

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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Sterna Hirundo Linnaeus, 1758, *Syst. Nat.*, ed. 10(1): 137 — Europe = Sweden.

The specific name is from the Latin *Hirundo*, a swallow, and refers to the long wings, forked tail, short legs and graceful flight of this tern, which was formerly known as '*Hirundo marina*' or 'sea-swallow'.

OTHER ENGLISH NAMES Asiatic Common Tern.

POLYTYPIC Nominate *hirundo* breeds e. North America, Caribbean, Europe, North and West Africa, and Middle East, E to plains of Kazakhstan and w. Siberia. Subspecies *longipennis* Nordmann, 1835, breeds e. Siberia S to n. Kuril Is, Sakhalin, and ne. China, grading into nominate *hirundo* over wide area in central Siberia between about Ob R. and c. 110°E; subspecies *tibetana* Saunders, 1876, breeds e. Kashmir, Pamir, Tien Shan, and Dzungaria through Tibet, E to w. Mongolia and Kansu (China). Birds of unknown subspecies recently recorded breeding Sri Lanka (Hoffmann 1990).

FIELD IDENTIFICATION Length 32–37 cm; wingspan 72–82 cm; weight c. 120 g. Archetypal commic tern. Medium-sized, slender sea tern, with long slender bill; sloping forehead and flat crown; long narrow wings; long deeply forked tail, with, in adult breeding plumage, tips of outermost rectrices falling level with wing-tips at rest; and rather long legs. Second largest commic tern. Bigger and bulkier than Arctic Tern *Sterna paradisaea*; smaller and slimmer than White-fronted Tern *S. striata*. Much larger and bulkier than Roseate Tern *S. dougallii*. Timing and pattern of moult helpful in ageing and identification. Adult in breeding plumage distinctive: light grey above, with neat black cap, contrasting white rump and tail with dark sides to tail, dusky wedge on outer primaries, and mostly grey underbody and white underwing with diagnostic black trailing-edge to outer primaries. In non-breeding plumages show prominent blackish cubital bar; white forehead and underbody; and grey-white tail, shorter and less deeply forked than in adult breeding. Sexes alike. Some seasonal variation. Juvenile distinct. Immatures separable. Two subspecies recorded HANZAB region, differing in colour of bill in adult breeding plumage (see Plumages, Bare Parts).

Description Adult breeding Forehead, crown and nape, black, forming neat cap extending to level with bottom of eye, and with narrow white wedge (with straight upper edge) between cap and gape. Rest of head and neck, white, with varying grey wash on throat, which can give appearance of broad white cheek-stripe. Saddle and tertials, light grey, with narrow white scaling to rearmost scapulars and tertials when fresh. Rump and tail, white, contrasting strongly with grey saddle and with grey-black sides to tail; tips of tail-streamers

fall level with wing-tips at rest (though streamers may be broken off during breeding season). At rest, folded wing, light grey; primaries, slightly darker, silvery grey, with thin tapering white upper edge petering out well short of wing-tip; outer primaries always darker than inner primaries. In flight, upperwing varies much with wear: in fresh plumage (Apr.–May) almost uniform light grey, with narrow white trailing-edge tapering onto inner primaries; in early breeding season, outer primaries slightly darker grey, with narrow tapering dark streak in centre of outerwing, abutting paler grey inner primaries, and diffuse dusky trailing-edge; during breeding season, outer primaries darken, forming diagnostic dusky-grey wedge, contrasting with light-grey rest of wing; secondaries also darken, forming dusky secondary bar. Throat to lower belly, light grey, sharply demarcated from white vent and undertail-coverts. Underwing, white, with thin grey-black stripe on outermost primary; and diagnostic narrow blackish trailing-edge, evenly wide and diffusely demarcated from pale bases of primaries but sharply and squarely cut off from inner primaries. Only inner four or so primaries translucent, though may show more extensive translucence momentarily when wing at full stretch. Bill, black; rarely, have faint red tinge at base or up to basal half brighter red; in nominate *hirundo*, wholly red. Iris, dark brown. Legs and feet, dusky red to dark red-brown or red, with brighter red soles; can appear dull black at distance; legs, bright red in nominate *hirundo*. **Adult non-breeding** Differ from adult breeding by: Anterior lores and forehead (to level with or slightly behind eye), white; most of crown, dirty white, streaked or mottled black where merging with black half-hood on rear-crown, nape and ear-coverts; large black patch in front of eye.

Rump, light grey, grading to paler grey-white on uppertail-coverts; contrast only slightly with grey upperparts. Tail, slightly shorter and less deeply forked, tip falling short of wing-tips at rest; grey, with dark-grey sides. Upperwing: in flight, light grey, with prominent black cubital bar, and contrasting dark secondary bar and wedge on outerwing; central innerwing-coverts often develop white patches during moult; at rest, show prominent black cubital bar and very worn dull-black primaries, or contrast between worn outer primaries and new silvery-grey inner primaries. Underbody, white. Bill, black; rarely, with red tinge at base or up to basal half very dark red. Legs and feet vary from black with faint red tinge to bright orange-red.

Juvenile Similar to adult non-breeding. Differs by: Forehead and lores washed pale brown when fresh. Saddle, tertials and innerwing-coverts, light grey, with pale-brown, buff or off-white tips to feathers and varying dark-brown crescents or spots (that fade with wear). In flight, upperwing, light grey, grading to slightly darker grey on outer primaries and primary coverts, with: black cubital bar and dusky-grey patch at alula; narrow white trailing-edge, petering out well before wing-tip; dark-grey secondary bar. On folded wing: prominent black cubital bar extends narrowly round carpal; folded primaries, silvery grey, with fine white edges and tips that peter out before reaching wing-tip. Uppertail-coverts tend to be whiter and tail narrowly tipped white when fresh; tail shorter and much less deeply forked, falling well short of wing-tips at rest. Underbody, white; some have buff wash extending from mantle onto sides of upper breast, which is quickly lost with wear. At first: bill, pink to dull orange, with broad black tip and culmen; legs and feet, pink-orange. Bill soon darkens to black; bill, legs and feet as first immature non-breeding by time of arrival in HANZAB region. **Transition to first immature** Post-juvenile moult complete and protracted, and gradually attain non-breeding appearance. From Nov. to Apr., separable from adult by different moult-schedule and distinctive retained juvenile plumage: from arrival till early Jan. (during which time adults moulting wing and tail), appear similar to adult non-breeding but with retained juvenile tail and upperwing. Moult wing and tail, Dec.–Aug.; midway through moult, separated by blackish cubital and secondary bars and retained very worn and faded outer primaries and their coverts, which form striking dark wedge on outerwing reaching to carpal; central innerwing-coverts often develop white patches (at this time, adults have fresh pale-grey remiges and deeply forked tail). During austral winter (when adults in breeding plumage), similar to adult non-breeding, either with fresh outer primaries or with extremely worn and faded black-brown outer primaries and coverts. Bare parts as adult non-breeding.

First immature non-breeding Differ from adult non-breeding only by dusky centres to tertials and fresher remiges. **First immature breeding and subsequent immature plumages** Most not separable from adult plumages in field; for differences see Plumages.

Similar species Often confused with **Arctic Tern**, which differs by: (1) smaller and slimmer; with smaller more rounded head and shorter neck; somewhat shorter, more oval-shaped body but longer tail; shorter and finer bill; and much shorter legs. In flight: appear more delicate and rakish, with characteristic neckless jizz; wings, narrower, with proportionately shorter innerwing but longer, finer, more pointed outerwings; wings appear to be set farther forwards on body and often strongly angled back from carpal; in adults, long tail often held closed, with long streamers tapering to wispy point. (2) Flight usually more buoyant and graceful, with slower and shallower or

deeper and more thrusting wing-beats, always with distinct pause on upstroke. (3) Feeding flight often different and helpful in separation of distant feeding birds (see Arctic Tern and below). In ALL PLUMAGES, Arctic further differs by: (4) in Aust. and NZ waters, remiges always uniformly grey; (5) slightly paler grey upperparts, with contrasting white rump and tail; (6) diagnostic clear-cut tapering black line along trailing-edge of primaries both above and below; (7) all remiges translucent, with characteristic dark streaks showing through outerwing; primaries often flash paler than rest of wing when seen from above. In ADULT BREEDING PLUMAGES, further differ by: (1) bill, red, normally without black tip (though bill can be all red in nominate *hirundo*) and legs and feet, brighter or darker red; (2) narrower white wedge between gape and lower border of black cap; (3) underbody, darker grey, contrasting more with white underwing, and extending farther onto chin and throat; normally sharply demarcated from white cheeks, which, on darker birds, form narrower, more contrasting white cheek-stripe; (4) tail, longer and more deeply forked and projects beyond wing-tips at rest; and (5) during moult to non-breeding plumage black cap often has characteristic white patch in centre of crown (in Common, cap typically whitens from forehead and lores). In NON-BREEDING PLUMAGES, differs by: (1) white extends farther onto rear-crown, forming larger pale forecap, and ground-colour of crown, whiter; (2) cubital bar, narrower and paler, grey-black, normally much less prominent and contrasting; and (3) legs and feet, black (always tinged red in Common). **JUVENILES**: in addition to above differences, distinguished from juvenile and non-breeding Common by: (1) upperwing: typically show strikingly white secondaries and inner few primaries contrasting strongly with grey rest of upperwing; may be grayer in some but always appear noticeably paler than rest of wing. For further differences in fresh juvenile plumage, see Olsen & Larsson (1995) and Plumages. Often confused with **White-fronted Tern**, which differs by: bigger and bulkier, with bigger, more rounded forehead and longer crown in profile; longer bill; in adults, much longer, more deeply forked tail, with tips of streamers extending well beyond wing-tips at rest; in flight, wings slightly broader; and flight steadier, less buoyant and more purposeful, with deep regular wing-beats and no pause on upstroke. In ALL PLUMAGES, White-fronted differs by: thicker white line along upper edge of folded primaries, reaching to tip of outermost primary; normally has much paler and greyer subterminal dusky streaks or marks near tips of outer primaries, forming only faint dark line bordered by narrow white trailing-edge to remiges; with wear, white trailing-edge lost leaving diffuse dark trailing-edge similar to that of Common but usually slightly shorter, narrower and less prominent. In addition to these characters, ADULT BREEDING PLUMAGE distinguished from same of Common by diagnostic narrow white band over lower forehead and lores, separating black cap from bill; and white underbody with pink flush. In ADULT AND SECOND IMMATURE NON-BREEDING, further differs by: (1) paler-grey and more uniform upperparts without dark cubital or secondary bars or wedge on outer primaries, and broader white trailing-edge to remiges extending to wing-tip; generally appear whiter above, especially at distance or in flight; (2) in adult non-breeding, rump and tail, uniform pale grey, concolourous with rest of upperparts and without dark sides; second immature non-breeding has contrasting grey sides to tail, but much paler grey and less contrasting than on Common; (3) remiges more translucent. **JUVENILES** easily distinguished by coarse black markings on upperparts. **FIRST IMMATURE NON-BREEDING** can be confused

with non-breeding Common; best distinguished by size and structure, as above; and: (1) Paler grey upperparts; (2) Distinctive pattern of upperwing, with large blackish triangle from base of wing to carpal, dusky-grey triangle on outer primaries and coverts, and a paler greyish-white triangle covering rest of wing (with apex at carpal) and with a narrow white trailing-edge extending to wing-tip. At rest, have broader black cubital bar, with prominent black crescents on coverts below bar; black-and-white barring at tips of grey-black tertials; and prominent thick white upper edge to folded primaries; and (3) White tail, with prominent blackish corners (cf. dark sides on Common). Very similar to non-breeding Common when moulting from first immature to second immature non-breeding; best distinguished by differences in size, structure and colour of upperparts and: (1) often retain a few distinctive worn juvenile dark crescents on coverts below cubital bar; (2) new tertials often have prominent dark centres; (3) at rest, worn blackish outer primaries still retain at least a trace of thick white upper edge, or new inner primaries have diagnostic thick white upper edge and tip; and (4) often still have a few distinctive juvenile rectrices.

Gregarious. In HANZAB region seen singly or in small groups, sometimes in hundreds at favoured sites; often associate with other terns. Often tame, single birds allowing close approach. Carriage horizontal; more upright when alert or in display. Trotting gait similar to that of other terns. Occasionally alight on water, and swim well. Flight graceful, buoyant and direct, with easy languid wing-beats and slight pause on upstroke. When foraging, patrol to and fro 3–8 m above water, with bill pointing down; often plunge directly from hovering position, though usually keep moving forward and, on sighting prey, turn round, sometimes in figure-of-eight, before hovering and then plunging directly into water, often submerging completely; also feed by dipping, and hawk for insects. Feeding flight often little different from that of Arctic Tern, but less adept at hovering, and generally hover lower to water; do not have distinctive stepped-hover behaviour of Arctic (q.v.) or vertical retreat from hovering position after low-level swoop or aborted dive. Often noisy and excitable; normal contact note uttered in flight is repeated *kik*; also grating *kee-yah* in alarm, angry *kek-kek* and *karr* in interspecific conflict.

HABITAT Marine, pelagic and coastal. Off Wollongong, NSW, observed in all marine zones, but generally in offshore and pelagic regions, between 11 and 55 km from shore (Wood 1991; Brandis *et al.* 1992); considered by Hitchcock (1965) not to be primarily oceanic. Often recorded in near-coastal waters, both on ocean beaches and in sheltered waters, such as bays, harbours and estuaries (Corben 1972; Morris 1975, 1989; Roberts 1979; Morris *et al.* 1981, 1990; Storr 1985) with muddy, sandy or rocky shores. Occasionally recorded in coastal and near-coastal wetlands, either saline or freshwater, including lagoons, rivers, lakes, swamps and saltworks (Hitchcock 1965; Eckert 1969; Storr 1977, 1984a; Pegler 1983; Chafer 1991; Hoskin 1991; Qld Bird Rep. 1990; Vic. Bird Rep. 1987); sometimes with mangroves or saltmarsh (Morris *et al.* 1990; J.M. Peter). Rare inland record at sewage pond (Vic. Bird Rep. 1985); also at ocean sewage outlet (Vic. Bird Rep. 1983).

Forage in marine environments, close to shore (Storr 1980; Chafer 1991), including sheltered embayments (Morris 1989; Morris *et al.* 1990). Recorded feeding in surf-zone off headland (Corben 1972); farther out to sea, recorded feeding over water c. 60 m deep (Milledge 1977). Once recorded foraging behind trawler in Gulf of Carpentaria (Blaber &

Milton 1994). Also forage in near-coastal terrestrial wetlands, including estuaries, rivers and swamps (Hitchcock 1965; HASB).

Roost or loaf on unvegetated intertidal sandy ocean beaches, shores of estuaries or lagoons, and sandbars (Hitchcock 1965; Eckert 1969; Corben 1972; Pegler 1983; Tas. Bird Rep. 22), on rocky shores, on rock platforms or rocks protruding above surface of water (Hitchcock 1965; Storr 1980; Morris 1989; Morris *et al.* 1990; Hoskin 1991); also at edge of saltpond (J.M. Peter). Often recorded perched on wooden piers, wharves and posts and groynes and rock walls (Hitchcock 1965; Eckert 1969; Morris 1989; Guest 1991; Vic. Bird Rep. 1984). Recorded sheltering in coastal sand-dunes or embayments in bad weather (Dale 1988; Morris *et al.* 1990).

DISTRIBUTION AND POPULATION Breed North America, Europe and Asia. In North America, from Alberta and Montana, E to s. Quebec, Newfoundland, Nova Scotia and ne. coastal USA, with scattered breeding on coasts S to North Carolina; also breed at scattered sites in Gulf of Mexico; and in Bermuda, Greater and Lesser Antilles and islands off Venezuela. Breed Azores and Madeira; a few sites in Africa, including s. Nigeria, from Guinea-Bissau N to w. Sahara, and se. Tunisia. Widespread but scattered through Europe, from Britain and Scandinavia, S to n. Mediterranean, se. Black and w. Caspian Seas; E through Russia, mainly S of c. 62°N; E of Caspian Sea, s. edge of range extends round headwaters of tributaries to Aral Sea (with isolated sites in Iraq, Iran and Afghanistan), E to L. Balkhash, but farther E, s. boundary mainly c. 50°N; ranges E to n. Sea of Japan, Sea of Okhotsk and w. Bering Sea, including Kamchatka Pen. and Kurile Is. Also in belt from n. Korean Pen., SW through ne. China to Tibet and n. India. During non-breeding period, almost cosmopolitan. In North and South America, Pacific coasts from s. California and Baja California, S through Central America to s. Peru; on Atlantic coasts, from Newfoundland and Gulf of St Lawrence, S to s. Florida, Gulf of Mexico and Caribbean islands, to Colombia and Venezuela and entire e. coast of South America, S to se. Argentina; also islands in South Atlantic. Entire African and European coasts except Barents Sea. In Asia, from Red Sea, Arabian Pen., E to w. India; also from se. coast of India, N to n. Bay of Bengal and inland along Ganges R. Valley. Widespread from s. Malay Pen., S to Indonesia, E to Aust., PNG and Solomon Is, and N along coast of Gulf of Thailand through Vietnam, e. China, Japan and e. Siberia, to Kamchatka Pen. (Bartels & Stresemann 1929; Delacour & Mayr 1946; Hoogerwerf 1948; Dement'ev & Gladkov 1951; Medway & Wells 1976; Blake 1977; Ash 1982; AOU 1983; de Schauensee 1984; Coates 1985; Urban *et al.* 1986; van Marle & Voous 1988; Hicks 1990; BWP).

Aust. Mainly e. coast. **Qld** Widespread se. Gulf of Carpentaria and w. C. York Pen.; also e. Torres Str., but few records between there and Cooktown. Sparsely scattered from Cairns, S to Rockhampton; commonly recorded in SE (Roberts 1979; Draffan *et al.* 1983; Storr 1984b; Qld Bird Reps; Aust. Atlas). **NSW** Entire coast, though somewhat less often on s. coast S of Port Hacking (Gibson 1977; Morris *et al.* 1981; Whiter 1993; NSW Bird Reps; Aust. Atlas). **Vic.** Widespread on Gippsland coast, SW to Port Albert; few records between Wilson's Prom. and Westernport Bay. Many records Port Phillip Bay. Rarely recorded in SW, between Port Fairy and C. Bridgewater (Vic. Bird Reps; Vic. Atlas). Rare inland records include Kaniva and Kow Swamp (Vic. Bird Rep. 1985; Aust. Atlas). **Tas.** Single, 3 km S of Temma, 3 Dec. 1979 (Tas. Bird

Rep. 9). **SA** Six records before 1967: single, specimen, Buckland Park, 2–31 Dec. 1956 (Lendon 1957); single, beachcast, American R., Kangaroo I., Sept. 1959 (Wheeler 1960); single, beachcast, North Glenelg, 27 July 1960 (Glover 1969); single, specimen, Port Gawler, 29 Oct. 1962 (Eckert 1969); three, near Lucindale, Feb. and Mar. 1964 (Attiwill 1966); eight, including single specimen, Naracoorte, 9 Mar.–3 Apr. 1965 (Attiwill 1966). However, Eckert (1969) considered that records from Lucindale and Naracoorte were probably misidentified Whiskered Terns *Chlidonias hybridus*. Since 1967, many records, mainly from Adelaide, SE to The Coorong, with records from Goose I. in Spencer Gulf, and Baudin Rocks and Carpenter Rocks in SE (Eckert 1969; SA Bird Reps; Aust. Atlas). **WA** Rarely recorded S of 30°S; on s. coast, at Eyre, 1 July 1984, 23 Sept. 1984 (Dymond 1988) and Esperance, 12 Aug. 1979 (Aust. Atlas). In SW, at Metricup (Johnstone 1979), and regularly at Mandurah (*West. Aust. Bird Notes Obs.* 1983–94 *passim*); also at various places round metropolitan Perth (e.g. Dunnet 1956; Anon. 1983, 1985b; Jaensch 1983, 1987; Vervest & Jaensch 1988; Jaensch *et al.* 1988), and once at Rottneest I., May 1985 (Anon. 1985a). Farther N, scattered records on coast, from Carnarvon NE to Leslie Saltworks (Howard 1981; Storr 1984a, 1985; Halse & Halse 1988; Aust. Atlas), and in Kimberley Div., at Broome and Port Warrander. **NT** First confirmed record, East Alligator R., Feb. 1973 (Schodde & Mason 1974); generally erratic occurrence round Darwin; Aust. Atlas also lists records from C. Arnhem and Kapalga; many records from e. Arnhem Land and w. Gulf of Carpentaria, including Groote Eylandt (Aust. Atlas; H.A.F. Thompson & D.K. Goodfellow). **Interruptions** In Vic., large numbers reported from Gippsland and Port Phillip Bay between Jan. and Mar. 1981 (Vic. Bird Rep. 1981), while later in 1981, many recorded off coasts of NSW between Oct. and Dec. (NSW Bird Rep. 1981).

NZ First confirmed record, Pukerua Bay, 27 Jan. 1984 (Guest 1992), though several earlier but unconfirmed reports (e.g. Kinsky 1978; Falla *et al.* 1981; Latham 1986; NZCL). Other records include (singles unless stated): mouth Rangitaiki R., 8 Apr. 1984 (Latham 1986); Pouto Ls and Beach, 24–25

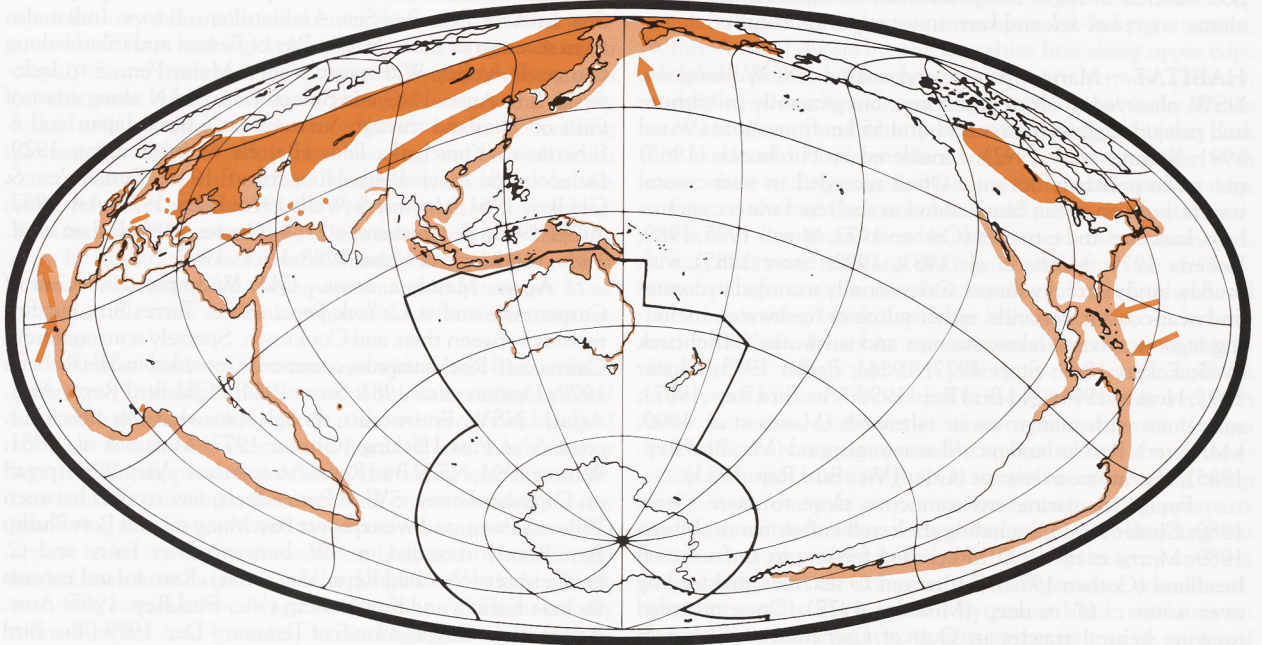
Feb. 1990 (Guest 1991; CSN 38); Bowentown, Tauranga Harbour: 26 Jan. 1987 (CSN 35); 1–3, 29 Nov. 1987–24 Jan. 1988 (CSN 36); two, 23 Nov. 1988 (CSN 37); 10–11 Jan. 1989 (CSN 37); mouth Tarawera R.: unknown number, 1988 (NZCL); 25 Feb. 1989 (CSN 37); Manawatu R. estuary, 25 Dec. 1987–17 Jan. 1988 (CSN 36); mouth of Waimeha Stream, 21 Nov. 1985 (A.J.D. Tennyson); Waikanae R. estuary: 1–2, 28–29 Jan. 1984; 21–22 Nov. 1985; 1–4 Apr. 1988 (Guest 1992; NZCL; CSN 36; A.J.D. Tennyson); 8 Dec. 1991 (CSN 41); Pukerua Bay, 27 Jan. 1984; 15 Jan. 1994 (Guest 1992; A.J.D. Tennyson).

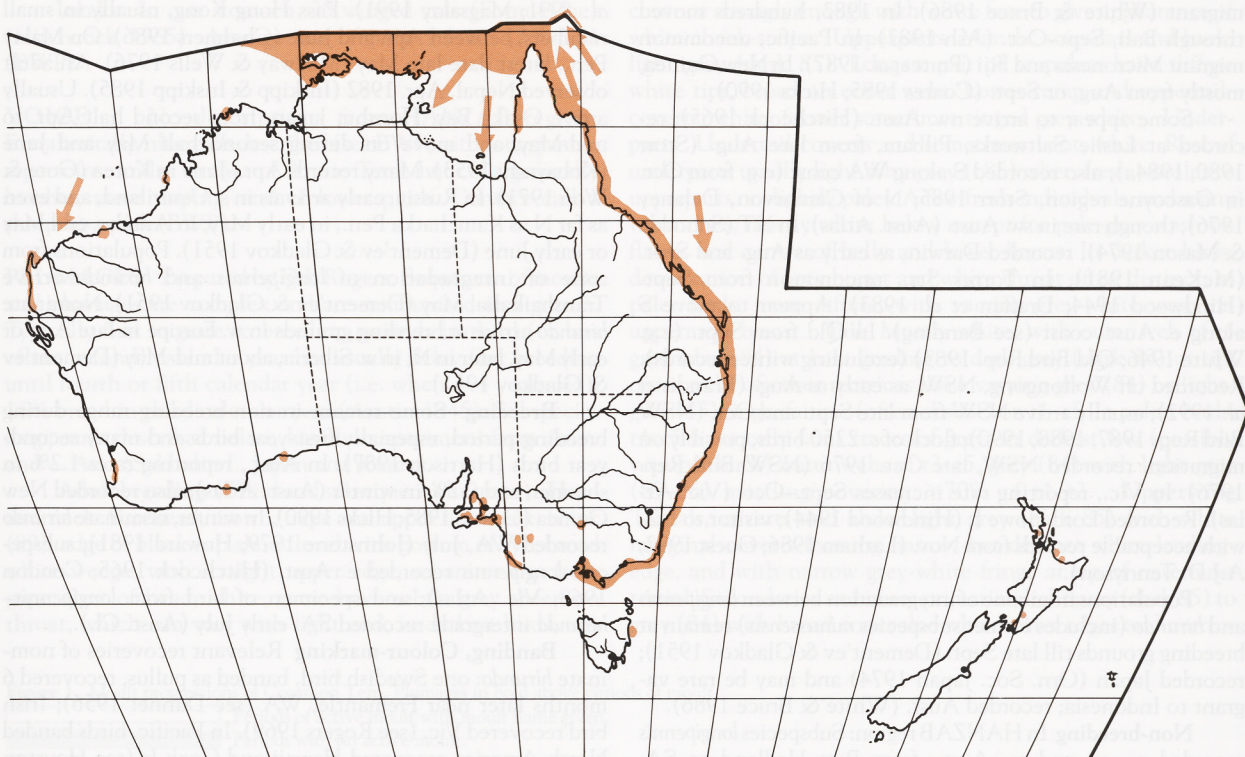
Lord Howe I. Single, specimen, 1 Jan. 1913 (Hitchcock 1965); two, specimens, 2 Feb. 1915 (Hindwood 1940).

Cocos-Keeling Is Two, 11 Feb. 1941 (Gibson-Hill 1949, 1950).

Populations Some localities where 2000+ birds recorded include: **nsw**: Nambucca Heads, 2250, 28 Oct. 1976 (NSW Bird Rep. 1976); Botany Bay, 1000+, 31 Dec. 1981 (NSW Bird Rep. 1981); Long Reef, c. 1000, 20 Dec. 1981 (NSW Bird Rep. 1981); Boat Harbour, 1000, Dec. 1976 (NSW Bird Rep. 1976); Sydney Harbour, 200, 26 Dec. 1981 (NSW Bird Rep. 1981); **QLD**: Reef Pt, >650, 4 Dec. 1991 (Qld Bird Rep. 1991); Bowen, 350, 29 Dec. 1990 (Qld Bird Rep. 1990); Fraser I., c. 200, May 1973 (Perkins 1973); **vic.**: Pt Lonsdale, 430+, 3 Mar. 1981 (Vic. Bird Rep. 1981); **sa**: Mosquito Pt, SA, 200, 29 Mar. 1981 (SA Bird Rep. 1977–81); **wa**: Broome, 400, Apr. 1994 (Anon. 1994). Numbers in NSW thought to be increasing, e.g. round Parramatta R., not recorded before 1950, but now moderately common (Morris *et al.* 1990); in Sydney Harbour NP, seldom reported before 1970, but more recent counts typically up to 60 birds (Morris 1986).

MOVEMENTS Migratory, though movements of some populations poorly known. Breed n. hemisphere and move S to non-breeding areas. Three subspecies; in HANZAB region, subspecies *longipennis* recorded regularly, nominate *hirundo* accidental. Subspecies *longipennis* moves to non-breeding areas from Malay Pen. E through Indonesia and New Guinea to Aust. and Philippines; straggle to NZ and Cocos-Keeling Is.





Nominate *hirundo* and subspecies *longipennis* intergrade over wide area in central Siberia between about Ob R. and c. 110°E. Nominate *hirundo*: Nearctic populations move to non-breeding areas S of breeding range, through Caribbean and Central America, to South America as far S as Peru, s. Argentina and Falkland Is; most of Old World population apparently moves to non-breeding areas in w. and s. Africa, with a few to Portugal and s. Spain. Central Russian populations possibly move to non-breeding areas in s. Caspian Sea or Persian Gulf; central Asian populations also move to coasts of w. Pakistan, India, Sri Lanka and possibly Malay Pen. Non-breeding range of subspecies *tibetana* poorly known, probably from e. India, including Sri Lanka, to Burma and Malay Pen.; possibly Hong Kong. Subspecies *tibetana* not considered further. Also recorded regularly during non-breeding season in s. and e. Africa (Hachisuka 1932; Gibson-Hill 1950; Hitchcock 1965; Clancey 1976; Latham 1986; Inskipp & Inskipp 1985; Urban *et al.* 1986; Hoffmann 1990; Dickinson *et al.* 1991; Hong Kong Bird Rep. 1992; BWP; see Banding). Extraliminally, move along coasts and across inland; juveniles accompany adults or travel alone (BWP). Discussion of HANZAB region refers to subspecies *longipennis* unless stated, though many sight records are not identified to subspecies. Most birds in n. and e. Aust. apparently subspecies *longipennis* (Hitchcock 1965; Schodde & Mason 1974; Serventy & Whittell 1976). Only nominate *hirundo* recorded sw. WA (Storr & Johnstone 1988).

Immatures apparently not common in Aust. (*contra* Hindwood 1944; Hitchcock & Hindwood 1964; Hitchcock 1965). Of 1423 Terns caught at high tide roosts in Vic. Dec.–Mar. (VWSG), only 53 (3.58%) were first-year birds (see also Minton 1989, 1990); in nw. Aust., of 37 caught Mar.–Apr. only two were first-year birds; of 27 Aust. specimens, only five (18.5%) were immatures (which may be overly represented in collections because young birds tend to be more often beachcast

than adults). However, proportions of immatures in se. Qld probably higher than above samples (C. Corben). Proportion of immatures in Aust. very different to that reported for other wintering areas (e.g. 68–79%; Elliot 1971; Blokpoel *et al.* 1984).

Departure Timing of departure of Nearctic population varies between years; move down Atlantic and Pacific coasts of North America. Occur Atlantic North America till Sept.; pass n. West Indies, Aug.–Dec.; occur s. West Indies, from mid-Sept.; in South America, from Nov. (Austin 1953). Recorded moving from North America into central (rare migrant) and s. (straggler) Pacific Ocean (Pratt *et al.* 1987; see Banding). European populations leave from end July to Oct.; in w. Siberia, mainly by late Aug. or early Sept.; some of s. and w. European populations move rapidly down w. African coast, Nov. (Dement'ev & Gladkov 1951). Suggested that Aust. records are birds blown E by w. winds prevailing at latitudes of s. Africa (HASB; BWP).

Subspecies *longipennis*. Remain in n. breeding range till late Aug. or early Sept., and in s. breeding range till late Sept. Migrate along Asian coastline (Dement'ev & Gladkov 1951; HASB). Abundant on migration in Korea, Aug.–Sept. (Gore & Won 1971); arrive Osaka Bay, Japan, from late July and early Sept., with most birds beginning to move S in first half Oct. (Kobayashi 1953). Transient se. China (de Schauensee 1984); in Hong Kong, most numerous on s. passage, between late Aug. and late Sept., though latest date for s. passage period, Nov. (Chalmers 1986). On Malay Pen. (subspecies *tibetana* also recorded), earliest date end July (Medway & Wells 1976). Some possibly move farther W (Ripley 1982; Roberts 1991). Generally rare passage migrant Borneo, with sight records at Papar, Sept.–Dec., though large concentrations recorded Oct. in Sarawak (Smythies 1981; Edwards *et al.* 1986); few records from Wallacea, where apparently passage

migrant (White & Bruce 1986). In 1982, hundreds moved through Bali, Sept–Oct. (Ash 1982). In Pacific, uncommon migrant Micronesia and Fiji (Pratt *et al.* 1987). In New Guinea, mostly from Aug. or Sept. (Coates 1985; Hicks 1990).

Some appear to arrive nw. Aust. (Hitchcock 1965); recorded at Leslie Saltworks, Pilbara, from late Aug. (Storr 1980, 1984a); also recorded S along WA coast (e.g. from Oct. in Gascoyne region, Storr 1985; N of Carnarvon, Delaney 1976), though rare in sw. Aust. (Aust. Atlas). In NT (Schodde & Mason 1974), recorded Darwin, as early as Aug. and Sept. (McKean 1981). In Torres Str., uncommon from Sept. (Hindwood 1944; Draffan *et al.* 1983). Appear to move S along e. Aust. coast (see Banding). In Qld from Sept. (e.g. White 1946; Qld Bird Rep. 1983) (excluding winter records). Recorded off Wollongong, NSW, as early as Aug. (Brandis *et al.* 1992); usually arrive NSW from late Sept. and Oct. (NSW Bird Reps 1987, 1988, 1990); flock of c. 2250 birds, possibly on migration, recorded NSW, late Oct. 1976 (NSW Bird Rep. 1976). In Vic., reporting rate increases Sept.–Oct. (Vic. Atlas). Recorded Lord Howe I. (Hindwood 1944); visitor to NZ, with acceptable records from Nov. (Latham 1986; Guest 1992; A.J.D. Tennyson).

Populations from zone of integration between *longipennis* and *hirundo* (includes former subspecies *minussensis*) remain at breeding grounds till late Sept. (Dement'ev & Gladkov 1951); recorded Japan (Orn. Soc. Japan 1974) and may be rare vagrant to Indonesia; recorded Aust. (White & Bruce 1986).

Non-breeding In HANZAB region: Subspecies *longipennis* recorded n., e., and se. Aust., from Port Hedland to SA; collected once Cocos-Keeling Is, Feb. (Gibson-Hill 1950; Hitchcock 1965). Immatures appear not to be common in Aust. (for age-composition, see above). In some areas numbers vary between years (e.g. NSW Bird Rep. 1983). Some local movements possibly dispersive; large concentration observed where fish abundant (NSW Bird Rep. 1972). Numbers in ne. Qld in 1990 apparently associated with cyclone (Qld Bird Rep. 1990). Specimen collected SA in late Dec., possibly from intergrade zone of *longipennis* and *hirundo* (Hitchcock 1965; Latham 1986). Nominate *hirundo* accidental to WA (Jan., Apr.) and Vic. (Oct.) (see Johnstone 1979; Storr & Johnstone 1988; HASB; Aust. CL); also, possible record at Boonooroo Pt, Qld, Jan. (Qld Bird Rep. 1988). In sw. WA, occur from Sept. (Storr & Johnstone 1988).

Return Recorded in sw. Aust. till Apr. (Storr & Johnstone 1988). Acceptable NZ records, as late as Apr. (Guest 1992; A. Tennyson). In Vic., reporting rates at winter levels after Apr. (Vic. Atlas). Recorded leaving The Entrance, NSW, late Mar., 1990 (NSW Bird Rep. 1990); latest date off Wollongong, NSW, between Apr. 1985 and Mar. 1987, late May; in Apr. 1986 small, moving flocks observed up to 55 km off Wollongong, pattern consistent with migration in extralimital areas (Wood 1991; Brandis *et al.* 1992). In WA, moderately common till Mar. in Gascoyne region, recorded till late Apr. in Leslie Saltworks, Pilbara (Storr 1984a, 1985); between Port Hedland and C. Keraudren, nw. Aust., recorded till end Apr. where flocks of up to 800–1000 birds recorded before departure (Serventy & Whittell 1976). At Darwin, NT, recorded as late as Mar. (McKean 1981), possibly Apr. (Crawford 1972). Mainly present Torres Str. till Feb. (Draffan *et al.* 1983). Apparently leave New Guinea by late Apr. or early May, with passage recorded in some areas (Coates 1985; Hicks 1990). In 1982, hundreds moved through Bali, Mar.–Apr. (Ash 1982).

Subspecies *longipennis*. Apparently passed Olango I., Philippines, from early Feb. till at least Mar. in 1991 (Dickinson *et al.* 1991; Magsalay 1991).

Pass Hong Kong, usually in small numbers, between Apr. and June (Chalmers 1986). On Malay Pen., latest date late May (Medway & Wells 1976). An adult observed Nepal, Apr. 1982 (Inskipp & Inskipp 1985). Usually arrive Osaka Bay, Honshu, Japan, from second half Apr. to mid-May, and move on during second half May and June (Kobayashi 1953). Many records Apr.–June in Korea (Gore & Won 1971). In Russia, early arrivals in s. Ussuriland, and even as far N as Kamchatka Pen., in early May; in Anadyr, end May or early June (Dement'ev & Gladkov 1951). Populations from zone of integration of *longipennis* and *hirundo* arrive Transbaikalia, May (Dement'ev & Gladkov 1951). Nominate *hirundo* arrive at breeding grounds in w. Europe in late Apr. or early May, later in N; in w. Siberia, about mid-May (Dement'ev & Gladkov 1951).

Breeding Some remain in non-breeding range during breeding period, especially first-year birds and many second-year birds (Harrison 1987). In Aust., reporting rates 1.2% in summer, and 0.2% in winter (Aust. Atlas); also recorded New Guinea (Coates 1985; Hicks 1990). In winter, nominate *hirundo* recorded WA, July (Johnstone 1979; Howard 1981); subspecies *longipennis* recorded e. Aust. (Hitchcock 1965; Condon 1968; Vic. Atlas); and specimen of bird from *longipennis*–*hirundo* intergrade recorded SA, early July (Aust. CL).

Banding, Colour-marking Relevant recoveries of nominate *hirundo*: one Swedish bird, banded as pullus, recovered 6 months later near Fremantle, WA (see Dunnet 1956); Irish bird recovered later Vic. (see Rogers 1969). In Pacific, birds banded North America recovered Hawaii and Cook Is (see Houston 1963). Some recaptures of subspecies *longipennis* in Vic. indicate at least some fidelity to non-breeding area, though few recoveries of birds elsewhere in subsequent summers (see below). Local movements (e.g. 120 km) of banded and colour-marked birds also recorded within non-breeding seasons: bird banded NSW recovered c. 830 km SW in Vic.; birds marked in Vic. recovered along e. Aust. coast, with maximum displacement c. 2515 km (see below). Birds banded Vic. recovered in Philippines in Oct., and in e. Siberia (Minton 1990, 1991, 1992, 1993; see below).

32S151E	01	1+	U	18	10974	349	ABBBS
37S147E	03	2+	U	31	5889	331	ABBBS
37S147E	00	U	U		2515	354	U
32S151E	11	1+	U	15	782	214	ABBBS
37S147E	01	U	U	24	559	36	U
37S147E	01	U	U	24	537	36	U
37S147E	03	2+	U	46	535	37	U

FOOD Poorly known in HANZAB region. Carnivorous; mainly fish, occasionally insects and crustaceans. Extraliminally, also take worms and squid (BWP). **Behaviour** Crepuscular. Feed by surface or shallow plunging, generally from 2 to 3 m, but from 1 to 6 m, above water; also plunge from perches. Also feed by dipping, taking prey from, or just below, surface. Hawk for insects. Glean from ground. Steal food from other terns (especially when food scarce). Recorded taking fish from nets. Take offal. Often feed in tight formations (Hitchcock 1965; Milledge 1977). For extralimital details, see BWP.

Adults At Hunter R. estuary (four stomachs, 30 items; Hitchcock 1965): Insects: Orthoptera: Gryllotalpidae: *Gryllotalpa* 3.3% no.; Gryllidae: *Teleogryllus commodus* 13.3; Coleoptera: Carabidae 3.3; Lepidoptera: Noctuidae 3.3; Hymenoptera: Formicidae: possibly *Camponotus consobrinus* 66.6; Fish: 10.0. **Other records** Insects: Lepidoptera: moths; Fish: Clupeidae; Engraulididae (Hitchcock 1965; Milledge 1977; FAB).

white tips (petering out at p4–p6), forming clear white trailing-edge, c. 2 mm wide when fresh. Secondaries subtly darker than coverts when fresh and distinctly darker (especially inner secondaries) when worn, sometimes forming distinct bar. Outer 4–6 (rarely 3 or 7) primaries retained from non-breeding plumage; when fresh (Apr.–May), exposed parts light grey (c85); outermost feather coloured like inner primaries but central primaries subtly darker) grading to slightly darker grey (85–84) at tips, especially on inner webs; shafts white; p10 has grey-black (c82) outer web. When worn, light-grey sheen of primaries reduced gradually to expose grey-black regions below, especially at tips of primaries and in parts of inner web bordering shaft. Though subtle, above differences in pattern combine with greater wear of outer primaries to form obvious and diagnostic field character (from Arctic Tern), from about July to Oct.: outer primaries darker than inner primaries, especially along trailing-edge, and appear as distinct panel in flight. Contrast less conspicuous when outer primaries fresh but can be seen before departure from A'asia (Apr.–May), even in those still growing p10: dark distal parts of inner webs exposed on non-breeding (basic) primaries as short tapering streaks (wedges) running back from trailing-edge, longest at point in centre of wing, where non-breeding outer primaries meet unstreaked inners. **Underwing** Mostly white; inner four or so primaries and outer two or so secondaries, translucent. P10 has dark line bordering shaft on inner web, broad and dark grey (83–84) at tip, grading to narrow and grey (84) at base. Dark-grey (c83) tips to outer (retained non-breeding) primaries (p9–p6 or p5), partly divided by white wedge on inner webs and bordered inside by dark-grey distal portions to inner edges (hookbacks); forms broad but smudged dark trailing-edge. Hookbacks, paler and diffuse or absent on inner (breeding plumage) primaries, so dark trailing-edge ends abruptly, with square-cut boundary at about p5 or p6. Light-grey (c85) distal ends of secondaries can form diffuse and inconspicuous subterminal bar or trailing-edge.

Adult non-breeding (Third and subsequent basic). **Head and neck** Mostly white, including forehead and anterior lores. Dull black (119–89) half-cap on hindcrown and nape extends through ear-coverts to meet large black (119–89) spot in front of eye; black can encircle eye but white of cheeks often curves up to meet lower eyelid. Feathers of crown, grey (85–84) with large grey-black (c82) smudges at centre of tips, especially on hindmost feathers; grey-and-black mottling or streaking often extends in front of eye in mid-line of crown, but sparser at sides, so white of sides of forehead can extend to level of mid-eye. White bases of feathers of crown partly exposed when worn, but ground-colour of crown never appears wholly white (cf. Arctic Tern). **Upperparts** As adult breeding but white half-collar typically separates mantle from black nape. Rump, light grey (dark 85), grading to pale grey (c86) on distal uppertail-coverts. White bases of distal uppertail-coverts can be partly exposed but do not show wholly white patch on rump and uppertail-coverts (cf. Arctic Tern). **Underparts** White. **Tail** Mostly pale grey (86), grading to grey (c84) on outer feathers; t2–t5 have white inner webs grading to grey-white at shafts and tips. Outer web of t6, dark grey (84–83); inner web, white with grey (84–85) tip, which is narrowly fringed white when fresh. **Upperwing** Patterned like adult breeding, but with dark-grey (c83) cubital bar (brownier when worn) formed by shortest 3–4 rows of lesser secondary coverts. In addition, different stages of moult cause conspicuous differences from adult breeding. By Nov.–Dec., primaries usually show active moult rather than distinct contrast between worn outer and

fresh inner primaries; dark areas of outer primaries, their coverts, and sometimes a few feathers of alula, may fade to black-brown (119) or dark brown (c121). When very fresh (Feb.–Mar.), some new outer primaries have very narrow white fringes at tips of inner webs; these sometimes visible as fine (often broken) white line along upper edge of folded primaries (this effect never as striking as in Roseate and White-fronted Terns). **Underwing** As adult breeding, but hookbacks of inner primaries in basic plumage slightly darker and more strongly defined than on inner primaries of alternate plumage; when outer primaries worn, trailing-edge slightly broader and more conspicuous.

Juvenile Head and neck Forehead and most of lores, white, varying tinged light brown (223D) to grey-brown (239) when very fresh. Rest of face and throat, white. Sooty (c119) half-cap on nape and hindcrown like adult non-breeding but can be faintly scalloped by minute buff (c92) tips when very fresh. Crown grades from black-brown (119) at rear to greyish brown (c119B) in front and is varying mottled or streaked by broad off-white to buff (c124) edges or fringes to feathers. Eyelids usually visible as narrow white crescents above and below eye (Olsen & Larsson 1995). **Upperparts** Narrow grey-white to white half-collar separates mantle and half-cap. Mantle, scapulars and back, light grey (dark 85); when fresh, feathers have off-white to buff (118) or light-brown (123A) tips; pale tips often bordered by varying grey-brown (c119B) to dark-brown (121) subterminal crescents, mostly narrow but broad and bold on longest scapulars. When worn, pale tips fade to white, and most subterminal crescents, except those on longest scapulars, fade and become mottled and inconspicuous. Rump, pale grey (86) grading to grey-white or white on uppertail-coverts; feathers can be narrowly tipped brown (119B) when very fresh. **Underparts** White; can have faint buff tinge at sides of upper breast when plumage very fresh. **Tail** T1 and outer webs of t2–t4, mostly pale grey (86), grading to grey (84) or dark grey (c83) on outer webs of t5–t6. T1 has white inner edges and other rectrices have wholly white inner webs; on t2–t3 white extends onto base and along shaft of outer web. All feathers have white tips 2–3 mm wide; when very fresh, tips can be faintly tinged buff and may extend slightly along outer edge of t1–t5. **Upperwing** Tertiaries and innermost greater secondary coverts, as longer scapulars; when plumage moulting, primaries and the dark subterminal markings of tertiaries most conspicuous juvenile remnants. Greater, median and longest two rows of lesser secondary coverts, light grey (c85); greater coverts have white tips; median and lesser coverts have narrow light-brown (c223D) to off-white tips and, sometimes, faint-brown (c119B) subterminal bars. Dark cubital bar formed by 3–4 rows of shortest lesser secondary coverts; feathers, dark grey (83) to grey-black (82) with grey (84) bases and very narrow pale-grey (86) or grey-white fringes. Alula and lesser primary coverts, light grey (85–86) with dark-grey (83) centres; these often align as dark continuation of cubital bar. Greater primary coverts, light grey (c85) to grey (c84) with narrow grey-white fringes. Primaries and secondaries, patterned like those of adult, but uniform age causes some differences in appearance: (1) ground-colour of secondaries becomes dark grey (84–83) with wear, forming dark secondary bar contrasting with secondary coverts; (2) white tips of inner primaries broader (2–3 mm) when fresh, becoming narrower on outer feathers and petering out at p7–p8; (3) in fresh plumage, inner and outer primaries similar in colour; with wear, outer primaries look darker than inner primaries but without distinct moult-contrast. **Underwing** As adult breed-

ing, but dark trailing-edge slightly longer, with less square-cut inner boundary (especially when fresh).

First immature non-breeding (First basic; sometimes referred to as portlandica plumage [see introduction to Sterninae]). Like adult non-breeding when moult finished, except perhaps for darker outer webs to secondaries and dusky centres to tertials. In Nov.–Apr., differ from adults by moult-schedule and retained juvenile plumage: (1) Dark subterminal markings of upperparts fade and are lost during austral summer, though a few markings can be seen on retained juvenile scapulars and tertials until Nov.–Dec. (rarely Jan.). (2) Retained juvenile tail less deeply forked till outer feathers moulted Jan.–Feb. (3) Retained juvenile primary coverts and lesser secondary coverts much faded by Jan., so cubital bar can appear broader and browner than it ever does in adults and typically meets dark outerwing; after mid-Jan., moult of secondary coverts often partly exposes white bases of greater secondary coverts, which form diffuse white bar behind cubital bar; when moult finished, coverts like adult non-breeding. (4) Juvenile remiges worn and dull black by Nov.–Dec.; in flight, secondaries form dark trailing-edge, contrasting with grey greater coverts, and dark primaries obvious, even when wing folded. Moult of primaries begins Jan. but always less advanced than in adults (Table 1); by Apr., when many retain no other juvenile plumage, retained outer 3–6 primaries and their coverts form dark wedge on outerwing (outer primaries of adults are fresh and pale).

First immature breeding (First alternate). Only one specimen examined, and that aberrant; following based mostly on field observations of thousands of birds in se. Qld (C. Corben). Like adult non-breeding, differing by: (1) Some have more black on forehead; (2) Underparts usually white, often with traces of grey (seldom or never extensively grey below); (3) Pattern of tail intermediate between adult breeding and non-breeding, with more grey than former, more white than latter; (4) Cubital bar usually reduced and often absent. Most have fresher outer primaries than adult (which also differ May–Aug. in having much or complete breeding plumage); some suspend post-juvenile moult of primaries at p7–p9, and retained, extremely worn, juvenile outer primaries are diagnostic of age. Aberrant specimen collected PNG, June, had retained juvenile median and greater secondary coverts, which were so worn that white bases to these coverts and secondaries exposed, forming white panel contrasting with dark cubital bar.

Second immature non-breeding (Second basic). Very similar to adult non-breeding. American nominate *hirundo* can have dark outer webs to secondaries and dusky centres to tertials, thus differing from adult non-breeding in having dark trailing-edge along innerwing (Wilds 1993); not known if this is so in Aust. *longipennis*. In se. Qld, Nov.–Dec., unmoulted outer primaries obviously fresher than those of adult non-breeding but difference becomes less obvious during austral summer (C. Corben).

Second immature breeding (Second alternate; sometimes referred to as pikei plumage [see introduction to Sterninae]). Only studied in nominate *hirundo*. Vary. Some have almost as much non-breeding plumage as first immature breeding, differing in not retaining juvenile outer primaries, in having 3–6 new inner primaries (cf. 1–3 in first immature breeding in boreal summer) and usually in having a few black feathers on forehead. Others, very similar to typical adult breeding, though usually duller, with slightly fresher outer primaries (second basic sometimes still growing in May–July) and with some non-breeding plumage: scattered white feath-

ers on forehead and underparts (forecrown may be wholly white), dark feathering in cubital bar, and some grey on rump and uppertail. A few older adults may also show such traces of non-breeding plumage (e.g. Austin 1938), so certain ageing not possible.

BARE PARTS Except where stated, based on photos (Pringle 1987; Wilds 1993; Olsen & Larsson 1995; unpubl.: B. Chudleigh; J.N. Davies; D.W. Eades; D. Graham; D.I. Rogers).

Adult breeding Subspecies *longipennis* (Asia): Iris, black-brown (119). Bill, black (82–89), usually with minute cream or white tip (≤ 1 mm wide). Inside of mouth, orange; occasionally seen as fine orange line or spot on gape even when bill closed. Legs and feet, blackish grey (82–83), always with red (110, c31, c108) tinge; red tinge often so strong that legs look dusky red or dark red-brown. Soles, as feet but with stronger red or orange tinge; claws, black (89). Not known if legs become brighter red when breeding. Nominate *hirundo*: Bill, bright orange-red (c13, c14) to red (210, 110) with sharply defined black (89) tip, typically 12–19 mm wide; in some, black tip smaller, confined to upper mandible; rarely, bill wholly red, especially in boreal autumn and late summer (Wilds 1993). Legs and feet, red (13, 14, 210) with black (89) claws. **Adult and first and second immature non-breeding** Subspecies *longipennis*: Mostly as adult breeding; first immature breeding (first alternate), se. Qld, can have bright red legs, especially in Aug. (C. Corben). Nominate *hirundo*: Bill, mostly black; begins to change colour as early as July in some, not before Oct. in others; some retain varying crimson-red areas on base to lower mandible and just below nostrils (BWP; Olsen & Larsson 1995). Legs and feet apparently vary; like *longipennis* in some, but described as orange-red in some (e.g. BWP). **Juvenile** Nominate *hirundo*: When newly fledged: bill, pink (c13, c110) to dull orange (6, 106, 116) with broad black (82–89) tip and culmen; legs, pinkish orange (c4, c13, c106) with black (89) claws. Bill darkens soon after fledging (Palmer 1941) and some have black bill by Sept.; bill and legs like adult non-breeding on arrival in non-breeding areas. **Subspecies longipennis**: Few data, but one label (MV) suggests they also have pale legs and base to bill on fledging; non-breeding coloration apparently attained by time of arrival in Hong Kong (Carey & Leader 1993). **Second immature breeding** Nominate *hirundo*: Like adult breeding, but generally with broader black tip to bill (bill can be more black than red).

MOULTS Except where stated, based on 46 skins of subspecies *longipennis* (AM, ANWC, MV, QM), data on moult of primaries from 1460 birds banded in Aust., mostly in Vic., Dec.–Mar. (VWSG, AWSG), and reviews in BWP, Wilds (1993) and Olsen & Larsson (1995).

Adult post-breeding (Third and subsequent pre-basic). Complete; primaries outwards. In nominate *hirundo*, often begin moult while on or near breeding grounds, replacing some feathers of head and body, rectrices and inner 1–4 primaries (rarely inner 5–7) from early July to late Aug.; failed breeders may begin moult as early as June. In most detailed study of early stages (Walters 1979 in Netherlands): (1) most adults began moult of primaries and tail just after chicks had fledged, though many breeding late, in July, began moult during incubation; (2) moult of rectrices started just before that of primaries; (3) tail moulted in sequence t1–t2–t3–t6–t4–t5 and was completed in some birds before migration. Usually suspend moult during migration, but Olsen & Larsson (1995) suggest that some moult may occur at stopover sites

with abundant food in North Sea and Waddensee. Extent of moult before suspension and s. migration varies markedly between individuals, though usually only a little; extent may also vary geographically (see Olsen & Larsson 1995). Early stages of moult of subspecies *longipennis* probably similar to nominate *hirundo* but fewer data. On arrival in se. Qld, in late Sept.–Oct., most retain much breeding plumage and some have not moulted any feathers of head or body; all have replaced some inner primaries (usually 4–6) and at least some arrive with moult of primaries suspended (C. Corben). In n. WA, an early arrival at end Aug. had not begun moult of primaries (AWSG); in Vic., two birds photographed in early Nov. (D.W. Eades) still retained much breeding plumage but had moulted t6, inner four primaries and 10–30% of feathering on (at least) head, lesser coverts and underparts. By Dec., all Aust. adults have attained non-breeding appearance, though may still be growing a few feathers of body and rectrices (typically t4 and t5), and all are moulting secondaries (inwards), and primaries. Moult each primary when adjacent primary about half-grown, so typically have one or two primaries growing concurrently. Of 1086 in pre-basic moult of primaries (VWSG): 98% had 1–2 primaries growing concurrently, 17 (1.5%) were growing three primaries, and 6 (0.5%) had briefly suspended moult. Progress of pre-basic moult of primaries in adults and immatures summarized in Table 1. Data on timing from South Africa (Underhill & Prys-Jones 1986) and Trinidad (Blokpoel *et al.* 1984) appear similar. Pre-basic moult finished with growth of p10, and overlaps with pre-alternate (pre-breeding) moult (see below). In Vic., earliest recorded finishing date, 5 Mar. and 6.9% have finished moult by 9–10 Mar.; in n. WA, 24 of 28 examined 2–6 Apr. had completed pre-basic primary-moult. **Adult pre-breeding** (Third and subsequent pre-alternate). Partial. Involves: (1) all feathers of head, body and tail; (2) outer few secondaries in some; (3) inner 4–5 (rarely, 3 or 6–7) primaries and their coverts; and (4) all secondary coverts and alula. Moult begins first in inner primaries and sometimes tail: in adult samples in Table 1, 3% had started pre-alternate (pre-breeding) moult of primaries by 30 Dec.–1 Jan., 18% by 13–14 Jan., 30% by 25–28 Jan., 63% by 31 Jan.–1 Feb. and 86% by 4–10 Mar. On any given date, individuals beginning pre-alternate moult of primaries tend to be those most advanced in pre-basic (post-breeding) moult, e.g. of adults growing p1 in pre-alternate moult (i.e. at beginning of moult), average outermost growing pre-basic primary 7.9 (1.03; 5–9; 27) on 13–14 Jan., 8.9 (0.62; 8–10; 66) on 31 Jan.–1 Feb. (cf. data presented for all adults in Table 1). Only grow 1–2 primaries concurrently (as in pre-basic). Pre-breeding moult of feathers of head and body begins about Mar. (also overlapping with pre-basic moult of primar-

ies), starting on underparts and finished on forehead and, sometimes, cubital bar. Timing varies individually, e.g. in n. WA in early Apr., most had 50%–90% breeding plumage, some had attained breeding appearance and some (possibly in second pre-breeding [pre-alternate]) had only 5%–20% breeding plumage (AWSG). Many or all adults finish moult before n. migration; pre-alternate moult of inner primaries finishes at about same time as pre-basic moult of outer primaries, while feathers of cap, cubital bar and tail-streamers may finish slightly later. **Adult, Third series of primaries** (Assumed to be pre-supplemental). Some adults replace p1 and p2 in a third, outwards moult, late Jan. to late Mar.; surprisingly, appear to replace alternate (breeding plumage) primaries that show little or no wear. Moult arrested before n. migration. According to Baker (1993), some adults have three generations of primaries on arrival in breeding grounds, but in general the differences in wear between supplemental and alternate primaries so slight that number of birds performing pre-supplemental moult might easily be underestimated. In Aust., third moult-series has been found in 0.14% of adults caught 1–28 Jan., 2.08% caught 31 Jan.–1 Feb. and 3.70% caught in Mar. (see Table 1 for sample sizes). The 12 birds found with third moult-series were also replacing p3–p5 in pre-alternate moult-wave, and p8–p10 in pre-basic. Additional information in BWP and Underhill & Prys-Jones (1986). **Post-juvenile** (First pre-basic). Complete or nearly so; primaries outwards. In nominate *hirundo*, moult of body typically starts in non-breeding areas, Nov.–Dec., though, exceptionally, may start before s. migration (Wilds 1993; BWP). Little information on early moult (before Dec.) of subspecies *longipennis*; some retain full juvenile plumage till arrival in Hong Kong (Carey & Leader 1993), but one specimen collected Kurile Is on 10 Sept. had already begun moult of body (MV). Some arrive in Aust. in complete juvenile plumage (C. Corben) but difficult to estimate how many do so because worn juvenile plumage on upperparts similar to that of first immature non-breeding. By late Dec., moult of head and body of Aust. subspecies *longipennis* advanced, with only a few juvenile feathers on rump and scapulars; traces of body-moult last recorded at end Jan. Feathers of wing and tail do not begin moult till late Dec., when moult starts on tertials, p1 and (sometimes slightly later) on median and greater secondary coverts and t1; see Table 1 for summary of progress of moult of primaries. By Mar.–Apr., only remaining juvenile feathers are outer primaries and their coverts, inner (sometimes all) secondaries and occasionally some feathers of alula. Most moult all primaries; New Guinea skin, 16 June (ANWC) with primary-moult S³N³I¹V² suggests moult of primaries finished June–Aug. as in nominate *hirundo*. Some *longipennis* in se. Qld and nominate *hirundo* visiting breeding grounds arrest moult, with up to p7–p9 new (C. Corben; BWP); not known if this is so in *longipennis*. **First immature pre-breeding** (First pre-alternate). Partial, but extent of moult not certain; probably occurs late in austral autumn and early in austral winter of second calendar year. BWP states that nominate *hirundo* moult directly from first non-breeding to second non-breeding plumage (i.e. that they do not undergo this moult) but field observations in se. Qld indicate that some moult must occur (C. Corben; see Plumages). Most or all moult tail, many moult some upperwing-coverts, and some moult a few feathers of forehead and underparts. It is possible that most other feathers of head, body and upperwing-coverts are also moulted, but that this moult has been overlooked as resultant plumage like first immature non-breeding. Not known if any primaries moulted; moult of inner primaries in May–July

Table 1. Mean outermost primary growing in post-breeding (pre-basic) moult. Adult data, from Vic. banding study (VWSG) probably include a few in second pre-basic; information on post-juvenile moult also includes data from skins (AM, MV, QM) from scattered Aust. localities. Mar. data do not include the 4% of adults that had completed moult.

	ADULT POST-BREEDING	POST-JUVENILE
30 Dec.–1 Jan.	6.60 (0.75; 5–8; 196)	0.13 (0.35; 0–1; 8)
13–14 Jan.	7.46 (0.86; 5–10; 275)	1.77 (0.83; 0–3; 13)
25–28 Jan.	7.99 (0.86; 6–10; 225)	2.90 (0.79; 2–4; 9)
31 Jan.–1 Feb.	8.48 (0.81; 6–10; 147)	3.17 (0.41; 3–4; 6)
4–10 Mar.	9.80 (0.50; 8–10; 243)	5.11 (0.60; 4–6; 9)
Apr.	Usually complete	5.80 (1.33; 4–7; 6)

usually ascribed to second pre-basic (q.v.; see Wilds 1993 and BWP) but on present knowledge, difficult to exclude possibility that it is part of first pre-alternate. **First immature post-breeding** (Second pre-basic; few or none breed in preceding plumage). Few data on this and subsequent adult moults in subspecies *longipennis*. Following summary based mainly on study of nominate *hirundo* (BWP). Moults of feathers of head, body and tail occurs June–Aug. of second calendar year; inner primaries start May–July of second calendar year, often before post-juvenile moult of outer primaries finished (BWP). Moults of primaries apparently slow and often temporarily suspended (e.g. with p1–p3 new in birds visiting breeding grounds); not finished till Mar.–June of third calendar year. More information needed on moult of primaries; if the moult of inner primaries observed May–July is a partial first pre-alternate, it may be that second pre-basic moult of primaries starts much later. Because difficult to separate from adults (see Plumages), only recorded with certainty in one Aust. *longipennis*, a retrap with primary-moult N¹S¹O⁴ on 26 Jan. (VWSG). **Second immature pre-breeding** (Second pre-alternate; not all breed in resultant plumage. This moult same as ‘Third series of primaries’ of BWP). Probably partial. Begins in primaries, Dec.–Feb. of third calendar year, before second pre-basic moult of outer primaries finished. Varying amount of breeding plumage attained Feb.–June, including 40–90% of head and underparts, often less of upperparts and tail, and none to all of wing-coverts. In those nominate *hirundo* migrating to breeding areas in boreal summer of third calendar year, moult of primaries is arrested with inner 5–7 (rarely 4 or 8) new (Olsen & Larsson 1995). Those remaining in non-breeding areas said to replace all primaries, finishing moult Aug.–Oct. (BWP) but confirmation needed. Few data for *longipennis*, in which only former strategy of moult of primaries recorded: e.g. known-age retrap in Vic., 1 Feb. (VWSG), had third pre-basic primary-moult of N⁶4¹O².

MEASUREMENTS Subspecies *longipennis*. SE. Aust. and ne. Asia (Japan, Korea and Sakhalin I.), skins; T1 = length of central rectrices; T6–T1 = depth of tail-fork, from tip t1 to tip t6; Bill D(N) = depth of bill at basal corner of nostril (AM, ANWC, MV, QM): (1) Breeding adults with fresh p10 and breeding (alternate) rectrices; (2) Non-breeding Aust. adults with worn p10 and non-breeding (basic) rectrices; (3) Adults, all plumages (measurements of bill combined with data from BWP); (4) Fresh juveniles; (5) Immatures, with worn juvenile p10; (6) Juveniles and first non-breeding immatures with juvenile remiges and tail; (7) Ages combined.

	MALES	FEMALES	
WING	(1) 279.6 (5.92; 272–287; 6)	276.5 (3.94; 271–281; 6)	ns
	(2) 266.8 (8.18; 260–279; 6)	263.6 (2.08; 262–267; 4)	ns
	(4) 256	263, 268, 263	ns
	(5) 251.0 (11.97; 240–268; 4)	239, 259	ns
	(1) 77.0 (2.37; 74–81; 6)	73.5 (2.59; 70–77; 6)	*
T1	(2) 75.1 (7.32; 66–88; 8)	73.0 (4.06; 67–79; 10)	ns
	(6) 73.6 (7.02; 65–83; 5)	70.7 (5.09; 64–78; 7)	ns
	(1) 85.0 (3.29; 80–88; 6)	77.8 (8.06; 65–87; 6)	ns
T6–T1	(2) 62.8 (7.99; 54–76; 6)	61.5 (6.58; 52–74; 6)	ns
	(6) 44.8 (7.92; 39–58; 5)	44.2 (7.29; 37–53; 5)	ns
	(3) 35.8 (1.46; 33.0–38.0; 23)	33.9 (0.86; 32.0–36.5; 22)	**
BILL	(6) 33.8 (0.76; 32.9–34.7; 5)	30.6 (2.92; 28.8–35.8; 5)	ns
	(3) 8.01 (0.573; 7.0–8.7; 9)	7.38 (0.473; 6.7–8.2; 12)	*
BILL D(N)	(6) 7.82 (0.506; 7.2–8.5; 5)	7.30 (0.400; 6.8–7.8; 5)	ns
	(7) 20.0 (0.99; 18.5–21.6; 20)	20.0 (0.87; 17.9–21.1; 24)	ns
TARSUS	(7) 24.0 (1.57; 21.0–26.2; 15)	24.2 (0.91; 22.8–26.2; 14)	ns
TOE C			

(8–11) NW. Aust. and Vic., live (AWSG): (8) Adults, Mar.–Apr., with fresh p10; (9) Adults, Dec.–Feb., with worn p10; (10) All adults; (11) First immature non-breeding, Jan.–Feb., with worn juvenile p10.

	VIC.	NW. AUST.	
WING	(8) 277.8 (9.09; 267–296; 13)	280.3 (9.83; 265–294; 22)	ns
	(9) 265.1 (7.51; 241–296; 663)	–	
	(11) 254.4 (5.13; 241–268; 31)	–	
BILL	(10) 35.4 (1.77; 30.1–41.4; 1026)	34.8 (2.09; 32.0–39.4; 34)	ns
	(11) 34.8 (1.60; 31.5–38.0; 31)	–	
THL	(10) 74.9 (2.68; 65.0–82.6; 748)	75.2 (2.18; 70.7–81.0; 30)	ns
	(11) 73.7 (2.67; 68.5–78.3; 18)	–	

Nominate *hirundo*. Netherlands, skins, May–Sept. (BWP): (12) Adults; (13) Juveniles; (14) Ages combined.

	MALES	FEMALES	
WING	(12) 272 (7.01; 257–287; 73)	270 (6.52; 259–290; 39)	ns
	(13) 255 (8.84; 248–270; 19)	256 (8.37; 244–268; 21)	ns
T1	(14) 70.5 (3.06; 66–76; 45)	69.7 (2.92; 66–75; 33)	ns
T6–T1	(12) 76.9 (7.42; 64–94; 46)	78.4 (7.20; 66–92; 27)	ns
	(13) 43.0 (5.47; 36–54; 20)	42.5 (3.68; 37–48; 21)	ns
BILL	(12) 37.1 (1.40; 35–40; 66)	35.2 (1.24; 32–37; 36)	**
TARSUS	(14) 20.2 (0.77; 19–22; 45)	19.8 (0.52; 19–21; 36)	**
TOE	(14) 22.8 (0.98; 21–24; 25)	22.1 (1.07; 21–24; 13)	ns

Males slightly larger than females, significantly so for length and depth of bill. In our region, THL appears the best external measurement for sexing; using HUMPS–UV program (Rogers 1995) on samples of live Aust. adults (AWSG, see above), separation of sexes could be achieved for THL but not for wing or bill: THL was estimated as 76.2 (1.95; 469) for males and 72.7 (1.87; 270) for females. Above sample suggests sex-ratio skewed in favour of males in se. Aust. In adults, length of wing decreases significantly when worn, and for much of non-breeding period average length of wing is 12–14 mm shorter than when breeding. Wing and t6 significantly shorter in juveniles than in adults. Bill of newly fledged juveniles shorter and less deep than in adults, with difference easily seen in field (e.g. Olsen & Larsson 1995); Aust. samples above show bill still significantly shorter than adults by Jan.–Mar. of second calendar year; not known when adult bill-length attained. Tarsus and toe of juveniles fully grown when c. 2 weeks old (e.g. LeCroy & Collins 1972).

WEIGHTS Mainly or all subspecies *longipennis*. A'asia; mostly Dec.–early Mar.; immatures in first non-breeding or in second post-breeding moult (AM, ANWC, MV, QM; Hitchcock 1965; Schodde & Mason 1974). Includes adult male collected May weighing 128 g and immature females collected New Guinea, June–Aug. weighing 84, 105 and 105 g).

	MALES	FEMALES	
ADULTS	124.5 (14.65; 100–140; 10)	120.1 (11.37; 92–125; 8)	ns
IMMATURES	98, 115, 125	94.9 (12.83; 75–106; 7)	ns

(1–2) Live birds from banding studies (AWSG): (1) Vic.; (2) NW. WA.

	ADULTS	IMMATURES	
28 Aug.	(2) 105.0 (3.74; 101–110; 4)	–	
Dec.	(1) 116.2 (8.86; 96–145; 97)	–	
Jan.	(1) 117.0 (9.28; 80–149; 743)	111.4 (7.81; 89–128; 29)	**
Feb.	(1) 116.1 (9.13; 94–135; 107)	103, 120	
4–6 Mar.	(1) 115.7 (6.11; 100–135; 99)	100	
9–10 Mar.	(1) 123.1 (8.15; 92–143; 163)	115.5 (13.18; 103–132; 4)	ns
2–11 Apr.	(2) 125.5 (8.54; 108–140; 28)	–	

Above data suggest slight gain in weight before migration in Mar.–Apr. in adults and, possibly, immatures. However, interpretation complicated by much variation in average weight from catch to catch in Jan. samples, e.g. adults in same area of Vic., 113.3 (9.40; 80–138; 289) on 13–14 Jan. 1990, and 121.6 (8.82; 102–149; 204) on 25–27 Jan. 1992. Whatever the causes of variation (possibly yearly fluctuations, or time between capture and last feeding), they appear to affect immatures as well as adults, and immatures lighter than adults in each Jan. catch. Adults in Mongolia, early June to early Aug.: males 119 (110–138; 12), females 129 (105–150; 10) (Piechocki 1968); no other data available on weights of subspecies *longipennis* outside HANZAB region.

No weights available for nominate *hirundo* in Aust. In Trinidad, late Jan. and early Feb., adults (including second immature non-breeding) 105.8 (10.6; 12) and immatures 101.4 (9.1; 41) (Blokpoel *et al.* 1984); other extralimital non-breeding weights given in BWP. Adults on breeding grounds: New York State, USA, 120.4 (103–145; 265) (LeCroy & LeCroy 1974); Massachusetts USA, 125 (106–147; 116) (BWP); England, 126.2 (10.0; 30) (BWP). Weights from Netherlands in Aug. and Sept. (BWP) suggest possible gain in weight before migration: adults 132.5 (12.88; 89–165; 67), juveniles 121.2 (19.22; 40). Detailed studies of gain of weight of chicks by LeCroy & Collins (1972), LeCroy & LeCroy (1974), Langham (1972, 1983), and Ricklefs & White (1981).

STRUCTURE Wing, long, pointed and narrow. Eleven primaries: p10 longest, p9 11–23 mm shorter in adult, p8 29–43, p7 50–67, p6 73–90, p5 85–113, p4 112–134, p3 132–152, p2 145–170, p1 160–186; p11 minute, concealed by primary coverts. Wing-tip less pointed in juveniles, e.g. p9 6–10 mm shorter than p10, p8 24–33. Walters (1979) recorded aberrant adult with 12 primaries. Sixteen secondaries, including three or four tertials; longest tertials reach to between tips of p4 and p5 on folded wing. Tail, long, deeply forked (seasonal and age-related variation described in Measurements). Bill, straight, about length of head; culmen gently decurved; distinct gonydeal angle midway along underside of otherwise straight lower mandible. Bill, laterally compressed for most of length but broad (c. 5.8 mm) at base; depth of bill in Measurements. Tarsus, short and slender; scutellate; tibia about equal to tarsus in length, with distal half unfeathered. Toes, short and webbed, with sharp slender claws; outer toe c. 88% of middle, inner c. 69%, hind c. 30%.

RECOGNITION See Antarctic Tern, Figure 8.

GEOGRAPHICAL VARIATION Three subspecies recognized on basis of differences in colour of bill and leg and slight differences in size and colour of plumage. E. Siberian subspecies *longipennis*, described above, characterized by black bill and dark legs and underparts in breeding plumage. Nominate *hirundo* of Europe, w. Russia and North America, differs from

longipennis mainly by mostly red bill in breeding plumage (see Bare Parts) and slightly shorter wing and significantly longer bill (see Measurements). Slight geographical variation in size within *hirundo*, e.g. average wing in North America c. 6.5 mm shorter than in Europe (BWP), and adults from w. Turkestan (previously treated as a subspecies *turkestanica*), small, with average wing and bill of 261 and 33 mm respectively (Stegman 1936). In all adult plumages, upperparts slightly paler grey (c85–c86) than *longipennis* but difference too slight for confident identification in non-breeding plumage. In breeding plumage, also differ in pale-grey (pale 86) to grey-white underparts (in darkest individuals, similar to palest *longipennis*) with white of throat usually extending farther onto breast; grey wash on central rectrices usually more extensive. Nominate *hirundo* and subspecies *longipennis* intergrade over wide area in central Siberia, from about Ob R. Basin to Transbaikalia. Variation in this region clinal; most birds appear intermediate between *hirundo* and *longipennis*, with varying red base to bill and proportion of black-billed birds increasing to E (Stegman 1936; Johansen 1960; Vaurie 1965). These intermediates sometimes considered a subspecies *minussensis*, but this treatment rejected by BWP. Subspecies *tibetana* of central Asia has plumage at least as dark as *longipennis* but bill-colour like nominate *hirundo*; length of wing and bill similar to *longipennis*.

Subspecific identification difficult in non-breeding areas (e.g. Clancey 1976). In non-breeding plumage, measurements are little use in identification of subspecies because they overlap in size (see above) and wear affects length of wing (see Measurements). Variation in darkness of upperparts and colour of bill and legs (see Bare Parts) possibly useful but differences subtle and not properly described. From observations of hundreds of birds in Vic. and s. Qld, and c. 50 in nw. Aust. (and single bird in NZ), black bill and dark underparts of adults attaining breeding plumage Mar.–Apr. show that subspecies *longipennis* certainly most common (Hitchcock 1965; Latham 1986; unpubl. photo: B. Chudleigh; D.W. Eades; D.I. Rogers; unpubl. photos, as in Bare Parts). A few in Vic. (probably <1%, but no systematic records) show inconspicuous traces of red at base of bill (VWSG; D.W. Eades) and two (Vic., Sept. [D.W. Eades]; n. WA, Apr. [D. Graham]) had red (c11, c14) gapes and basal 50–60% of lower mandible; latter also had mostly dull-crimson (110) legs. Those records suggest that some individuals of w. populations of subspecies *longipennis* (so-called *minussensis*) migrate to HANZAB region. Only confirmed records of other subspecies from our region are two band-recoveries of European *hirundo* (apparently vagrants) in s. WA and Vic. Specimen from SA (SAM B24805), previously identified as subspecies *turkestanica* on basis of small size (Hitchcock 1965), is in first immature non-breeding, and measurements (wing 246 and bill 32.5) appear typical of those now available for *longipennis*. Hybridization with Roseate Tern (q.v.) reported.

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Volume 3, Plate 37

White-fronted Tern *Sterna striata* (page 632)

1 Adult breeding; 2 Adult non-breeding; 3 Downy young; 4 Juvenile, black-and-white morph (= typical birds); 5 First immature non-breeding, first austral winter; 6 First immature non-breeding in late stage of moult to second immature non-breeding, first austral spring to second austral summer

Common Tern *Sterna hirundo* (page 655) Subspecies *longipennis* unless stated

7 Adult breeding; 8 Adult breeding, subspecies *hirundo*; 9 Adult non-breeding; 10 Juvenile, moderately worn plumage; 11 Early stage of moult from juvenile to first immature non-breeding, first austral spring; 12 Mid-way through moult from juvenile to first immature non-breeding, late Jan. of first austral summer

Roseate Tern *Sterna dougallii* (page 621)

13 Adult breeding, while feeding chicks; 14 Adult breeding, developing red bill during incubation period; 15 Adult non-breeding; 16 Downy young; 17 Juvenile; 18 Late stage of moult from juvenile to first immature non-breeding

Black-naped Tern *Sterna sumatrana* (page 645)

19 Adult; 20 Downy young; 21 Juvenile; 22 Early stage of moult from juvenile to first immature non-breeding; 23 Late stage of moult from juvenile to first immature non-breeding



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Volume 3, Plate 38 [caption error corrected from original]

Common Tern *Sterna hirundo* (page 655)

Subspecies *longipennis* unless stated

1 Adult breeding, fresh plumage, austral autumn; 2 Adult breeding, subspecies *hirundo*, worn plumage, boreal summer; 3 Adult non-breeding, early Jan.; 4 Juvenile, moderately worn plumage; 5 Mid-way through moult from juvenile to first immature non-breeding, late Jan. of first austral summer

White-fronted Tern *Sterna striata* (page 632)

6 Adult non-breeding; 7 First immature non-breeding, first austral winter; 8 First immature non-breeding in late stage of moult to second immature non-breeding, first austral spring to second austral summer

Roseate Tern *Sterna dougallii* (page 621)

9 Adult breeding; 10 Early stage of moult from juvenile to first immature non-breeding; 11 Late stage of moult from juvenile to first immature non-breeding

Black-naped Tern *Sterna sumatrana* (page 645)

12 Adult breeding; 13 Early stage of moult from juvenile to first immature non-breeding; 14 Late stage of moult from juvenile to first immature non-breeding