

Order CHARADRIIFORMES

A large, diverse assemblage of small to medium-large (12–75 cm long) limicoline, pratincoline, aquatic or terrestrial birds. Cosmopolitan from Arctic to Antarctic regions; in all sorts of maritime, freshwater and open terrestrial habitats (including deserts) with a few (woodcocks and snipes) even using dense forests. Once known as Limicolae or Laro-limicolae (e.g. Mayr & Amadon 1951); colloquially, the assemblage (excluding alcids, skuas, gulls, terns and skimmers) is often referred to as waders (especially in Britain) or shorebirds (especially in North America).

About 350 species in 19 families, though taxonomic treatments vary. Following families recognized (mostly based on recent reviews of Order [Sibley *et al.* 1988; Sibley & Ahlquist 1990; Sibley & Monroe 1990]):

Thinocoridae	seedsnipes; four species, S. America.
Pedionomidae	Plains-wanderer; monotypic, Aust.
Scolopacidae	sandpipers, snipes and allies; c. 85 species, cosmopolitan.
Rostratulidae	painted snipes; two species, s. America and Old World.
Jacaniidae	jacanas; seven species, pantropical.
Chionididae	sheathbills; two species, Antarctica and subantarctic islands.
Burhinidae	thick-knees, stone-curlews; nine species, widespread in Old World and two in Neotropics.
Haematopodidae	oystercatchers; c. 11 species, worldwide in tropics and temperate regions.
Recurvirostridae	avocets and stilts; about seven species, worldwide in tropical and temperate regions.
Ibidiorhynchidae	Ibisbill; monotypic, central Asia.
Charadriidae	plovers and lapwings; c. 60 species, cosmopolitan.
Pluvianellidae	Magellanic Plover; monotypic, S. America.
Dromadidae	Crab Plover; monotypic, Arabian region.
Glareolidae	pratinoles, coursers, and Egyptian Plover; c. 15 species, widespread in Old World.
Stercorariidae	skuas and jaegers; about seven species, mostly in Arctic and Antarctic regions.
Rhynchopidae	skimmers; three species, pantropical.
Laridae	gulls; c. 47 species, cosmopolitan.
Sternidae	terns; c. 42 species, cosmopolitan.
Alcidae	auks; c. 20 species, Arctic and temperate regions of n. hemisphere.

Apparently monophyletic. Pteroclididae (sandgrouse) probably sister-group of Charadriiformes (e.g. Fjeldså 1976, 1977; Sibley & Ahlquist 1990; BWP), though whether best placed within Charadriiformes or in separate order is debated. Flamingoes (Phoenicopteridae) and divers (Gaviidae) have also been treated as Charadriiformes (Olson & Feduccia 1981; Fjeldså 1976, 1977) but DNA–DNA hybridization studies (Sibley & Ahlquist 1990) inconsistent with these theories. Affinities to other orders still controversial; DNA–DNA hybridization has suggested closest links are to large waterbirds, such as storks, herons and allies, Pelicaniformes, Procellariiformes, penguins, grebes, divers (Gaviidae) and also Falconiformes. All these were combined in huge order Ciconiiformes by Sibley & Ahlquist (1990).

Taxonomy and relationships reviewed in Sibley & Ahlquist (1990), Christian *et al.* (1992) and BWP (and references therein). Recent reviews have included: patterning of downy young (Jehl 1968; Fjeldså 1976, 1977), osteology (Strauch 1978; Mickevitch & Parenti 1980; Olson & Steadman 1981), DNA–DNA hybridization (Sibley *et al.* 1988, Sibley & Ahlquist 1990) and electrophoresis of tissue proteins (Christian *et al.* 1992). The studies of allozymes, DNA–DNA hybridization and the most recent osteological study of the entire order (Strauch 1978) have agreed in finding two or three well-knit, monophyletic assemblages within the Charadriiformes: scolopacids and allies (Thinocoridae, Pedionomidae, Scolopacidae, Rostratulidae, Jacaniidae) and charadriids and allies (Chionididae, Burhinidae, Haematopodidae, Recurvirostridae, Ibidiorhynchidae, Charadriidae, Pluvianellidae, Dromadidae, Glareolidae, Stercorariidae, Rhynchopidae, Laridae, Sternidae, Alcidae); Strauch (1978) treated Alcidae as separate lineage, but skeletons may be so highly modified for foot-propelled diving that they do not reflect relations well (Sibley & Ahlquist 1990); gulls and allies have also been regarded as a separate lineage (Christian *et al.* 1992) or as allied to charadriids (e.g. Sibley & Ahlquist 1990). Further relationships within the Order discussed in introductions to families.

Because the Order comprises so many species and adaptations are so diverse, few characters shared by all species; those that are shared are mostly anatomical features of the skull, e.g. most or all have schizorhinal nostrils, schizognathous palates, well-developed vomer, lachrymals fused with ectethemoid and pre-frontal bones, well-developed supra-orbital grooves; see Olson & Steadman (1981) for more information on osteological characters. Wings usually have 11 primaries, with p10 longest and p11 minute; 15–24 secondaries; diastataxic except in *Scolopax minor*, as far as is known. Usually 12 tail-feathers. Necks usually rather long with 15–16 cervical vertebrae. Oil-gland bilobed and tufted. Syrinx, tracheo-bronchial; two carotids (type A-1 of Glenny 1955); caeca present. Legs usually rather long; hind toe small or lacking in most but all toes greatly elongated in Jacaniidae. Feathers with small thin afterfeathers. Normally two moults annually: complete post-

breeding and partial pre-breeding; some jacanas and alcids have flightless periods when moulting remiges. Young, downy, usually with intricate cryptic patterns on upperparts of three chief types: pebbly, spotted and striped, matching characters of habitat (Fjeldså 1976, 1977): precocial, nidifugous usually, self-feeding or not depending greatly on parents.

Thirteen families recorded in HANZAB region, with 54 species breeding, 41 occurring as regular non-breeding migrants and c. 38 as accidentals or probable accidentals. Scolopacidae, Stercorariidae, Laridae and Sternidae will be dealt with in Volume 3 of HANZAB.

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Family LARIDAE skuas, jaegers, gulls and terns

A large assemblage of small to very large charadriiform seabirds. We recognize four subfamilies within the Laridae following Mayr & Amadon (1951), AOU (1983).¹

Stercorariinae Skuas and jaegers; about six species; cosmopolitan.

Larinae Gulls; c. 47 species; cosmopolitan.

Sterninae Terns; c. 42 species; cosmopolitan.

Rynchopinae Skimmers; three extralimital species, pan-tropical.

Taxonomic rank given to above groups varies greatly. Considered four families within suborder Lari (e.g. Campbell & Lack 1985; BWP), or four tribes within subfamily Larinae (e.g. Sibley *et al.* 1988; Sibley & Ahlquist 1990; Sibley & Monroe 1990). Others have divided Lari into three families (Stercorariidae, Laridae and Rynchopidae) with gulls and terns usually considered subfamilies within Laridae (e.g. Wetmore 1960; Judin 1965; Hackett 1989; Peters). Moynihan (1959) divided the group into two subfamilies, Stercorariinae, containing the skuas, and Larinae, containing gulls, terns and skimmers in three tribes. Study of skeletal and external morphology of suborder 'Lari' (our Laridae) was mostly unable to cluster gulls and terns satisfactorily and found group surprisingly uniform (Schnell 1970a,b). Despite lack of agreement on taxonomic ranking of above groups, monophyly of Laridae is not in doubt. Studies of biochemistry (Christian *et al.* 1992), DNA–DNA hybridization (Sibley & Ahlquist 1990), downy young (Fjeldså 1977) and skeletal morphology (Strauch 1978; Mickevich & Parenti 1980; Chu 1995) generally agree in finding close relation with Glareolidae (pratincoles) and Dromadidae (Crab Plover *Dromas ardeola*). DNA–DNA hybridization suggests Alcidae (auks) also closely related (Sibley & Ahlquist 1990), though this contradicted by studies of skeletal morphology (e.g. Strauch 1978; Chu 1995).

Body-form varies greatly, from small and slender in some gulls and terns, to robust and thickset in skuas, jaegers, some gulls and a few terns. Differences in size between sexes slight; males usually larger but females larger than males in Stercorariinae. Wings usually long, narrow and pointed, but broader and more rounded in some; 11 primaries; p10 longest, p11 minute; 17–24 secondaries. Tail has 12 rectrices; shape varies: in Stercorariinae, central rectrices project beyond rest of tail and greatly elongated in adult breeding plumages of *Stercorarius*; in most Sterninae and Rynchopinae, outer rectrices elongated and tail forked; in Larinae, usually square. Bill, varies, though usually rather short and stout, with prominent gonydeal angle; rather fine in some Larinae and Sterninae; tip pointed in Sterninae, decurved in strong hook in Stercorariinae. Bill highly modified for unique foraging methods in Rynchopinae (Zusi 1962). Lack cere, except in Stercorariinae. Nostrils schizorhinal and perforate, with no median septum. Legs, short and stout; attached near centre of body; tibiae partly bare; tarsi, short and typically scutellate in front. Four toes; hindtoe, short, raised, sometimes rudimentary or absent; front toes, fully webbed (webs somewhat incised in some). Claws, moderately long, strong, laterally compressed. Caeca ranges from large (Stercorariinae) to poorly developed (Rynchopinae, Sterninae). Supra-orbital salt-glands well developed.

Plumages mainly browns, black, white and greys. Colours of bare parts often striking and often showing marked variation with both season and age. Adults moult twice annually: (1) a post-breeding (pre-basic) moult to non-breeding plumage, which is complete (with apparent exception of *Larus sabini*); and (2) a pre-breeding (pre-alternate) moult to breeding plumage, which is almost always partial (but see *Larus pipixcan* and *L. sabini*); some terns also undergo one or two pre-supplemental moults of inner primaries. Primaries moult outwards.

Hatch in natal down, which is replaced by juvenile plumage; downy young precocial but more dependent on

¹ This treatment differs from the arrangement presented in the introduction to the Charadriiformes in Volume 2 of HANZAB (p. 648), where these four subfamilies were listed as families. Recent major studies in avian classification (particularly by Sibley and co-workers) and the publication of a revised species list of Aust. birds (Christidis & Boles 1994) since the preparation and publication of Volume 2, have brought much rearrangement. In this and subsequent volumes of HANZAB, taxonomy, nomenclature and arrangements of species follow Christidis & Boles (1994) (though they do not present subfamilial taxonomy). Their sequence of families of Charadriiformes occurring in HANZAB region is: Pedionomidae, Scolopacidae, Rostratulidae, Jacanidae, Chionidae, Burhinidae, Haematopodidae, Recurvirostridae, Charadriidae, Glareolidae and

Laridae. However, work on Volume 2 was too advanced to follow their sequence and taxonomy fully. The Scolopacidae are out of place in the arrangement of subfamilies in Volumes 2 and 3; other families follow the order of Christidis & Boles (1994).

Plate 23

Oriental Pratincole *Glareola maldivarum* (page 366)

1 Adult breeding; 2 Adult non-breeding; 3 Juvenile;
4, 5 Adult

Australian Pratincole *Stiltia isabella* (page 373)

6 Adult; 7 Downy young; 8 Juvenile;
9 First immature non-breeding;
10, 11 Adult

parental feeding than other Charadriiformes. Post-juvenile (first pre-basic) moult complete or partial, varying within and between families; moults of subadults complicated and vary between subfamilies (see subfamily accounts). Generally slow to mature, attaining adult plumage when 2–4 years old and first breeding at 2–4 years (smaller gulls and terns) to 4–9 years (many skuas and larger gulls and terns); some may breed in first year (e.g. *Sterna albifrons*).

Inhabit wide range of marine and freshwater habitats from Tropics to polar regions; many species strongly migratory, especially those breeding at high latitudes, e.g. South Polar Skua *Catharacta maccormicki* and Arctic Tern *Sterna paradisaea*, which migrate between polar regions. Most nest in terrestrial colonies near water (see subfamily accounts); some species highly pelagic in non-breeding season. Use wide range of foraging methods (see subfamilies; for discussion of feeding methods, see General Introduction).

See subfamily accounts for summaries of social organization and breeding.

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Subfamily STERNINAE terns and noddies

Cosmopolitan group of seabirds, with narrow pointed wings and long pointed bills, ranging in size from Little *Sterna albifrons* (20–28 cm) to Caspian Terns *Sterna caspia* (up to 55 cm). Mostly smaller, slimmer and longer-tailed than gulls (Larinae) and more aerial. About 42 species in six genera.

GENUS	NUMBER OF SPECIES
<i>Sterna</i>	Sea terns (including commic terns); c. 32 species; 17 in HANZAB region (15 breeding, 2 non-breeding migrants; 1 species not acceptably recorded)
<i>Chlidonias</i>	Marsh terns; 3 species; all recorded HANZAB region (1 breeding, 1 non-breeding, 1 accidental)
<i>Phaetusa</i>	Monotypic; Large-billed Tern <i>P. simplex</i> ; extralimital in South America; often combined in <i>Sterna</i>
<i>Anous</i>	Dark noddies; 3 species; all breed HANZAB region
<i>Procelsterna</i>	1 (possibly 2) species; Grey Ternlet <i>P. albivitta</i> breeds HANZAB region (second taxa extralimital)
<i>Gygis</i>	Monotypic; White Tern <i>G. alba</i> ; breed HANZAB region
<i>Larosterna</i>	Monotypic; Inca Tern <i>L. inca</i> ; extralimital in South America

Studies of osteology (Strauch 1978; Mickevich & Parenti 1980; Chu 1995), behaviour (Moynihan 1959), DNA–DNA hybridization (Sibley & Ahlquist 1990) and allozymes (Christian *et al.* 1992) have generally suggested that terns more closely related to gulls than to other Laridae; monophyly of the Sterninae appears not to be in doubt, and sometimes considered a full family (e.g. BWP).

Number of genera recognized varies. Moynihan (1959) recognized only three: *Sterna* (including *Chlidonias* and *Phaetusa*), *Larosterna*, and *Anous* (including *Procelsterna* and *Gygis*). Others have recognized as many as ten (e.g. Peters) or 12 (e.g. Wolters 1975) genera. Gull-billed Tern *S. nilotica* often placed in monotypic genus *Gelochelidon*; large terns with erectile crests (e.g. *S. bergii*, *S. bengalensis*) sometimes placed in *Thalasseus*; Caspian Tern *S. caspia* sometimes placed in monotypic genus *Hydroprogne*, or in *Thalasseus*. *Anous*, *Procelsterna* and *Gygis* sometimes treated as tribe Anousini (noddies). Our arrangement follows Christidis & Boles (1994) and Sibley & Monroe (1990), except that Black-fronted Tern *S. albostrata* placed in *Sterna* rather than *Chlidonias* (following Mees 1977; Lalas & Heather 1980; NZCL; see that account). Monophyly of genus *Sterna* as recognized here has been challenged by electrophoretic study of Hackett (1989).

Body-form gull-like, but slimmer and more elongate than gulls except in largest species. Males usually slightly larger than females, especially in length and depth of bill. Necks short. Wings, long and pointed, narrower than in gulls; when wing folded, primaries project well beyond tertials (tips of 5–6 outer primaries usually exposed) and often beyond tip of tail. About 18–24 secondaries; ulnar part of wing shorter than in gulls. Flight musculature differs from gulls by lack of expansor secundarium (except in *Anous*). Tail, long in most species, with 12 rectrices: most have deeply forked tail, with t6 often elongated as tail-streamer; *Chlidonias* has short tail, only shallowly forked; tail of noddies forked, but with t3 or t4 longest in *Anous* and t5 longest in *Procelsterna* and *Gygis*. Bill, straight, with simple rhamphotheca and no cere; slender and rather long in most species, heavier in larger species, especially *Phaetusa*, short and thick in *S. nilotica*; tip pointed, not hooked. Legs, short or very short; tarsi rather weak; scutellate. Three front toes fully webbed, though webs deeply incised in *Chlidonias*; hindtoe reduced or vestigial, raised. Swim less readily than gulls, and have less well developed oil-gland (vestigial in *S. fuscata*). Supra-orbital salt-glands well developed. Down occurs on both pterygiae and apteria.

Sexes similar in plumage. Adult *Sterna* and *Phaetusa* usually uniform light grey above and white or pale grey below (with evanescent pink flush in some species), usually with contrasting black markings on head (often in form of cap) and tip of wing; some browner above (e.g. *S. fuscata*, *S. anaethetus*). *Chlidonias*, *Larosterna* and *Anous* mostly dark grey, dark brown or black above and below; *Procelsterna*, uniform ash-grey; *Gygis*, all white. Irides normally dark brown. Bill, legs and feet of most, yellow, orange, red or black. *Phaetusa*, *Chlidonias* and most *Sterna* show seasonal change in plumage: in non-breeding plumage, black caps reduced or flecked with white, many develop dark cubital bars, fork of tail usually less deep (and tail often slightly darker), underparts of grey-bellied species become paler, and bill and feet often become darker; *Chlidonias* also develop paler upperparts. No seasonal change in appearance of noddies. Adults typically have two moults per cycle: a complete post-breeding (pre-basic) moult to non-breeding plumage; and a partial pre-breeding (pre-alternate) moult to breeding plumage (which involves at least head, neck and some of body, and often all of body, tail and varying number of inner primaries). Primaries moult outwards. Moult of remiges, especially primaries, protracted in most; post-breeding (pre-basic) moult of primaries continues long after moult of body finished, and often overlaps with start of pre-breeding (pre-alternate) moult. Species moulting inner primaries in pre-breeding (pre-alternate) moult can thus have two concurrently active waves of moult in primaries. In some species (e.g. *S. albifrons* and some *Chlidonias*) there is often a third wave, as innermost primaries replaced a third time in a pre-supplemental moult. In two small pale tropical species (*Gygis alba* and *Sterna*

sumatrana), primaries replaced in staffelmauser, which is interrupted only when breeding; pre-alternate moults possibly lost in these species. Breeding and moult seldom overlap, except for some pre-basic moult of feathers of head when raising chicks (usually in larger or migratory species); in migratory species, most or all moult of remiges occurs in non-breeding areas and post-breeding moult (if started) is suspended during migration. In several species of oceanic terns nesting in Tropics, annual cycles last for less than 1 year, with duration between breeding events possibly dependent on time needed to complete moult (e.g. Ashmole 1962, 1963, 1968).

Downy young, precocial or semi-precocial; semi-nidifugous in most; nidicolous in *Gygis*, *Anous*. Natal down, ramose and woolly in most species, but long, straight, silky and very soft in *Chlidonias* (perhaps an adaptation to rather wet nesting sites). In some *Sterna* (e.g. *S. dougallii*), terminal barbs of down cling together to cause spiny appearance, especially on upperparts; down also very short in some (e.g. *S. albifrons*, *S. nereis*). Ground-colour of down ranges from white to grey or buff (rich orange-buff in *Chlidonias*), though dark, like adults, in some *Anous*. Dark markings on upperparts complex and diffuse: *Chlidonias* have bold black blotches; others varyingly streaked or speckled dark brown or black above, without distinct pattern except for three radiating lines on crown in many. Some species virtually unmarked above (e.g. *S. caspia*, *S. nilotica*). Some variation in colour and patterning of down (especially ground-colour) appears to be geographical (e.g. down of tropical populations of *S. dougallii* usually paler than in temperate populations) but also much individual variation, and siblings from the same clutch often look totally different (see Fjeldså 1977 for more information on downy young). Juvenile plumages typically differ from non-breeding adults in having buff or blackish tips or bars on much of upperparts and upperwing; tail generally darker than in adult, often with dark subterminal markings; many species have much individual variation in upperparts, and darkness of ground-colour and width of dark barring usually correlated. Juvenile plumages rather unusual in *S. virgata*, *S. vittata* and *S. fuscata*; see species accounts for details. In *Anous*, *Gygis* and *Procelsterna*, juvenile plumage similar to adult.

Sequence of moults from juvenile to adult plumage, complex. When recognizable traces of juvenile plumage have been lost, distinction of immatures from adults depends mainly on moult and wear of primaries. However, this of little use for ageing species in which timing of breeding and moulting vary (a frequent occurrence in Tropics) and subadult moults of such species (including all noddies) poorly known. Following generalizations based on species of *Sterna* and *Chlidonias* with regular cycles. **POST-JUVENILE (FIRST PRE-BASIC) MOULT** usually complete, with head and body finished several months before last outer primaries; in some species, birds can arrest moult when a few very worn outer primaries remain. In several species of medium-sized *Sterna* from s. hemisphere (*striata*, *albostrata*, *vittata* and *virgata*), post-juvenile moult appears to be partial, moulting almost no remiges or rectrices (though interpretation complicated because, unlike most juvenile terns, first post-breeding [second pre-basic] moult of head and body coincides with first moult of primaries, much as in typical gulls [D.J. James]); these species (and possibly *S. hirundinacea*) have several other unusual features in common, including heavily marked juvenile plumages, little sexual dimorphism in length of wing, and only one moult of primaries and (apparently) rectrices per cycle. They may represent a radiation from a single s. hemisphere ancestor (D.J. James). Whether first pre-basic moult partial or complete, most terns superficially resemble adult non-breeding when 3–7 months old, except for retained juvenile remiges (which are still moulting). When 9–12 months old, at least some perform partial **FIRST PRE-BREEDING (FIRST PRE-ALTERNATE) MOULT**, often starting before post-juvenile moult finished; some attain traces of breeding plumage (especially on crown and cubital bar) but in most there is probably no change in appearance. Resultant first immature non-breeding (first alternate) plumage superficially like adult non-breeding and, in species with regular cycles, held when adults in full breeding plumage.¹ When c. 1 year old, complete **FIRST IMMATURE POST-BREEDING (SECOND PRE-BASIC) MOULT** brings on plumage almost identical to adult non-breeding; this retained for much of second year, so most immatures retain non-breeding appearance from c. 5 months to c. 21 months old. Partial **SECOND PRE-BREEDING (SECOND PRE-ALTERNATE) MOULT** near end of second year is first moult to bring on extensive breeding plumage. In many species, second immature breeding plumage may differ from adult breeding in having a few non-breeding-like feathers in crown, cubital bar, tail or underparts; however, reliability of these ageing characters undermined in some species by similar variation in very small number of adults. Subsequent moults, as adults.

Mostly marine, inshore; some frequent both littoral and freshwater habitats; some markedly pelagic. Carnivorous; some only or mainly take fish (e.g. Black-naped Tern *S. sumatrana*, White-fronted Tern *S. striata*); other HANZAB species take mixture of fish, molluscs, crustaceans and insects; some freshwater species also take small vertebrates, such as mice or frogs (e.g. Whiskered Tern *C. hybridus* and Gull-billed Tern *S. nilotica*). Mostly diurnal but some nocturnal or crepuscular. Forage singly, in small groups or in mixed species feeding flocks, usually with other terns or seabirds, such as shearwaters. Feed mainly by surface plunging, occasionally shallow plunging; and by dipping (contact and non-contact). Also feed by hawking for insects over land and water; gleaning food while walking on ground or in shallow water; and kleptoparasitism.

¹ In Arctic Terns, the first alternate plumage was once mistaken as a separate species and named *Sterna portlandica* (Ridgway 1874), and the second alternate plumage was mistaken as another, *Sterna pikei* (Lawrence 1853). These taxonomic treatments have long since been discarded, but the terms 'portlandica plumage' and 'pikei plumage' still confusingly and incorrectly used for homologous plumages in many terns.

Highly gregarious when feeding, roosting and breeding, and will mob predators at colonies. Monogamous, with pair-bonds tending to persist from year to year. Birds may breed as early as 1 year old, but usually not till 3–4 and even older. Can live for many years. Normally breed in colonies, which can number up to tens of thousands. Nesting densities vary with species and habitat, and in large colonies of some *Sterna*, distances between nests can be a body-length. Nesting territories used for courtship and pair-formation, courtship feeding, copulation, and nesting. Fidelity to nesting site between years high in some species, though other species move between colonies or shift site of colonies altogether (Campbell & Lack 1985). At colonies, social flights, called MASS FLIGHTS, DREADS, PANICS, or UPFLIGHTS, common. In these displays, some or all members of a colony take flight and fly round in dense flock. Many authors use the terms interchangeably. Others distinguish between Mass Flights and Dreads: In Dreads, birds take off and fly low over colony for some distance without calling, then fly upwards calling loudly; Dreads an escape response but may also be used to help synchronize breeding. In Mass Flights, all birds take off and fly upwards, calling loudly from outset; Mass Flights most common before laying and are used to help synchronize breeding cycles of individuals; resurgence of Mass Flights occurs when chicks being fed, mostly by non-breeding birds visiting colony, at least some of which are preparing to breed in the next breeding season (K. Hulsman). The distinction is often not clear in published descriptions of flock behaviour. Vocal at breeding colonies; calls raucous.

In *Sterna* and allied genera, displays usually elaborate and similar between species. Aerial flights and some ground displays persist after laying. In GROUND DISPLAYS, which often involve more than two birds, birds drop wings, raise tails and stretch necks upwards. Aerial displays occur in and round colonies. In HIGH FLIGHTS, several birds ascend rapidly to 100 m or more, with some birds displaying as they descend. Zigzagging flights common and especially spectacular in Crested Tern, even after nesting has finished (Gibson 1956). A male carrying a fish will execute noisy LOW FLIGHT through colony, which often stimulates others to join in. FISH-OFFERING CEREMONIES involve one bird flying round, calling loudly, usually with fish held crosswise in bill; usually, another joins it, flying in front of first. Fish not transferred on wing, but may be passed on ground, accompanied by strutting.

Noddies (*Anous*, *Procelsterna* and *Gygis*) have different displays to sea terns. Similarities include ground displays before and during incubation, which involve birds dropping wings so that tips on or close to ground. In courtship display at nest-site, male bobs head slightly and caresses head and neck of female with bill; male courtship-feeds female, and birds call and touch bills. In aggressive territorial displays, male raises feathers of crown slightly, gives rattling call, then thrusts stiffened neck forward and bows. In all displays, orange tongue, pale crown and markings round eyes prominent (Woodward 1972).

Within Sterninae, both sexes share nest duties. Chicks semi-precocial and, if undisturbed, semi-nidifugous (most species) or nidicolous (*Anous*, *Gygis*); older chicks occasionally form crèches in some *Sterna*. Food given in bill (most species) or by regurgitation (e.g. *S. fuscata*, *Anous*). Parental feeding continues after fledging, sometimes for several months and, sometimes, after dispersal from colonies (Campbell & Lack 1985; BWP).

Breeding seasonal, though some tropical terns, notably Bridled *S. anaethetus* and Sooty *S. fuscata* Terns, breed at sub-annual intervals depending on local conditions; at some sites, breeding of population may be continuous (King & Buckley 1985; King *et al.* 1992; BWP). Usually breed in colonies on offshore islands or on headlands; also on or round terrestrial wetlands or in coastal habitats, such as sand dunes, beaches and on islands and sandspits in estuaries; some species nest on cliffs (e.g. Grey Ternlet *P. albigitta*); Black-fronted Terns nest in shingle beds in streams; Whiskered Terns in vegetation in freshwater swamps; occasionally nest on man-made structures, such as jetties and wrecked ships (HASB; Aust. NRS). Will nest with other species of terns. Ground-nesting birds make unlined or poorly lined scrape in sand or gravel, sometimes under vegetation or in crevice of rock; most noddies nest in trees and bushes, and build bulky nests out of plant material, though many Common Noddies *A. stolidus* nest on ground; Whiskered Terns build mounds or platforms of vegetation; White Terns make no nest, laying egg on bare branch or leaf of a tree (Fjeldså 1977; HASB; Aust. NRS). Ground-colour of eggs varies from cream or stone-grey to greenish stone, buff or light brown, with markings of black or dark brown, occasionally dark purple (HASB). Clutch-size, 1–3; most species breeding temperate zones average two eggs per clutch, most in tropical areas only one. Incubation period ranges from 19 to 36 days; species that lay 2–3 eggs per clutch incubate for shorter periods, mostly between 19 and 23 days, while those that usually lay one egg incubate for longer, from 28 to 36 days. Both sexes incubate. Adults defecate away from nest. Both sexes feed young, mostly bill to bill or by dropping item beside chick, though noddies, *Procelsterna* and some tropical *Sterna* fed by regurgitation. Young of ground-nesting species leave nest within 1 week of hatching but may remain near nest for a few more days; usually seek shelter in nearby cover, though some species form crèches (Hulsman 1977; HASB); young of tree-nesting species usually remain in nest till able to fly (but see *Gygis alba*). Most species dependent on parents for food for up to 4 months after fledging. Age of first breeding, usually 3–4 years, some species at 2 years (BWP).

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Chlidonias leucopterus White-winged Black Tern

COLOUR PLATES FACING PAGES 704 & 705

Sterna leucoptera Temminck, 1815, *Man d'Orn.*: 483 — coasts of Mediterranean Sea.*Leucoptera* is directly from the Greek λευκόπτερος, for white-winged.

OTHER ENGLISH NAMES White-winged Tern, White-winged Marsh Tern, Black Tern, White-tailed Tern, White-winged Sea-swallow.

MONOTYPIC

FIELD IDENTIFICATION Length 20–23 cm; wingspan 60–67 cm; weight male 60–65 g. Smallest *Chlidonias*. Small compact marsh tern. Slightly smaller, slimmer and more compact than Whiskered Tern *C. hybridus*. Very close in size to Black Tern *Chlidonias niger* but more compact. Adult in breeding plumage strikingly black and white, with diagnostic white forewing-coverts. Sexes separable in fresh breeding plumage. Marked seasonal variation. Juvenile distinct. Immatures separable.

Description Adult male breeding Head, underbody and underwing-coverts, velvet-black, sharply demarcated from white vent and undertail-coverts and silver-grey undersides of remiges. Saddle, dull black, grading evenly to slightly darker neck but sharply demarcated from white rump and tail and pale upperwing; uppertail-coverts and centre or sides of tail sometimes pale grey. Upperwing-pattern, diagnostic: pale silvery-grey, grading to broad white leading-edge of innerwing, with dusky-grey wedge on outer primaries, and, usually, dusky-grey secondary bar; inner secondary coverts often dark grey and, with secondary bar, can form diffuse dusky triangle on rear innerwing; both secondary bar and wedge on outerwing become much darker with wear. At rest, white leading coverts of folded wing contrast markedly with black body. In transition to non-breeding plumage typically develop mottled white face and white forehead, chin and throat; later, most have non-breeding head and forebody, with rest of body appearing irregularly spotted and barred with black; normally, black underwing-coverts moulted last, and stand out against predominantly pale underbody. Bill, black to dark red, with red base in breeding season. Iris, dark brown. Legs and feet, red.

Adult female breeding Like adult male breeding but generally duller black, with grey tone to body and scapulars.

Adult non-breeding Differ from adult breeding by: Head and neck, white, with crown and centre of nape, black, streaked white, and separated from mantle by white hindneck; small black patch in front of eye; black spot or vertical band on ear-coverts, extending below level of eye and often separated from dark crown by narrow white supercilium; and narrow broken white eye-ring; in fresh plumage, can appear white-headed apart from black marking at ear and indistinct dusky crown and nape. Saddle, uppertail-coverts and tail, grey, with narrow diffuse darker-grey border to upper edge of mantle, narrow white sides to tail (conspicuous when tail spread), and white rump; with wear, rump darkens and contrasts less with rest of upperparts. Upperwing: remiges, silvery grey, with slightly darker secondary bar and dusky-grey wedge on outer primaries contrasting only slightly with newer paler inner primaries. Underparts, white, with diffuse grey trailing-edge to remiges; often retain diagnostic black line along tips of greater coverts and scattered black spots on white lining. In transition to

breeding plumage, typically have black on head and underbody and on much or all of wing-lining. Bill, black. Legs and feet, dark red, with grey or black tinge.

Juvenile Similar to adult non-breeding, differing by: Dark areas of crown, nape and ear-coverts, uniform black, forming neat dark cap streaked white at border with forehead (which is washed buff in fresh plumage); with wear, head like adult non-breeding. Saddle, brown-black, with indistinct pale fringes, and contrasting strongly with pale wings. Tertiaries, grey, with narrow pale fringes and dark bands. Rump, white. Uppertail-coverts and tail, grey, with white sides to tail and, sometimes, narrow dark terminal tail-band. Upperwing more uniform than in adult: grey, with narrow grey-black cubital bar and patch on alula and median primary coverts, dusky trailing-edge to primaries and dusky secondary bar; usually appears palest on central secondary coverts. Underbody, white; a few have narrow diffuse buff or brown patch extending from mantle onto sides of breast. Bill, black-brown, with paler red to grey-yellow base. Legs and feet, red, red-brown or grey-orange.

Transition to first immature Post-juvenile moult protracted, gradually attaining non-breeding plumage like that of adult. At first, plumage as juvenile except: head and saddle as adult non-breeding; upperwing, very worn, brownish grey, with dark cubital and secondary bars and diffuse whitish panel on central innerwing; some birds have some grey non-breeding central secondary coverts. Later, similar to adult non-breeding but with retained worn juvenile cubital and secondary bars, and longer dark wedge on outerwing, contrasting strongly with new pale-grey inner primaries. When first immatures are in non-breeding plumage and still moulting remiges, adults are acquiring breeding plumage.

First immature (non-breeding and breeding) Inseparable from adult.

Similar species In non-breeding and juvenile plumages, often confused with **Whiskered Tern** (q.v.). In ALL PLUMAGES, easily confused with vagrant **Black Tern**, which differs by very slight differences in size and structure: smaller and slimmer; with longer, narrower, more pointed wings; longer and more deeply forked tail; longer, finer bill; flatter forehead, giving less rounded profile; shorter legs; and, in flight, more rakish jizz and faster and deeper wing-beats. In **ADULT BREEDING PLUMAGE**: (1) wings, darker grey, contrasting less with black underbody when perched; (2) bill, legs and feet, much darker, black to dark red-brown; and, in flight: (3) upperwing, rump and tail rather uniform and darker grey, with only narrow white leading-edge to innerwing and little contrast between upperwings and darker grey saddle; and (4) underwing-coverts, white, contrasting strongly with black underbody. **TRANSITIONAL PLUMAGES** (moulting into and out of breeding plumage): Black has diagnostic combination of dark patches at sides of breast, grey wash on flanks and white underwing-coverts

(White-winged Black may show black patch on sides of breast superficially similar to that of Black, but then always have black mottling elsewhere on underbody and some black on underwing-coverts). In NON-BREEDING PLUMAGES, Black differs by: (1) diagnostic dark patch on sides of breast and grey wash on flanks; (2) darker-grey upperparts, with, in flight, rump and sides of tail as rest of upperparts or slightly paler; (3) darker, more solid black crown, usually appearing more sharply demarcated from white forehead and continuous with black band on ear-coverts (apparently never appears to have white head with isolated black ear-patch, as in palest-headed White-winged Black); also, black patch on nape broader, and white on sides of neck does not extend so high up behind black band on ear-coverts as on typical White-winged Black; (4) legs and feet much darker, black to dark brown (cf. red or orange-red in White-winged Black); (5) in flight, dark cap and patches at sides of breast form characteristic double marking, visible at long range. Further distinguished by: (6) underwing-coverts, white (often with some scattered black spots and black line along greater coverts on White-winged Black). In JUVENILE PLUMAGE, best distinguished by prominent dark patches at sides of breast and extensive grey-brown wash on flanks (a few White-winged Black have superficially similar narrow buff or brown patch on sides of upper breast, but mark always smaller, paler and less distinct, and flanks always white and unmarked). Also differs by: same differences in head, rump and tail as non-breeding, but crown streaked white at first (in fresh plumage, White-winged Black have solid black crown); and sides of rump may appear slightly paler than rest of upperparts (but never have white rump). Upperparts darker, brown-grey and more uniform, darkest on upper mantle, with broader dark cubital bars that join dark upper mantle to form characteristic band on upperparts. See also comments under **Grey Ternlet** *Procelsterna cerulea*.

Gregarious; normally forage and roost in small flocks; sometimes in hundreds or thousands at favoured sites; in Apr.–May, often gather in large flocks at staging sites before n. migration. Often associate with other terns, especially Whiskered Terns. Inhabit wide variety of coastal and inland, freshwater and brackish wetlands; also irrigated croplands. Less marine than Black Tern, though sometimes seen in open coastal waters, especially during migration. Flight and feeding actions similar to other marsh terns: typically forage in noisy flocks; feeding flight rather leisurely, erratic and buoyant; beat steadily into wind, with quick shallow wing-beats, often dipping to surface to take prey; seldom plunge-dive; often hover while hawking for insects over water or grassland. Normal flight slightly slower, steadier, more leisurely and direct than that of Black Tern, with slightly quicker shallower and stiffer wing-beats. Gait and carriage similar to Black Tern but stand slightly taller; stance usually low and horizontal when perched; wing-tips extend well beyond tip of tail, which ends roughly halfway between vent and wing-tips. Normal call, hoarse dry *kersch*, deeper and harsher than call of Black Tern; also abrupt *kik*, excited *keek-keek-keek*, short *kett* or *kreck*.

HABITAT Mostly coastal or subcoastal, fresh or saline wetlands. Frequent tidal wetlands, such as harbours, bays, estuaries and lagoons, and their associated flats; and terrestrial wetlands, including swamps, lakes, billabongs, rivers, floodplains, reservoirs, saltworks, sewage ponds and outfalls. Wetlands may be open, or with floating emergent or marginal vegetation. Rarely inland, on arid or subalpine wetlands (Sibson 1962; Roberts 1980). Occasionally recorded over dry land;

sometimes at sea, especially on migration (Roberts 1979); recorded between 300 m and 2 km offshore (Garnett & Bredl 1985; Brandis *et al.* 1992).

Only breeding record in HANZAB region was at sandy margin of coastal estuarine lagoon, among Marram Grass *Ammophila arenaria* and weeds (Pierce 1974).

Mainly forage aerially, over water or muddy or sandy edges of wetlands; also adjacent land, especially if inundated (Ford 1956; Wall 1963; Smith 1965; Keeley & Sagar 1968; Rix 1970; Crawford 1972, 1977; Pierce 1974; Todd & Lloyd 1980; Atherton *et al.* 1985). Food usually taken low over water or ground, or from surface of water; less often, from ground. Very rarely, dive into water (Hutchison 1971; Pierce 1974; Todd & Lloyd 1980). Often hawk above wetland vegetation, such as reeds and rushes, saltmarsh and mangroves (Alexander 1917; Sibson 1954; Douglas 1956; Lindgren 1956; Watson 1956; Storr 1984) and flooded farmland and rice-paddies (Sibson 1954; Pierce 1974; Crawford 1977). Also over dry paddocks, crops, 'low scrub' and grass (Alexander 1917; Ford 1956; Lindgren 1956; Hutchison 1971; Stokes *et al.* 1984). Foraged at sewage outfall (Thomas 1957; Hamilton 1967). Forage at edge of tide, but occasionally farther out to sea (Serventy 1947; Thomas 1957; Pierce 1974; Crawford 1977; Storr 1980). Once recorded feeding at sea off river-mouth, at junction of floodwater and seawater (Amiet 1956). Rarely, recorded feeding on ground (Sibson 1954; Todd & Lloyd 1980).

Usually roost or loaf on ground at edges of wetlands, including sand and mudflats, beaches, spits, banks, islets and rocks (Sibson 1954, 1955, 1962; Fleming 1955; Douglas 1956; Thomas 1957; Morris 1971; Gosper 1973; Todd & Lloyd 1980; Atherton *et al.* 1985). Once, on gravel road in sewage farm (Smith 1965). Occasionally in reeds or among low vegetation (Alexander 1917; Lindgren 1956; Wakelin 1968). Sometimes perch on posts, piles, driftwood, boats or rubbish, either surrounded by water, floating, or on mud (Alexander 1917; Sibson 1955; Amiet 1956; Thomas 1957; Smith 1965; Frith 1969; Todd & Lloyd 1980). Rarely sit on water (Lindgren 1956).

DISTRIBUTION AND POPULATION Breed e. Europe, Russia and China. Scattered sites from Latvia to Romania, extending E through Russia to headwaters of Irtysh and Ob Rs, ranging N to c. 55°N, and S to n. Black Sea, Armenia, Azerbaijan, Kazakhstan and s. Russia; Iraq; also headwaters of Selenge R. in n. Mongolia; widespread ne. China, including Inner Mongolia, S of Hwang Ho. Once bred NZ (see below). During non-breeding period, occur n. Africa (most widespread S of Sahara Desert); rarely recorded India and Sri Lanka; scattered records from Bangladesh to Vietnam; more widespread from s. Malay Pen. to Indonesia, PNG and Aust.; also e. China (Dement'ev & Gladkov 1951; Ali & Ripley 1969; de Schauensee 1984; Coates 1985; Urban *et al.* 1986; BWP). Vagrant to USA (AOU 1983).

Aust. Mainly n. coasts, with scattered records elsewhere. **Qld** Scarce passage migrant Torres Str. (Draffan *et al.* 1983). Widespread Gulf of Carpentaria and w. C. York Pen. (Aust. Atlas). On e. coast between C. York Pen. and Townsville only recorded round Cairns, Innisfail and adjacent hinterlands (Bravery 1970; Gill 1970; Qld Bird Reps; Aust. Atlas); scattered records from Townsville and Ayr. More often recorded in SE. Rarely recorded in W, e.g. Dynevor Ls, W of Beetoota and L. Moondarra (Corben 1972; Atherton *et al.* 1985; Qld Bird Rep. 1988). **NSW** Early records summarized in Morris (1971) and Gosper (1973). Widespread E of Great Divide, mainly from Ballina to Wollongong (NSW Bird Reps; Aust. Atlas);

rarely S to Tuross and Wallaga Ls (Whiter 1993). W of Great Divide, scattered records from L. Cowal, Griffith, Finley, Booligal, L. Cawndilla, near Ivanhoe, and Narran L., near Brewarrina (Gosper 1973; NSW Bird Reps; Aust Atlas). **Vic.** Isolated records in Gippsland, at Marlo, Ocean Grange, Dowd's Morass, The Heart Morass and Jack Smith L.; once at Edithvale; regularly recorded w. Port Phillip Bay, at Altona, Werribee and L. Connewarre; in Western Districts, at L. Murdeduke, L. Terangpom and L. Pertobe, Warrnambool; also regularly in mid-Murray Valley, from Nyah to near Koondrook (Howard & Crawford 1989; Vic. Bird Reps; Vic. Atlas). **Tas.** Regular visitor in small numbers. First recorded 16 Dec. 1961 at Clear and Rushy Lagoons (Wall 1963). Subsequent records (singles unless stated): Chalky I., Flinders Grp, 21 Nov. 1980 (Tas. Bird Rep. 10); Cameron Inlet, three, Nov. 1981 (Newman *et al.* 1984). On mainland, all records in E: George Town: two, 2 Apr. 1988 (Tas. Bird Rep. 18); C. Portland: 6 Nov. 1977; 1 Dec. 1979; 19 Dec. 1983; three, 6 Nov. 1988; two, 5 and 16 Jan. 1990 (Cooper 1982; Tas. Bird Reps); St Helens, seven, 22 Dec. 1991 (Tas. Bird Rep. 21); L. Dulverton: 21 Dec. 1971, 2 Feb. 1980, 15 Dec. 1990 (Tas. Bird Reps 1, 10, 20); Orielton Lagoon: up to three, 20 Jan.–4 Feb. 1968, 17 Aug. 1974, 29 Mar. 1975, two, 13 Dec. 1981 (Wall 1968; Tas. Bird Reps 4, 5, 11); Clear and Rushy Lagoons, Sandford: 16 Dec. 1961 to 3 Mar. 1962 (specimen) (Wall 1963); two, 6 Nov. 1971; 28 Dec. 1971; two, 2 and 8 Jan. 1972; 24 Oct. to 2 Dec. 1973 (Tas. Bird Reps 1, 2, 3); South Arm, 5 Nov. 1977 (Tas. Bird Rep. 7); West Bay, Feb.–Mar. 1979 (Tas. Bird Rep. 9); Isthmus Bay, Bruny I., 19 Dec. 1985 (Tas. Bird Rep. 15); Elwick Bay, 10 Dec. 1985 (Tas. Bird Rep. 15). **SA** First record, 12, L. Alexandrina (single specimen collected) 27 Dec. 1964 (Eckert 1965). Records at seven locations to 1981 (SA Bird Reps; no later records published). Single, L. George, 28 Dec. 1981; L. Alexandrina (including Mosquito Pt, Tolderol and Langhorne Ck): 17 records between Dec. 1964 and Feb. 1981; single, Finnis, 10 Sept. 1966; Bolivar: up to five, early May to Aug. 1967; single, 1 May 1981; ICI Saltfields, St Kilda: seven records of one or two, between 1 Oct. 1967 and 11 Mar. 1979; singles, Port Gawler, 30 Oct. 1966, 22 Dec. 1977; Price

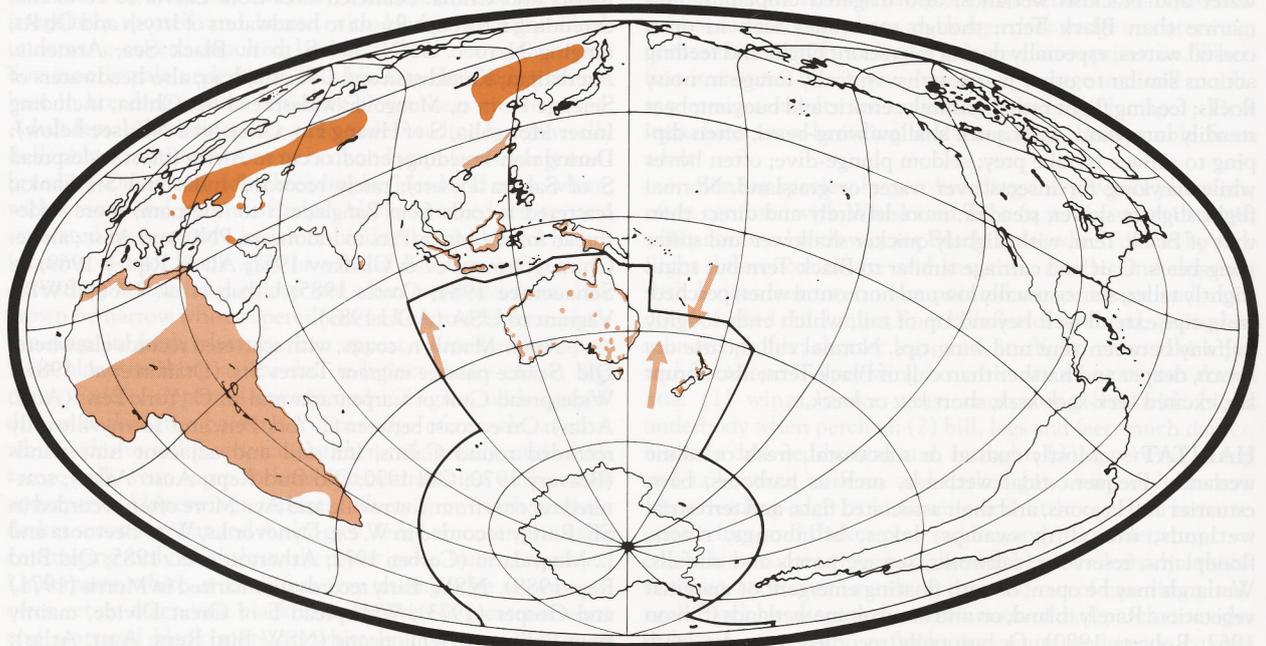
Saltfields, three, 9–12 Apr. 1971; singles, 20 Jan. 1974, 30 Oct. 1977 (SA Bird Reps). Recorded inland at Innamincka Stn (Badman 1989). **WA** Occasionally recorded on s. coast, e.g. Eyre Bird Observatory, Mullet L., Warden L., Woody L. and Riverton (Hutchison 1971; Congreve 1982; Anon. 1985; Jaensch *et al.* 1988). In SW, widespread from Balingup and Vasse R. estuary, N to Monger's L. (Jaensch *et al.* 1988; Aust. Atlas). Rarely in Gascoyne Region. Widespread Pilbara and Kimberley coasts, with occasional records farther inland (Storr 1980, 1984; Jaensch 1989; Jaensch & Vervest 1990; Aust. Atlas). **NT** Widespread annual visitor to coastal areas from Joseph Bonaparte Gulf, E through Top End to Groote Eylandt and Sir Edward Pellew Grp; also widespread elsewhere in Gulf of Carpentaria (Crawford 1972; Schodde 1976; Aust. Atlas; H.A.F. Thompson & D.K. Goodfellow). Rarely recorded inland: two, Frewena, 15 Dec. 1981 (Aust. Atlas); two, Alice Springs SF, 25 Dec. 1978 (Roberts 1980).

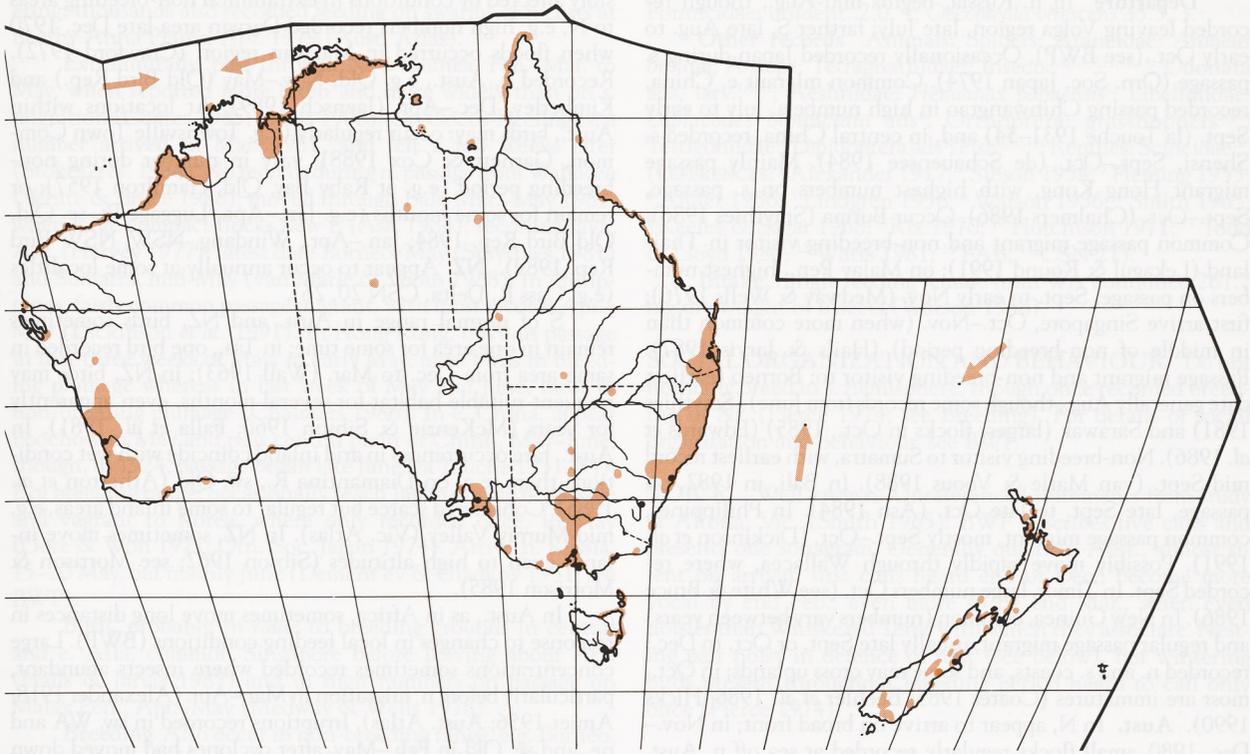
Lord Howe I. Two specimens (after severe storm), 13 Feb. 1915 (Hindwood 1940); single, 12 Nov. 1992 (NSW Bird Rep. 1992).

Norfolk I. Four, Feb. 1967 (Wakelin 1968); single, 1–13 Nov. 1971 (Moore 1985); single, 1 Dec. 1971 (Hermes *et al.* 1986); single, 31 Oct.–4 Nov. 1981 (Moore 1985); single, 18 Dec. 1984–7 Feb. 1985; two, 5 and 7 Jan. 1985 (Moore 1985; Hermes *et al.* 1986).

Cocos-Keeling Is Many, Mar. 1981; unconfirmed record of six, Jan. 1983 (Stokes *et al.* 1984); single, 3 Nov. 1993 (Carter 1994).

NZ Regular visitor in small numbers. **NI** Infrequently recorded in Northland, including Kerikeri Inlet, Whangarei and Pouto. More widespread Auckland, South Auckland and Bay of Plenty, from Okura and Manakau Harbour, E through Firth of Thames to mouth of Rangitaiki R., and occasionally E to mouth of Motu R. Occur at a few sites on e. coast, including Muriwai and round Napier. Recorded at L. Wairarapa and from Pauatahanui, N to Rangitikei R. Isolated records Taranaki, at New Plymouth and L. Ratapiko (CSN; NZ Atlas). **SI** Sporadic records Nelson and Marlborough, round Farewell Spit, Waimea Inlet, Nelson Haven, Blenheim and Kaikoura





Pen. In Canterbury, widespread from Ashley R., S to mouth of Rakaia R.; also at mouth of Opihi R. and Wainono Lagoon. Also occur in inland Canterbury, at Hawdon R., and from Spider Lagoon, SW to L. Ohau. In Otago, recorded at Middlemarch, Otago Harbour and L. Waiholo. Widespread from Waituna Lagoon, N to Dunton Ck (N of Te Anau) (though no records in Southland in NZ Atlas). On w. coast, records from Grey R., Westport and Karama (Heather 1960, 1964; Edgar 1978; Morrison & Morrison 1985; CSN; NZ Atlas).

Irruptions Several irruptions in sw. WA, all associated with gales or cyclones. In 1917, thousands seen from Monger's L., S to Busselton and Balingup (Alexander 1917). In 1918, 'a great number' recorded near Perth between 23 Apr. and May 1918 (Alexander 1918). Up to 1000 recorded from Lancelin Bay, S to Mandurah, between 4 Mar. and 6 Apr. 1956 (Douglas 1956; Ford 1956; Fuller 1956; Gentili 1956; Lindgren 1956). A small irruption recorded between 27 Mar. and 3 Apr. 1960, when up to 21 seen at wetlands from Monger's L., S to Walyungup L. (Ford 1961). Up to 100 seen in Perth, from Monger's L., S to Riverton, 7–25 Feb. 1970 (Hutchison 1971). Other smaller influxes noted in sw. WA in 1938, 1978, 1981 and 1983–86 (Storr & Johnstone 1988). Small irruption se. Qld, 1955 (Amiet 1956). In Tas., seven observed at St Helens in Dec. 1991 (Tas. Bird Rep. 21), an unusually high number, which coincided with above-average numbers in Vic.; above-average numbers also recorded Vic. 1985 and 1986 (Vic Bird Reps 1985, 1986). In NZ, small influx noted Ahuriri Lagoons, Westshore, and Napier, early Jan. till mid-May 1972, when >13 birds recorded (Todd & Lloyd 1980).

Breeding Only one confirmed record in s. hemisphere: mouth of Opihi R., NZ, Dec. 1973 till Feb. 1974 (Pierce 1974); record accepted by RBC (Kinsky 1977). Said to have bred Canterbury, 1927 (Oliver).

Populations In n. Aust., sometimes recorded in large

numbers, e.g. 15,000 at Port Hedland, WA, Mar.–Apr. 1982 (R.P. Jaensch); 6000 in 15 km, Eighty Mile Beach, WA (Jaensch 1989); up to 2600, Armstrong Plain, SW of Normanton, Qld, 8 Apr. 1985 (Qld Bird Rep. 1985); c. 1200, Darwin SF, NT, Dec. 1985 (H.A.F. Thompson & D.K. Goodfellow). On e. coast, ≥ 500 , Alva Beach 13 Mar. 1988; ≥ 500 , Ewan Maddock Dam, Qld, 21 Apr. 1986 (Qld Bird Reps 1985, 1988). In s. Aust.: 161 and 155 recorded at Werribee SF, 13 Mar. 1986 and 12 Apr. 1987 respectively (Vic. Bird Reps 1986, 1987); c. 150, Grahamstown Reservoir, Newcastle, NSW, 9 Feb. 1985 (NSW Bird Rep. 1985); 81, Koorangang I., NSW, 5 Mar. 1977 (NSW Bird Rep. 1977); 57, L. Wollumboola, NSW, 21 Dec. 1991 (NSW Bird Rep. 1991). In sw. WA, recorded at eight of 197 wetlands surveyed 1981–85 (Jaensch *et al.* 1988).

MOVEMENTS Migratory; breed n. Eurasia, mainly between 35°N and 55°N, and move to non-breeding areas in Africa, s. and e. Asia, Indonesia, PNG and Aust. Populations from w. Palearctic move to non-breeding areas in inland Afrotropical region; large numbers in Africa suggest part of central Russian population might move there. Origins of non-breeding birds in Persian Gulf, Pakistan, India and Sri Lanka, not known. Population from central and e. Asia moves to non-breeding areas in s. China, Philippines, Indonesia, Aust. and NZ, possibly also Burma and Malay Pen. Extraliminally, much overland passage (Delacour & Mayr 1946; Harrison 1957; de Schauensee 1984; BWP). Large influxes recorded during poor weather in Aust. (see Distribution) and extraliminally (e.g. Hong Kong, Chalmers 1986). Large flocks seen on coasts near and during periods of passage, e.g. Sumatra (van Marle & Voous 1988). Rest of account refers to populations breeding central and e. Asia, though origin of all birds on passage or wintering not certain (e.g. Burma, Pacific). For movements of w. breeding populations, see BWP.

Departure In n. Russia, begins mid-Aug., though recorded leaving Volga region, late July; farther S, late Aug. to early Oct. (see BWP). Occasionally recorded Japan during s. passage (Orn. Soc. Japan 1974). Common migrant e. China, recorded passing Chinwangtao in high numbers, July to early Sept. (la Touche 1931–34) and, in central China, recorded s. Shensi, Sept.–Oct. (de Schauensee 1984). Mainly passage migrant Hong Kong, with highest numbers on s. passage, Sept.–Oct. (Chalmers 1986). Occur Burma (Smythies 1986). Common passage migrant and non-breeding visitor in Thailand (Lekagul & Round 1991); on Malay Pen., highest numbers on passage, Sept. to early Nov. (Medway & Wells 1976); first arrive Singapore, Oct.–Nov. (when more common than in middle of non-breeding period) (Hails & Jarvis 1987). Passage migrant and non-breeding visitor to: Borneo (earliest date generally Aug., though some records from June) (Smythies 1981) and Sarawak (largest flocks in Oct., 1985) (Edwards *et al.* 1986). Non-breeding visitor to Sumatra, with earliest record mid-Sept. (van Marle & Voous 1988). In Bali, in 1982, on passage, late Sept. to late Oct. (Ash 1984). In Philippines, common passage migrant, mostly Sept.–Oct. (Dickinson *et al.* 1991). Possibly move rapidly through Wallacea, where recorded Sept. In Timor, large numbers Oct. (see White & Bruce 1986). In New Guinea, common (numbers vary between years) and regular passage migrant, usually late Sept. or Oct. to Dec.; recorded n. and s. coasts, and some may cross uplands; in Oct., most are immatures (Coates 1985; Beehler *et al.* 1986; Hicks 1990). **Aust.** In N, appear to arrive on broad front; in Nov.–Dec. 1980, small flocks regularly recorded at sea off n. Aust. between 120°E and 140°E, assumed to be on passage (Aust. Atlas). In Torres Str., passage migrant in small numbers (Draffan *et al.* 1983). In Kimberley Div., nw. Aust., recorded Oct.–Nov. and widespread from Dec. (Serventy 1947; Storr 1980; Jaensch 1989). In Darwin area, recorded Aug.–Sept., with numbers increasing mainly from Oct.; maximum numbers in Jan., which may mean earlier arrivals move farther S (Crawford 1972; McKean 1981). On Swan Coastal Plain, sw. Aust., from Nov. (Storr 1988); vagrant to Rottnest I., WA, where recorded as early as Oct. (Saunders *et al.* 1987). Inland record at Alice Springs, NT, Dec. 1978, indicates some move overland (possibly continuing to s. coasts) or are forced inland by cyclones (Aust. Atlas). In ne. Qld, small numbers recorded Oct.–Nov. (Bravery 1970; Gill 1970) with large numbers late Nov. (Qld Bird Rep. 1989). In Moreton Bay, Qld, in 1956 and 1957, arrived Oct. (Amiet 1957; Hamilton 1957). On coastal NSW, recorded from Oct. (Gosper 1981, 1983; Brandis *et al.* 1992). In Vic., from 1977 to 1981, recorded as early as Aug. (no records June–July) (Vic. Atlas). In SA, earliest record Sept., except for winter records (SA Bird Rep. 1966–67). Straggle to Tas. where recorded as early as Oct. (see Green 1989). **NZ** Occur annually in small numbers (particularly juveniles) (Falla *et al.* 1981); first-year bird recorded late July and Aug. (CSN 38). In Napier, NI, in 1972, unusually high numbers and first sighting was early Jan. (Todd & Lloyd 1980).

Non-breeding Breeding populations from central and e. Asia occur coastal China, from mouth of Yangste R. to Kwangtung, Hainan and Lanyu I.; also Taiwan, Hong Kong (isolated records), Philippines, New Guinea (few) and n. Aust. In Pacific, uncommon visitor to Palau and vagrant to Marianas (Delacour & Mayr 1946; de Schauensee 1984; Coates 1985; Chalmers 1986; Pratt *et al.* 1987; HASB; BWP). Occur Thailand (common), Malay Pen. (small numbers), Burma and Bangladesh (Medway & Wells 1976; Ripley 1982; Smythies 1986; Lekagul & Round 1991; BWP). **Aust.** Numbers pos-

sibly affected by conditions in extralimital non-breeding areas to N, e.g. high numbers recorded Darwin area late Dec. 1970 when floods occurred in Malayan region (Crawford 1972). Recorded n. Aust., e.g. Qld, Nov.–May (Qld Bird Rep.) and Kimberley, Dec.–Apr. (Jaensch 1989). At locations within Aust., birds may occur regularly (e.g. Townsville Town Common, Garnett & Cox 1988); vary in number during non-breeding period (e.g. at Raby Bay, Qld, Hamilton 1957); or remain for some months (e.g. Jan.–Apr., Luggage Pt, se. Qld, Qld Bird Rep. 1984; Jan.–Apr., Windang, NSW, NSW Bird Rep. 1989). **NZ** Appear to occur annually at some localities (e.g. Cass R. Delta, CSN 20, 26).

S of normal range in Aust. and NZ, birds sometimes remain in one area for some time; in Tas., one bird recorded in same area from Dec. to Mar. (Wall 1963); in NZ, birds may frequent suitable habitat for several months, even apparently for years (McKenzie & Sibson 1960; Falla *et al.* 1981). In Aust., rare occurrences in arid inland coincide with wet conditions there, e.g. on Diamantina R., sw. Qld (Atherton *et al.* 1985). Considered scarce but regular to some inland areas, e.g. mid-Murray Valley (Vic. Atlas). In NZ, sometimes move inland, even to high altitudes (Sibson 1962; see Morrison & Morrison 1985).

In Aust., as in Africa, sometimes move long distances in response to changes in local feeding conditions (BWP). Large concentrations sometimes recorded where insects abundant, particularly before n. migration in Mar.–Apr. (Alexander 1918; Amiet 1956; Aust. Atlas). Irruptions recorded in sw. WA and ne. and se. Qld in Feb.–May, after cyclones had moved down coasts or after strong winds (Alexander 1917, 1918; Mayo 1925; Amiet 1956; Gentilli 1956; Hamilton 1957; Ford 1961; Hutchison 1971; HASB). Some irruptions involve many immatures. During irruptions, some birds may move, or are moved, overland (Alexander 1917). After cyclones, thousands have been found exhausted (Gentilli 1956). Suggested some birds involved in irruptions might return regularly to area in subsequent years (HASB).

Return NZ At Napier, in 1972 (year with unusually high numbers), last sighting mid-May (Todd & Lloyd 1980). Recorded Lord Howe and Norfolk Is, Feb. (Hindwood 1940; Wakelin 1968). **Aust.** In Tas., recorded as late as Mar. (see Green 1989). In SA, in some areas, maximum numbers Mar.–Apr.; some birds leave as late as late May; at Bolivar Sewage Treatment Works, in 1967, numbers increased between early May and end June (SA Bird Reps 1966–67, 1967–68). In Vic., some remain till May, rarely later (Vic. Atlas). At Hunter R., NSW, small flocks from late Feb., with latest date (1970–77), early Apr. (Gosper 1981). In Qld, at some localities (e.g. Alva Beach), large numbers (100s) recorded almost annually, Mar.–Apr. (Qld Bird Reps 1986, 1988, 1990); in s. Qld, concentrations recorded Apr., e.g. 130 at Brisbane Airport (Qld Bird Rep. 1989). Appear to leave Moreton Bay, late Apr. to early May (Amiet 1957; Hamilton 1957); at Giru, ne. Qld, in 1987 numbers dropped Mar.–Apr. (Qld Bird Rep. 1987); farther N on Qld coast, flocks noted early May (e.g. Townsville, Bell 1961); at Edward R., Gulf of Carpentaria, common Mar.–Apr. and leave by early May (Garnett & Bredl 1985); in s. Gulf of Carpentaria, Apr. 1985, flocks of up to 2600 recorded (Qld Bird Rep. 1985). Apparently leave Aust. in broad front. In Torres Str., passage migrant in small numbers (Draffan *et al.* 1983). In Darwin area, no return passage apparent and latest records May (McKean 1981). At Port Hedland, nw. Aust., Mar.–Apr. 1982, concentration of c. 15,000 birds (including some in breeding plumage) assumed to be pre-migratory gath-

ering; thousands also recorded feeding on swarms of locusts at nearby Anna Plains, Apr. 1979 (Aust. Atlas).

Extraliminally, pass through New Guinea, Feb.–Mar. to May, when reported more often and more widely than on s. migration (Coates 1985; Hicks 1990). On Cocos-Keeling Is, a number arrived in Mar. 1981, and left a few weeks later (Stokes *et al.* 1984). No records during n. passage from Wallacea (White & Bruce 1986); moved through Bali, Mar.–May 1982, when large compact flocks flew E (Ash 1984); recorded Java, Apr. (Harvey 1977); latest date Borneo, May (Smythies 1981) and Sumatra, mid-May (van Marle & Voous 1988). In Philippines, fairly common passage migrant, with most records Apr.–May (Dickinson *et al.* 1991). In Hong Kong, obvious passage in first three weeks of May; in early May, most birds in breeding plumage whereas in last week of May and June, most in non-breeding plumage (Chalmers 1986). In e. China, appear Foochow in May and pass central plain of Chihli, May–June, though, in 1924, passage began late June (la Touche 1931–34). E of breeding range, occasionally reach Japan during n. passage and vagrant to Korea, where only recorded once, in May (Gore & Won 1971; Orn. Soc. Japan 1974). Arrive n. Russia, 15–20 May, but mainly June (Dement'ev & Gladkov 1951; see BWP).

Birds, probably *en route* to breeding grounds in central and e. Asia, common Singapore before leaving about Apr. (Hails & Jarvis 1987) and in high numbers on passage on Malay Pen., Apr.–May (Medway & Wells 1976).

Breeding Also occur in non-breeding range, e.g. Borneo, New Guinea, and isolated records from Hong Kong (Smythies 1981; Coates 1985; Chalmers 1986; see BWP). Recorded Aust. and NZ: in NSW and SA, June and July (SA Bird Reps 1966–67, 1967–68; NSW Bird Reps 1978, 1980); in Vic., June (Smith 1965; Vic. Atlas); in Darwin area, Aug. (McKean 1981); in NZ, recorded all months, with some apparently staying through winter (Sibson 1962). Single confirmed breeding record in s. hemisphere, NZ (see Distribution).

Banding Extraliminally, one banded e. Russia 15 July 1977 recovered 6900 km SSE in PNG, 7 Nov. 1979 (ABBBS 1981).

FOOD Carnivorous. Insects, spiders, fish; extraliminally, frogs and tadpoles. **Behaviour** In non-breeding areas, mainly forage on coastal estuaries and freshwater wetlands; occasionally reported over terrestrial vegetation (Ford 1956; Lindgren 1956; Watts 1981). During coastal migration, often seen feeding at sea (Alexander 1917), possibly taking wind-blown insects (Amiet 1956) or items from sewage outfalls (Hamilton 1957, 1967). Use three main methods: (1) **PLUNGING**: shallow dives from 2 to 4 m, usually with wings raised; only partly submerge (Todd & Lloyd 1980; BWP); (2) **HAWKING**: take insects (e.g. flying ants) in air (Smith 1965; Keeley & Sagar 1968; Crawford 1977; CSN 19 Suppl., 21, 32, 35); (3) **DIPPING**: fly 2–4 m above water, dipping down to take items on or just below surface of water (Rix 1970; Crawford 1977); may skim bill along surface (Amiet 1957). May also **GLEAN** insects while on ground or mud or while wading in shallow water among saltmarsh vegetation (Sibson 1954; Todd & Lloyd 1980). Follow predatory fish (e.g. tuna) and dolphins *Phocoena* to take small fish driven to surface (HASB; BWP). In Mali, recorded taking insects disturbed by fire (Curry & Sayer 1979).

Adult Near Darwin, NT (5 stomachs, 51 items; Crawford 1977): Animals: Spiders 3.9% no., 2% freq.; Insects: Orthoptera: Acrididae 13.5, 2; Coleoptera: Dytiscidae larv. 29.4, 1; Hydrophilidae larv. 3.9, 1; Curculionidae 11.8, 3;

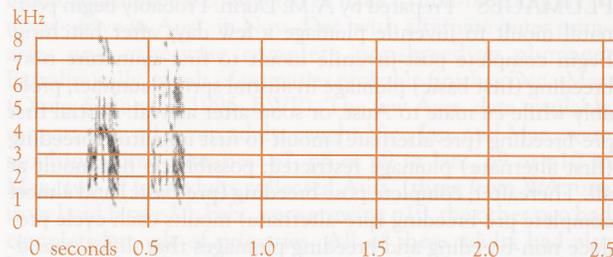
Formicidae: unident. 2.0, 1; *Oecophylla virescens* 35.3, 3.

Other records Animals: Spiders: Araneidae: *Araneus brounii*; *Argiope*; Tetragnathidae⁶; Insects^{2,4,7,8,9,11,12,14}: Odonata ads, larv.^{1,4,13}; Aeshnidae: *Hemianax papuensis*¹; Libellulidae: *Diplacodes bipunctata* ads⁶; Orthoptera: grasshoppers^{5,10}; Tettigoniidae⁶; Lepidoptera ads⁴; Fish^{3,10,11}; Reptiles: Scincidae¹⁰. (REFERENCES: ¹ Alexander 1917; ² Sibson 1954; ³ Fleming 1955; ⁴ Amiet 1956; ⁵ Lindgren 1956; ⁶ Watson 1956; ⁷ Smith 1965; ⁸ Keeley & Sagar 1968; ⁹ Rix 1970; ¹⁰ Hutchison 1971; ¹¹ Todd & Lloyd 1980; ¹² Watts 1981; ¹³ FAB; ¹⁴ CSN 21).

Intake Single feeding female from WA contained 261.7 mg dry weight of insects (Watson 1956).

SOCIAL ORGANIZATION AND BEHAVIOUR Do not normally breed in s. hemisphere, though once recorded breeding in NZ (Pierce 1974; see Breeding). For details of social organization and behaviour, see BWP.

VOICE Well known. Unreferenced statements from study at Altona, Vic. (Smith 1965). BWP describes five calls and presents one sonagram. Generally quiet. In Aust., almost silent on arrival; first calls heard end of Dec.; become more vocal by end Feb.; even more so by end Mar., when even noisier than Whiskered Terns with which they associate. Nesting pair noisy in defence of nest (see below), but wintering birds present throughout breeding period heard to call only once (Pierce 1974).



A F. van Gessell; Darwin, NT, Dec. 1984; P105

Adult AGONISTIC CALLS: high-pitched *kreek-kreek* when defending perching sites or when pursued by Whiskered Terns; loud insistent thin *keek-keek-keek*, with beginning and end of each *keek* accented, when in aerial pursuit of each other (sonagram A may show two *keek* calls); loud *kreek*, or long drawn-out thin *krreeeeek* with rising inflection, during long-distance chase; loud screech from bird pursued by Silver Gull *Larus novaehollandiae*; *kreea-kik-kik*, with sometimes an extra *kik* or two added, when fluttering low over head of intruder; rapid *kik-kik-kik...* or occasional sharp *kik*, becoming harsher *kek-kek-kek...* or *kek* at times, from bird apparently chasing away others from its chosen feeding place; *chik-a-tik-tik* and *krrek-krrek-krrek* variants. **Other calls** Before landing, give sharp *krip-krip*, incisive *keevit* or sharp *keet* (Sibson 1955; Smith 1965). *Kreeetch* and *kreee-itch*, audible for some distance, when flying about feeding. From late Mar., loud *kreeetch-kreeetch* and similar cries, often given simultaneously by bird on shore and by bird alighting. **Calls of nesting pair** Pair that nested at Opihi R., NZ, very noisy in defence of nest, uttering rasping *graack* or *graack-grak*, loudness proportional to urgency of situation; more pleasant but still fairly strident notes commonly given in flight (Pierce 1974).

Young No information for HANZAB region.

BREEDING Do not normally breed in s. hemisphere. One record of nesting in NZ (Pierce 1974). For details within normal range, see BWP.

Season Nest with eggs found, 23 Dec.; replacement nest found, with one egg, 13 Jan.; 2–3-day-old young, 6 Feb. **Site** On shingle beach in lagoon at mouth of river, with colony of White-fronted Terns *Sterna striata* and 2–3 pairs of Black-fronted Terns *Sterna albostratus*. Nest 5 m from edge of lagoon and c. 10 m from a nest of Black-fronted Tern. Replacement nest a few hundred metres N, 15 m from edge of lagoon, in sandy area near Marram Grass. **Nest, Materials** Shallow depression in shingle beside a small *Chrysanthemum*; unlined, with larger pebbles moved to outside of nest. Replacement nest consisted of Marram Grass, some of it growing in place, and other vegetation, all loosely shaped in fashion more typical of species.

Eggs Glossy pale-brown, with dark brownish blotches concentrated at larger ends. **Clutch-size** Not precisely determined; first clutch had three eggs, replacement only one.

Young A chick 2 or 3 days old found among Marram Grass beside nest. Adults in almost constant attendance at nest. Chick fed 12 times at irregular intervals during 140 min observation, each feed lasting 10–30 s. Change-over of parental roles occurred after 45 min. **Success** First clutch intact on 28 Dec. but on 13 Jan. nest found deserted, showing obvious signs of human disturbance. Replacement nest found deserted on 21 Feb. with no sign of chick.

PLUMAGES Prepared by A.M. Dunn. Probably begin post-natal moult to juvenile plumage a few days after hatching. Begin complete post-juvenile moult to first immature non-breeding (first basic) plumage in austral spring–summer, probably while *en route* to Aust. or soon after arrival. Partial first pre-breeding (pre-alternate) moult to first immature breeding (first alternate) plumage restricted; possibly do not moult at all. Thereafter, complete post-breeding (pre-basic) and almost complete pre-breeding (pre-alternate) moults each cycle produce non-breeding and breeding plumages that differ considerably in appearance. Second immature non-breeding (basic) and breeding (alternate) plumages may be separable from adult plumages. Attain adult plumage by end of third calendar year. Sexes similar. Age at first breeding, unknown; probably near end of second year.

Adult male breeding (Third and subsequent alternate). **Head and neck** Black (89). **Upperparts** Mantle, back and scapulars, black (89). Rump, white. **Uppertail-coverts** usually white but sometimes pale-grey (–). **Underparts** Breast, belly, flanks and upper vent, black (89). Lower vent and undertail-coverts, white. **Tail** White, though varies and can have varying amounts of grey on tail, especially on t1 (see Adult female breeding). **Upperwing** Lesser primary and secondary coverts, white. Median secondary coverts, grey (between 84 and 85), becoming darker grey on inner coverts. Greater secondary coverts and tertials, dark grey (c83), becoming darker grey on inner coverts. Outer 2–3 (sometimes 1 or 4) primaries, grey-black (82) grading to grey (c84) on inner primaries, all with reflective, silvery surface, which gradually wears away, leaving primaries darker. Outer two or three primaries have concealed white inner edge; rest have very fine white fringe on inner web, which can be lost with wear. Secondaries, dark grey (c83) with very narrow white fringe near tip. Dark inner median and greater secondary coverts combine with dark inner secondaries to form dark triangle on innerwing. With wear, outer 2–4 primaries and their coverts

appear much darker than inner primaries, forming contrasting dark wedge on outerwing. **Underwing** Coverts, black (89). Primaries and secondaries, grey (c84); outermost primaries have large white wedge along edge of inner web, which is reduced in size toward inner primaries.

Adult female breeding (Third and subsequent alternate). Similar to adult male but appearance less neat; generally duller black, often (especially when worn) with slight greying on scapulars and underparts; and c. 40% (higher proportion than males) have grey on tail, varying from faint grey wash on tips of rectrices to wholly pale grey tail, except for white outer web of t6 (BWP; Olsen & Larsson 1995). Probably only separable when breeding pairs together.

Adult non-breeding (Third and subsequent basic). **Head and neck** Forehead, forehead, most of lores, chin, cheeks, throat and neck, white. Hindcrown and centre of nape, black (89) with narrow white tips to feathers. Patch of black (89) feathers extends from crown to ear-coverts, forming vertical black bar behind eye; sometimes, black patch on ear-coverts isolated from crown. Hindneck, mostly white, forming white collar, with a club-shaped patch of black (89) feathers (with white tips) extending from nape to middle of hindneck. Small black (89) patch on lores just in front of eye breaks white eye-ring. **Upperparts** Mantle, dark grey to grey-black (83–82). Back and scapulars, grey (84) grading to light-grey (85) centre of rump and pale-grey (c86) uppertail-coverts. Sides of rump, white. **Underparts** White. **Tail** Grey to light grey (84–85) with paler bases to inner webs of rectrices. **Upperwing** Lesser secondary coverts, dark grey (83) to grey-black (82) with narrow white fringes that are lost with wear; forms dark cubital bar. Median and greater secondary coverts and tertials, grey (84) to light grey (85); smaller coverts have very narrow black (89) shaft-streaks. Alula, grey (84) with silvery outer surface and narrow white fringe. Median and lesser primary coverts, dark grey to grey (83–84). Greater primary coverts, grey to dark grey (84–83) with reflective silvery surface. Primaries and secondaries as breeding adult. **Underwing** All coverts, white. Primaries and secondaries as in adult breeding.

Downy young Based on published descriptions (Mathews & Iredale 1921; Fjeldså 1977; BWP). Down very long, straight and soft, with silky texture. **Head and neck** Forehead, crown and nape, buff-yellow (c53) with large ill-defined black (89) patches on hindcrown and nape; may also have small black spot or pair of spots on forehead, but forehead never wholly black (cf. Whiskered Tern). Area around eye, lores and chin, white (forming much larger patch than in Whiskered Tern). Lower cheeks and throat, dark brown (219A) contrasting with white round eye. **Upperparts** Buff-yellow (c53) with large ill-defined black (89) patches on sides of back and rump; sometimes joining to form broad irregular streaks. **Underparts** Flanks, light brown (c39) grading to light grey-brown (c119D) on chest and belly (cf. white or off-white in Whiskered Tern). **Wing-pads** Buff-yellow (c53) with large ill-defined black (89) patches. Wing-tips often white.

Juvenile **Head and neck** Forehead, lores, chin, throat and sides of neck, white, with buff (–) wash on forehead, which is quickly lost with wear. Black-brown (119) cap extends from crown to hindneck, forming narrow band in centre of nape and widening on hindneck to form club-shaped patch. Narrow white collar behind cap. Patch of black (89) feathers extends from crown to ear-coverts, forming a vertical black bar behind eye. **Upperparts** Feathers of mantle and upper back and most scapulars, black-brown (119) with slightly lighter brown (c121) fringes and dark-grey (83) bases; some birds can

have lighter brown (–) or buff (–) fringes; rarely, mantle and back appear dark grey (–). In most, some scapulars, grey (84) with narrow white fringes and black-brown (c119) subterminal fringes. Lower back, grey (84) with narrow dark-brown (121) tips. Rump, white. Uppertail-coverts, pale grey (86). **Underparts** White, except for a few dark brownish-grey (brownish 85) feathers on anterior flanks. On a few, dark feathers can appear as brown patch on sides of breast, but never form distinct dark tab (as in Black Tern). **Tail** Brownish grey (c79) with dark-brown (c121) tip; outer feathers have very pale (almost white) inner webs; outermost feathers, mostly white with dark-grey (c83) smudge near tip. **Upperwing** Lesser secondary coverts, grey-black (82) with very fine white fringes that are lost with wear. Median and greater secondary coverts, pale grey (86) with dark-brown (c219A) subterminal smudges on most feathers and very fine grey-black (82) shaft-streaks; some can have buff (–) or light-brown (–) tips and darker subterminal bands to feathers. Lesser primary coverts, grey-black (82) with pale-grey (86) fringes. Primaries and secondaries, grade from grey-black (82) on outer primaries to grey (84) on inner secondaries; all have a silvery coating and very fine white fringes. Tertiaries, grey (84) at base grading to dark brown (121) near tip. **Underwing** As adult non-breeding.

First immature non-breeding (First basic). **Head and neck** Similar to adult non-breeding except feathers of crown and centre of nape, grey-black (82) with white tips and very narrow white edges. Cap larger than in adult non-breeding and similar in extent to juvenile. **Upperparts** Similar to adult non-breeding except feathers of mantle, dark grey (83) with pale-grey (86) tips and concealed white bases. **Underparts** White. **Tail** Central rectrices, grey (84). Outer rectrices, mostly grey (84) fading to white on inner web. **Upperwing** Lesser primary and secondary coverts, dark grey (83) with pale-grey (86) fringes, appearing as scaly leading-edge to innerwing. Median secondary coverts, grey (84) with pale-grey (86) fringe. Concealed bases of feathers, white. Greater primary and secondary coverts, primaries, secondaries and tertiaries as non-breeding adult; outer primaries usually retained from juvenile plumage and very worn or moulting. **Underwing** As adult non-breeding.

First immature breeding (First alternate). Do not breed in this plumage. No specimens examined; based on published descriptions (Olsen & Larsson 1995; BWP). Like first immature non-breeding but may develop scattered traces of breeding plumage on scapulars, belly or lesser secondary coverts.

Second immature non-breeding (Second basic). No information for HANZAB region; based on published descriptions (Olsen & Larsson 1995; BWP). Like adult non-breeding and usually inseparable. Outer primaries said to be fresher than relatively worn primaries of adults in austral spring and early summer.

First immature breeding (Second alternate). No specimens examined; based on published descriptions (Olsen & Larsson 1995; BWP). Like adult breeding but can be distinguished by: head and body duller black (often brownish black); may have white feathers scattered on underparts and underwing-coverts; tail, grey or white with some grey feathers, especially t3–t5. Secondaries generally darker than in adult breeding.

BARE PARTS Based on photos (Pringle 1987; Rogers 1993; unpubl.: D.W. Eades) and published descriptions (Fjeldså 1977; Olsen & Larsson 1995; BWP). **Adult breeding** Bill, black (–) to blackish red (blackish 8); often redder at base. Iris, dark

brown (c219). Legs, red (13–11) to orange-red (–). **Adult non-breeding** Bill, black (89), often with red (c8) at base. Iris, dark brown (c219). Legs, dull red (dull 210) to grey-black (c82) with reddish tinge. **Downy young** Bill, grey-black (82) with small white egg-tooth. Iris, dark brown (c219). Legs and feet, greyish pink (greyish 5). **Juvenile, Immatures** Bill, black (89), to blackish brown (–), often with dark-red (dull 8) or greyish-yellow (–) base. Legs, red (–), red-brown (–), greyish orange (–) or dull pink (5), soon changing to colour of adult non-breeding.

MOULTS Based on information gathered from 23 adult Aust. skins collected Oct.–Apr. (AM, ANWC, HLW, WAM), ten live adults from nw. Aust. caught Mar.–May (AWSG), seven live adults and four immatures from Vic. caught Jan. and Mar. (AWSG), three extralimital juvenile and immature skins (AM, MV) and published information (Smith 1965; Pierce 1974; Alström 1989; Olsen & Larsson 1995; BWP). **Adult post-breeding** (Third and subsequent pre-basic). Complete; primaries outwards. Moulting appears to begin on or just after leaving breeding grounds, about June, with feathers of gape, eye-ring, lores and chin. Replacement of feathers of chest, sides of neck, crown and inner primaries begins about July. Underparts moulted about Aug., finishing with belly. Rest of plumage, except primaries, replaced during s. migration. Underwing-coverts, tertiaries and some median and greater coverts replaced last; some greater underwing-coverts can be retained (Alström 1989; Olsen & Larsson 1995; BWP). Most moult appears to be completed *en route* to non-breeding areas; many arrive in Aust. in Nov.–Dec. with alternate outer primaries and otherwise complete non-breeding plumage. Extraliminally, moult of primaries probably finishes Dec.–Mar. (Olsen & Larsson 1995; BWP). The few Aust. data available support this: all seven adults caught Vic., Jan. and Mar., were moulting outer primaries: p7, p8 or p9 in Jan., p9 or p10 in Mar.; two of four adults collected Aust. (three from WA, one from Lord Howe I.), Feb., were growing p10, the other two had completed moult of primaries. All of these adults had also begun pre-breeding (pre-alternate) moult of primaries (AM, WAM; AWSG). Timing of moult differed greatly in pair that (unusually) once nested NZ (Pierce 1974); had full breeding plumage in Dec. and mid-Jan., had undergone some moult of feathers of crown by early Feb. and resembled adult non-breeding by 18 Mar. **Adult pre-breeding** (Second and subsequent pre-alternate). Partial; involves head, neck, body, tail, wing-coverts, outer secondaries and most (sometimes all) inner primaries. Begins on upperwing-coverts, underwing-coverts, back, scapulars and tail; when these areas almost finished, moult nape and breast; head, neck and underparts replaced last. Timing depends on location or local conditions. In Vic., some began moult of head and body, Dec.; most began about Jan.; by Feb. there was active moult on throat, breast, abdomen, flanks, underwing-coverts and mantle; full breeding plumage attained Apr.–May (Smith 1965). In WA, timing similar to Vic.; in Apr., birds had between 30% and 95% breeding plumage (WAM). Pre-breeding and preceding post-breeding moult of primaries may overlap; begins late Nov. to early Jan., and arrested late Apr. or early May after 6–9 primaries replaced; occasionally all primaries replaced. Of 29 Aust. adults caught or collected between Feb. and Apr., all had active pre-breeding moult of primaries; four in Feb. were growing p4 or p6; four in Mar. were growing p6, p7 or p8; 20 in Apr. were growing p7, p8 or p9 (AM, ANWC, HLW, WAM; AWSG unpubl. data). **Adult, Third series of primaries** (Probably

pre-supplemental). Before completion of pre-breeding moult of primaries, some birds begin a further replacement of inner primaries. Begins Feb., Mar. or Apr., from p1, and 1–4 primaries replaced; arrested on completion of pre-breeding moult of primaries in about May. Of 19 adults caught or collected from WA, Apr. (WAM; AWSG unpubl. data), ten had begun pre-supplementary moult of primaries before finishing pre-breeding moult of primaries. One adult female collected WA, Feb. was growing p1, p5 and p10 and appeared to be completing post-breeding primary-moult, midway into pre-breeding primary-moult and beginning a pre-supplemental moult of primaries. **Post-juvenile** (First pre-basic). Complete. Timing varies; some begin Sept. and replace head, body, central rectrices, and some upperwing-coverts by late Nov.; others begin Nov. and do not reach a similar stage till late Feb. Most attain complete non-breeding plumage by Mar., but a few retain some juvenile feathers on mantle and upperwing-coverts till early May. Primaries begin Nov. to early Feb.; finished, June–Sept. **First immature pre-breeding** (First pre-alternate). Mould few, if any, feathers. Occasionally replace some feathers of belly, scapulars or lesser coverts with breeding plumage, May–July. **First immature post-breeding** (Second pre-basic). Complete. Begins May–July of second calendar year; can begin before post-juvenile moult of primaries finished. Often no breeding plumage attained between first and second non-breeding plumages. Primary-moult probably slower than in adult, and thus tend to have greater number of worn outer primaries than do adults in breeding plumage.

MEASUREMENTS (1) Aust., adults, skins (ANWC, HLW, MV, AM, WAM).

	MALES	FEMALES	
WING	(1) 212.1 (5.91; 202–219; 8)	210.6 (8.43; 196–220; 9)	ns
TAIL	(1) 68.9 (5.05; 61–78; 11)	70.4 (4.38; 64–80; 14)	ns
BILL	(1) 25.7 (1.12; 23.9–27.5; 11)	24.3 (1.58; 21.9–26.6; 14)	*
TARSUS	(1) 20.0 (0.85; 18.6–21.3; 11)	19.4 (0.85; 17.8–20.6; 14)	ns
TOE C	(1) 24.4 (1.16; 21.7–26.0; 11)	23.7 (0.86; 21.9–25.0; 14)	ns

Larger samples in BWP show males have significantly longer wing and bill than females. Juvenile wing 5–10 mm shorter than that of adult; tarsus and toe similar to adult shortly after fledging; bill similar from c. 1 year old (BWP).

(2) NW, Aust., adults, live (AWSG unpubl. data).

	UNSEXED
WING	(2) 213.5 (8.20; 197–226; 12)
BILL	(2) 25.7 (1.47; 23.0–27.0; 11)
THL	(2) 58.2 (3.59; 50.0–61.1; 9)

WEIGHTS Aust., adults, Oct.–Apr. (ANWC, WAM): males, 65.3 (7.27; 51–73; 7); females, 59.0 (10.68; 49–74; 4). No obvious trends in change of weight from Oct. to Apr., but the three lightest weights were from Oct. and Dec., and the three heaviest weights were from Feb., Mar. and Apr. Weights of unsexed adults caught nw. Aust. between late Mar. and early May were 68.6 (5.95; 57–78; 10) (AWSG). Also see BWP.

STRUCTURE Wing, long, narrow and pointed. Eleven primaries: p10 longest, p9 3–9 mm shorter, p8 17–24, p7 34–38, p6 49–58, p5 60–75, p4 77–89, p3 90–100, p2 101–110, p1

113–121; p11 minute. Fifteen secondaries, including about three tertials; tips of longest tertials fall between p3 and p4 on folded wing. Tail, rather short with shallow fork; 12 rectrices; t6 longest, t1 8–20 mm shorter. Bill, straight, slender and pointed; slightly shorter than head. Upper mandible, very slightly downcurved and tapers to tip. Lower mandible, rather straight; tapers to tip from gonys. Large oval nostril set in shallow nasal groove. Tarsus, rather short and slender; scutellate in front, reticulate behind. Tibia mostly feathered; 3–5 mm exposed. Outer toe 87–90% of middle, inner 66–71%, hind 29–35%. Front toes webbed; webs deeply incised.

GEOGRAPHICAL VARIATION None.

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Volume 3, Plate 43 [caption error corrected from original]

Whiskered Tern *Chlidonias hybridus* (page 765)

1 Adult breeding; 2 Adult non-breeding; 3 Downy young; 4 Juvenile; 5 Early stage of moult from juvenile to first immature non-breeding

White-winged Black Tern *Chlidonias leucopterus* (page 776)

6 Adult male breeding; 7 Adult non-breeding; 8 Downy young; 9 Juvenile

Black Tern *Chlidonias niger* (page 785)

Subspecies *surinamensis*

10 Adult male breeding; 11 Adult non-breeding; 12 Juvenile



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Volume 3, Plate 44 [caption errors corrected from original]

Whiskered Tern *Chlidonias hybridus* (page 765)

1 Adult breeding; 2 Adult non-breeding; 3 Juvenile; 4 Early stage of moult from juvenile to first immature non-breeding

White-winged Black Tern *Chlidonias leucopterus* (page 776)

5 Adult male breeding; 6 Adult non-breeding; 7 Late stage of moult from juvenile to first immature non-breeding, first austral autumn

Black Tern *Chlidonias niger* (page 785)

Subspecies *surinamensis*

8, 9 Adult male breeding; 10 Adult non-breeding; 11 Late stage of moult from juvenile to first immature non-breeding, first austral autumn; 12 Second immature breeding