, buff (124) with black-brown (119) band at tips; base of central feathers have small black-brown (119)

subterminal spots on both webs; only on inner webs of outer feathers. Shafts of scapulars streaked light rufous-brown (139); larger lowermost scapulars tipped light rufous-brown (139). **TAIL**. Feathers notched. **UPPERWING**. All coverts have prominent black-brown (119) rachis. Innermost lesser, median and greater coverts near body have light rufous-brown (139) subterminal shaft-streaks. **UNDERPARTS**. Barring on sides of upper breast, paler; barring reduced and indistinct on lower breast. Plumes, short. Outer thighs, edged light brown (119C). **UNDERWING**, paler.

**BARE PARTS** Based on photos in Pringle (1985) and Aust. RD, except where stated.

**ADULT** Inner ring of iris, orange-yellow (18) near pupil, outer ring, orange (17). Eye-ring, orange-buff (153). Bill, pink (3), varyingly mottled with grey-black (82) on upper mandible; lower mandible, no data. Legs and feet, including webs, pink (7).

**DOWNY YOUNG** Label data on skin at MV: Iris, no data. Bill, dark grey, yellow at tip. Legs and feet, greenish-brown; joints, pads, ends of webs and toes, yellow.

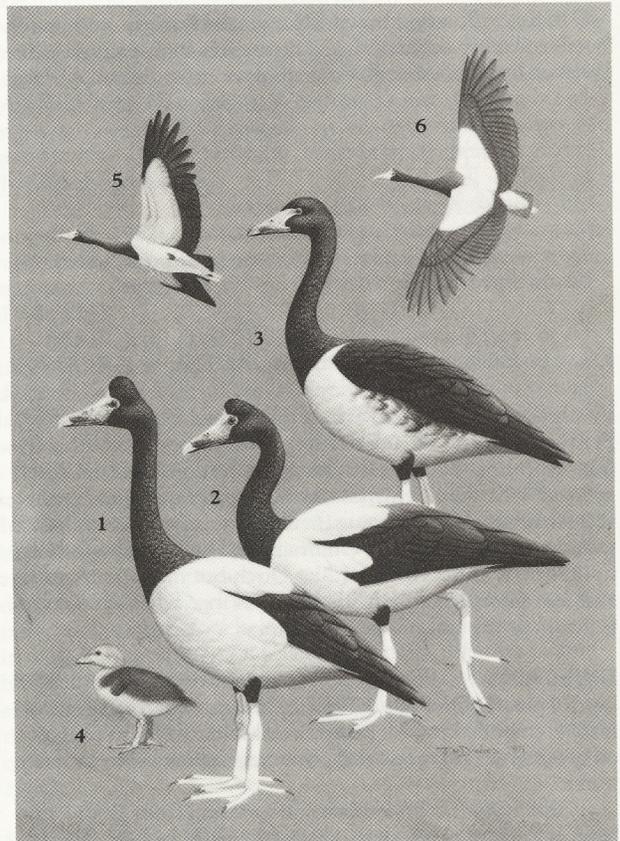


Plate 81

Magpie Goose *Anseranas semipalmata*

1. Adult male
2. Adult female
3. Juvenile
4. Downy young
5. Adult, ventral
6. Adult, dorsal

JUVENILE No data.

MOULTS Undescribed.

MEASUREMENTS (1) Presumably live birds; methods partly described (Frith 1982). (2) Skins (MV, SAM).

	MALES	FEMALES
WING	(1) 232.0 (222-242; 59) (2) 236.0 (5.93; 228-245; 8)	228.0 (215-245; 57) 227.6 (6.41; 217-236; 9)
8TH P	(2) 146.5 (5.17; 141-155; 8)	147.8 (4.06; 142-155; 9)
BILL	(1) 40.0 (37-48; 65) (2) 40.7 (1.03; 39.1-42.1; 8)	43.0 (37-49; 65) 39.7 (1.52; 37.7-42.5; 9)
TAIL	(2) 69.2 (2.49; 65-73; 7)	70.6 (4.89; 64-84; 8)
TARSUS	(2) 59.5 (2.23; 54.6-61.7; 8)	54.5 (2.13; 49.9-57.5; 9)
TOE	(2) 65.7 (1.91; 63.5-69.3; 8)	62.2 (2.68; 57.3-65.8; 9)

Delacour (1954-64) gives measurements for unsexed birds (sources not given) as: WING 240-245; BILL 42-44; TAIL 83-88; TARSUS 53-56.

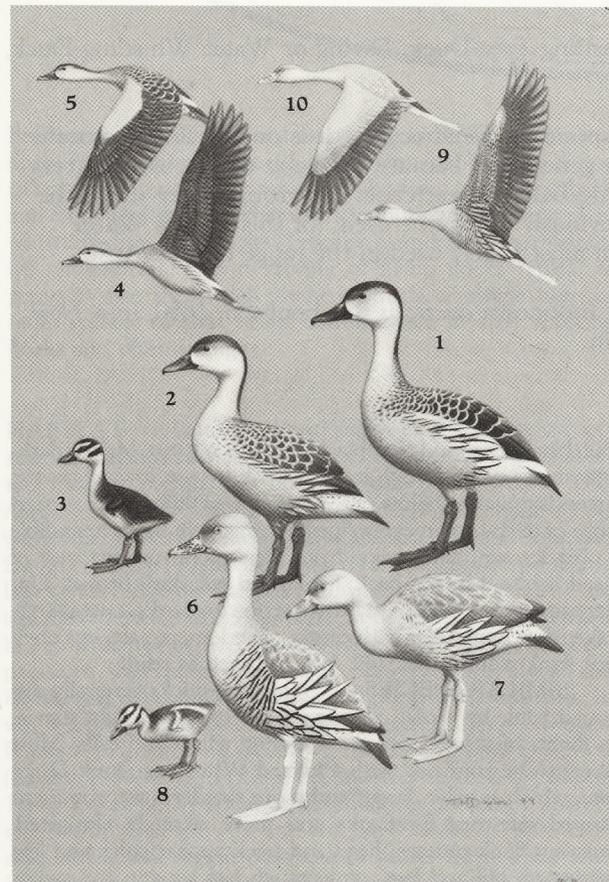


Plate 82

Wandering Whistling-Duck  
*Dendrocygna arcuata*

1. Adult
2. Juvenile
3. Downy young
4. Adult (flight), ventral
5. Adult (flight), dorsal

Plumed Whistling-Duck  
*Dendrocygna eytoni*

6. Adult
7. Juvenile
8. Downy young
9. Adult (flight), ventral
10. Adult (flight), dorsal

WEIGHTS Few data. (1) Frith (1982; as above). (2) H.J. Lavery.

(1) 788.0 (600-930; 63)	792.0 (580-1400; 65)
(2) 766 (n=78)	720.5 (n=72)

No data on seasonal changes.

**STRUCTURE** Wing, short and broad. Eleven primaries: p8 longest p10 5-12 mm shorter, p9 0-2, p7 1-2, p6 5-15, p5 26-33, p4 40-47, p3 51-58, p2 62-69, p1 70-92, p11 minute. P10-p8, emarginated on inner web; p9-p8, emarginated on outer. Narrow glossy tegmen on inner webs of primaries. Fifteen secondaries; four of tertiary form. Tail, pointed; 12-18 rectrices; usually 12; t1 longest, t6 12-13 mm shorter. Interramal area, bare. Bill, high at base; rounded nail. Nostrils, oval-shaped near base of bill. Legs, slender. Feet, webbed. Outer toe c. 86% of middle, inner c. 68%, hind c. 27%.

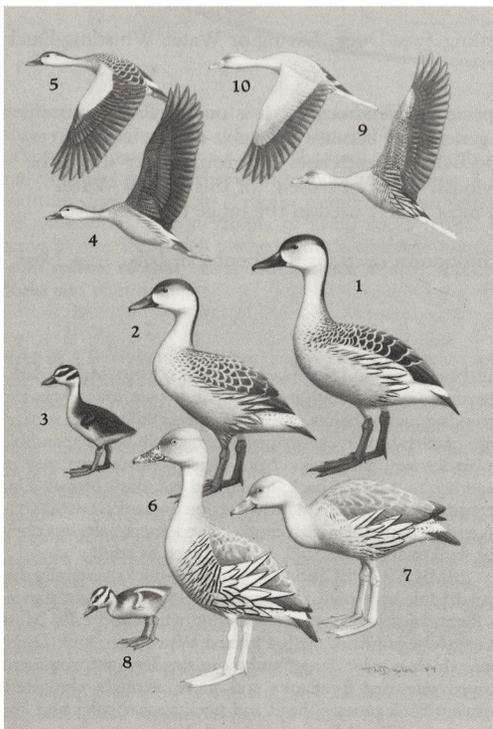
**SEXING, AGEING** Adults sexed on cloaca (see Hochbaum 1942). Detection of bulla in adults and downy young difficult (Beer 1961-62). Age categories on plumages (see above). RMO

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**Volume 1 (Part B), Plate 82**

Wandering Whistling-Duck *Dendrocygna arcuata*

1. Adult
2. Juvenile
3. Downy young
4. Adult (flight), ventral
5. Adult (flight), dorsal

Plumed Whistling-Duck *Dendrocygna eytoni*

6. Adult
7. Juvenile
8. Downy young
9. Adult (flight), ventral
10. Adult (flight), dorsal

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