

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]):

Thinororidae	seed-snipes; 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.
Chionidiidae	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	pratincoles, 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 (Thinororidae, Pedionomidae, Scolopacidae, Rostratulidae, Jacaniidae) and charadriids and allies (Chionidiidae, 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.

REFERENCES

- Christian, P.D., et al. 1992. *Aust. J. Zool.* 40: 291–302.
- Fjeldså, J. 1976. *Vidensk. Medd. dansk. Natur. Foren.* 139: 179–243.
- 1977. *Guide to the Young of European Precocial Birds*. Scarv Nature Productions, Tisvildeleje.
- Glenny, F.H. 1955. *Proc. US natn. Mus.* 103 (3346): 525–621.
- Jehl, J.L., Jr. 1968. *Mem. San Diego Soc. nat. Hist.* 3.
- Mayr, E., & D. Amadon. 1951. *Am. Mus. Novit.* 1496.
- Mickevich, M.F., & L.R. Parenti. 1980. *Syst. Zool.* 29: 108–113.
- Olson, S.L., & A. Feduccia. 1981. *Smithson. Contrib. Zool.* 323: 1–24.
- , & D.W. Steadman. 1981. *Smithson. Contrib. Zool.* 337: 1–25.
- Sibley, C.G., & J.E. Ahlquist. 1990. *Phylogeny and Classification of Birds of the World*. Yale Univ. Press, New Haven.
- , & B.L. Monroe. 1990. *Distribution and Taxonomy of the Birds of the World*. Yale Univ. Press; New Haven.
- , et al. 1988. *Auk* 105: 409–423.
- Strauch, J.G., Jr. 1978. *Trans. zool. Soc. Lond.* 34: 263–345.

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.

REFERENCES

- AOU. 1983. *Check-list of North American Birds*. Am. Orn. Union, Lawrence, Kansas.
- Campbell, B., & E. Lack. 1985. *A Dictionary of Birds*. Poyser, Calton, England.
- Christian, P.D., et al. 1992. *Aust. J. Zool.* 40: 225–33.
- Christidis, L., & W.E. Boles. 1994. *RAOU Monogr.* 2.
- Chu, P.C. 1995. *Condor* 97: 174–96.
- Fjeldså, J. 1977. *Guide to the Young of European Precocial Birds*. Skarv Nature Pubs, Strandgården, Tisvildileje.
- Hackett, S.J. 1989. *Condor* 91: 73–90.
- Judin, K.A. 1965. *Fauna USSR, Aves. Ser. 1, 2*, ns 91. Acad. Sci., Moscow & Leningrad.
- Mayr, E., & D. Amadon. 1951. *Am. Mus. Novit.* 1496.
- Mickevich, M.F., & L.R. Parenti. 1980. *Syst. Zool.* 29: 108–13.
- Moynihan, M. 1959. *Am. Mus. Novit.* 1928.
- Schnell, G.D. 1970a. *Syst. Zool.* 19: 35–57.
- 1970b. *Syst. Zool.* 19: 264–302.
- Sibley, C.G., & J.E. Ahlquist. 1990. *Phylogeny and Classification of Birds*. Yale University Press, New Haven.
- , & B.L. Monroe Jr. 1990. *Distribution and Taxonomy of Birds of the World*. Yale University Press, New Haven.
- , et al. 1988. *Auk* 105: 409–23.
- Strauch Jr, J.G. 1978. *Trans. zool. Soc. Lond.* 34: 263–345.
- Wetmore, A. 1960. *Smithson. Misc. Coll.* 139 (II): 1–37.
- Zusi, R.L. 1962. *Publ. Nuttall orn. Club* 3.

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. albostrigata* 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*, *albobristata*, *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. albivitta*); 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).

REFERENCES

- Ashmole, N.P. 1962. *Ibis* 103b: 235–73.
 — 1963. *Postilla* 76.
 — 1968. *Condor* 70: 35–55.

- Campbell, B., & E. Lack. 1984. *A Dictionary of Birds*. Poyser, Calton, England.
 Christian, P.D., *et al.* 1992. *Aust. J. Zool.* 40: 291–302.
 Christidis, L., & W.E. Boles. 1994. *RAOU Monogr.* 2.

576 Sterninae

- Chu, P.C. 1995. *Condor* 97: 174–96.
- Fjeldså, J. 1977. *Guide to the Young of European Precocial Birds*. Skarv Nature Publs, Strandgården, Tisvildileje.
- Gibson, J.D. 1956. *Emu* 56: 131–2.
- Hackett, S.J. 1989. *Condor* 91: 73–90.
- Hulsman, K. 1977. *Emu* 77: 49–60.
- King, B.R., & R.C. Buckley. 1985. *Corella* 10: 73–7.
- , et al. 1992. *Emu* 93: 1–10.
- Lalas, C., & B.D. Heather. 1980. *Notornis* 27: 45–68.
- Lawrence, G.N. 1853. *Ann. Lyceum Nat. Hist. New York* 6: 1–4.
- Mees, G.F. 1977. *Zool. Verh.* 157: 1–64.
- Mickevich, M.F., & L.R. Parenti. 1980. *Syst. Zool.* 29: 108–13.
- Moynihan, M. 1959. *Am. Mus. Novit.* 1927.
- Ridgway, R. 1874. *Am. Nat.* 8: 433.
- Sibley, C.G., & J.E. Ahlquist. 1990. *Phylogeny and Classification of Birds*. Yale University Press, New Haven.
- , & B.L. Monroe Jr. 1990. *Distribution and Taxonomy of Birds of the World*. Yale University Press, New Haven.
- Strauch, J.G. Jr. 1978. *Trans. zool. Soc. Lond.* 34: 263–345.
- Wolters, H.E. 1975. *Die Vogelarten der Erde. 1*. Hamburg.
- Woodward, P.W. 1972. *Atoll Res. Bull.* 164: 1–318.

Sternula nereis Gould, 1843, *Proc. zool. Soc. Lond.* 1842: 140 — Bass Strait.

In Greek mythology, Nereis was a sea-nymph, one of the fifty daughters of Nereus, the sea god.

OTHER ENGLISH NAMES Little Tern, White-faced Ternlet, Little Sea-swallow, Sea-swallow, Ternlet, Nereis Tern.

POLYTYPIC Nominate *nereis* s. and w. mainland Aust. and Tas.; subspecies *davisae* (Mathews & Iredale, 1913) NZ; subspecies *exsul* (Mathews, 1912) New Caledonia and, possibly, Loyalty Is.

FIELD IDENTIFICATION Length 22–27 cm; wingspan 44–53 cm; weight 70 g. Very small compact pale-grey and white tern. Much smaller than all other *Sterna*, other than Little Tern *S. albifrons*. Compared with medium-sized *Sterna*, has shorter tail; more hurried fluttering flight; bigger head; proportionately larger bill; and shorter, narrower wings. Very similar in size and shape to Little Tern. Adult in breeding plumage easily identified by wholly bright yellow-orange bill and diagnostic head-pattern. Adult in non-breeding plumage much as adult breeding, but forecrown streaked black and white, tail shorter and less deeply forked, and bill-pattern diagnostic. Sexes alike. Slight seasonal variation. Juvenile distinct. First immature non-breeding separable.

Description Adult breeding Crown, nape, ear-coverts and large rounded or square patch in front of eye, black, forming cap sharply demarcated from white forehead and anterior lores, which ends in rounded notch in front of and above eye. Rest of head and neck, white. Saddle and tertials, pale grey. Rump and tail, white, contrasting only slightly with rest of upperparts; tail, deeply forked, with tips of long outer rectrices falling just short of wing-tips at rest. In flight, upperwing, uniform pale grey, as saddle, with indistinct narrow white trailing-edge, broadest on secondaries and tapering outwards along primaries; with wear, outer few primaries and primary coverts appear as narrow dusky-grey wedge along leading-edge (not reaching carpal). At rest, folded wing, pale grey, with neat narrow tapering white line along upper edge of primaries, petering out just short of wing-tip, and thin dark line along bottom of primaries. Underparts, white; remiges translucent. Bill: at first, bright yellow-orange, with slightly paler tip (though often retain small black tip from non-breeding); later, typically acquire narrow dull-black band at base of upper mandible

then dull-black subterminal band. Iris, black. Legs and feet, bright orange. **Adult non-breeding** As adult breeding, differing by: Crown, white, heavily blotched, not streaked, black; or black with narrower zone of black-and-white blotching bordering forehead. Rump and uppertail-coverts, pale grey, contrasting little or not at all with saddle. Bill, slightly duller, orange-yellow, with diffuse grey-black subterminal band and narrow grey-black band at base; later, brighter orange-yellow, with well-defined black tip and narrower and paler dusky band at base of upper mandible. Tail, shorter, less deeply forked, tips of outermost rectrices falling well short of wing-tip at rest. Upperwing: at first, as worn adult breeding; later, uniform pale grey with, at darkest, faint-grey wedge on outerwing; some acquire faint narrow cubital bar. **Juvenile** Similar to adult non-breeding, differing by: dark band from in front of eye, through ear-coverts to nape, narrower and duller, brown-black, when fresh; anterior lores and forehead washed brown when fresh; crown, white, with fine black streaking merging to dull-black nape. Upperparts vary; typically, saddle and tertials, pale grey, with narrow white scaling and bold brown-black U-shaped marks; rump and tail, white, with indistinct thin broken brown subterminal tail-band. In flight, upperwing more boldly patterned than in adult: dark-grey cubital bar and dusky-grey outer primaries, primary coverts and alula combine to form dark leading-edge contrasting with much paler, pale-grey central secondary coverts and grey-white inner primaries and secondaries; some show indistinct narrow grey secondary bar. At rest, folded wing, pale grey, with narrow white scaling and, typically, dark U-shaped marks on coverts (reduced or lacking on palest birds) and narrow dusky-grey cubital bar, extending narrowly round carpal joint (often hidden by overhanging scapulars); folded primaries slightly darker, silvery grey, with

narrow white tips and tapering white line along upper edge, petering out just short of wing-tip. From below, all remiges except dusky outer primaries, translucent. In fresh plumage, cap, saddle, secondary coverts, tail and sides of breast washed buff. Bill, dark brown, with diffuse dull-black tip and base; may appear black at distance. Iris, black. Legs and feet, dark brown. **First immature non-breeding** Post-juvenile moult protracted, gradually attaining first immature non-breeding plumage. Differ from adult non-breeding by: (1) Head-pattern: narrower black band from in front of eye to nape; and more white on crown, with finer dark streaking over rear-crown (cf. messier blotching in adult), reduced in some to scattered dark spots or streaks; overall head-pattern similar to that of worn juvenile. (2) Bill, legs and feet duller: bill, brownish orange to dull orange, with diffuse blackish subterminal band and basal markings; legs and feet, brownish orange to orange. Before moult complete, also differ by: at first, retain very worn and faded juvenile tertials, tail and wing, including contrasting dusky cubital bar (though most replace central secondary coverts). Later, upperwing more contrasting than either juvenile or moulting adult: show prominent dusky cubital bar and long dusky-grey wedge on outerwing, longer than in adult (reaching to carpal joint). NZ populations (subspecies *davisae*) differ slightly from above in colour of upperparts; subspecies *exsul* (vagrant to Aust.) also differs; see Plumages for full details.

Similar species Often confused with **Little Tern** (q.v.); also see **Black-naped Tern** *Sterna sumatrana*.

Coastal tern. Normally forage close inshore over sheltered waters but in some areas, range well offshore over shelf-waters. Gregarious; usually seen in small groups, sometimes in larger flocks of up to 100 when feeding, though often forage alone. Often roost and feed with other terns, especially Little Terns. Active, noisy and excitable. Horizontal carriage and trotting gait as other small terns. Flight and feeding behaviour similar to those of Little Tern: normal flight, fast, hurried and wader-like, with quick fluttering wing-beats. Wings held strongly angled, and, in breeding plumage, long tail often held closed, forming long spike. Very vocal; usual flight call during breeding season a hard loud low-pitched *tchi-wick* or *ker-wick*, also excited chittering *kirrikiki-kirrikiki* and rapid high-pitched *ket-ket-ket-ket*; calls generally lower-pitched, more nasal than those of Little Tern.

HABITAT Mostly sheltered coasts, on mainland and inshore and offshore islands. In embayments, such as harbours, inlets, bays, estuaries and lagoons; and on ocean beaches. Rarely out of sight of land (Aust. Atlas). Also fresh or saline near-coastal terrestrial wetlands, including lakes and salt-ponds (Storr 1964a,b; Ford 1967; Cox 1974; Crawford 1975; Storr 1976; Jaensch & Vestest 1987; Storr & Johnstone 1988; Peter 1994; Vic. Bird Rep. 1983). Mostly associated with sandy beaches with spits and banks; also on shelly and, sometimes, coralline shores (Warham 1956; Storr 1964b; Fuller & Burbidge 1981; Barter *et al.* 1988), but rarely muddy spits (Eckert 1970). Occasionally on rocky islands (Paton & Paton 1977b; Hornsby 1978; Lane 1984a; Gill 1985a) and, rarely, on rock platforms (McCulloch 1987). Recorded ascending large rivers (Eckert 1970) but rare inland (Aust. Atlas).

Nest above high-water mark on sheltered beaches, spits, bars, banks and ridges, usually of sand but also of shell-grit or coral; either on mainland or on inshore islands, and often within estuaries and embankments; sometimes on islands of dredge-spoil (Warham 1956; Napier 1972; Storr 1976; Garstone 1978; Fuller & Burbidge 1981; Minton 1985; Johnstone &

Smith 1987; Barter *et al.* 1988; Storr & Johnstone 1988; G.R. Parrish & G.A. Pulham). Occasionally in coastal salt-fields (Cox 1974; Cooper 1978; Vic. Atlas) and, especially on Rottnest I., WA, at edges of coastal salt-lakes (Kilpatrick 1932; Storr 1964a,b, 1976). Occasionally breed on nearshore rocky or coral islands and stacks, among rocks and coral rubble; also on rocky peninsula cut-off from mainland at high-tide (White 1916; Whitlock 1919; Cooper 1971; Paton & Paton 1977b; Hornsby 1978; Fuller & Burbidge 1981; Lane 1984a; Aust. NRS). Once, on raised rock platform with scattered areas of sand and shell-grit, c. 20 m asl (McCulloch 1987). May nest in bare exposed areas; near low shrubs, bushes and grass tussocks; or among low sparse vegetation including *Sarcocornia*, *Carpobrotus* and *Arctotheca* (Gillham 1963; Eckert 1970; Fletcher & Newman 1980; Newman 1981; Lane 1984a; Johnstone & Smith 1987). Occasionally among, or on, beachcast seaweed (Storr 1966; Lashmar 1987) or other debris (Kitchener *et al.* 1975). Rarely, nest in sand-dunes (Macdonald 1953) or on sandy margins of airstrips (Storr 1964b).

Forage in shallow water (>10 cm deep) of sheltered coasts, embayments and estuaries. Usually close inshore, often near shoreline, over submerged banks or in adjacent shallow channels (Storr 1964a,b; Ford 1967; Peter 1990; J.M. Peter). May forage in lee of islands, or in straits between islands (Dickinson 1937; Storr 1964b; Paton 1973; Garstone 1978); occasionally over waters on exposed ocean side of islands (Serventy & Whittell 1976) or at sea, just beyond breaking waves (G.R. Parrish & G.A. Pulham). Also in coastal lagoons and near-coastal lakes (Hitchcock 1937; Ford 1967; Newman 1981; Peter 1994).

Generally roost or loaf on sheltered sandy beaches and other exposed sandy features, including spits, banks and bars; also sandy islets, including islands of dredge-spoil (Warham 1957; Eckert 1970; Storr *et al.* 1986; Barter *et al.* 1988; Peter 1990). Occasionally on shell-banks round near-coastal salt-lakes (Storr 1964b) and on rock-platform (McCulloch 1987).

If vegetation too overgrown, breeding sites become unsuitable (Gill 1985a; Barter *et al.* 1988); spits can be made suitable for breeding by removal of vegetation (Anon. 1982; Minton 1985, 1988).

DISTRIBUTION AND POPULATION Aust., NZ, and New Caledonia.

Aust. Mainly s. and w. mainland coasts and coasts of Tas.; vagrant to e. coast. **Qld** No records in Aust. Atlas. Two specimens (of New Caledonian subspecies *exsul*), Heron I., 20 Jan. 1950, 21 Jan. 1950 (AMS 38760, AMS 38761; D.I. Rogers) (see McKean 1978; Aust. Atlas; *contra* Storr 1984b). Recent unconfirmed records include: sight-records, Heron I. (e.g. Bingham 1977); four, Masthead I., 12 Dec. 1985 (Qld Bird Rep. 1985); single, Cairns, 20 Nov. 1988 (Qld Bird Rep. 1988); single, July 1994, N of Townsville (A. Taplin). Claim of breeding N of Townsville (A. Taplin) needs confirmation. **NSW** No records in Aust. Atlas. One confirmed record: single, Botany Bay, 12 Dec. 1962 (Hoskin & Hindwood 1964). Several unconfirmed or unacceptable records, including single bird at Tilba Tilba L. (said to be mated to Little Tern and incubating an egg), exhibiting 'several features characteristic of this species' (NSW Bird Reps 1981, 1983); single, Boatharbour, 9 Aug.–14 Sept. 1991 (NSW Bird Rep. 1991; not accepted by NSWORAC [Morris 1992, 1993]). **Vic.** A few records in East Gippsland, round Mallacoota, Pt Hicks and Gippsland Ls. Widespread Corner and Shallow Inlets; most common between Westernport and Port Phillip Bays, W to

Aireys Inlet. Occasionally recorded farther W (Vic. Bird Reps; Vic. Atlas). **Tas.** Widespread islands of Bass Str. On mainland, mostly on n. and e. coasts, with scattered records on w. coast, between Bond Bay and mouth of Pedder R. (Thomas 1979; Rounsevell 1983; White 1985; Tas. Bird Reps; Aust. Atlas). **SA** Widespread along much of coast, from E of Port MacDonnell to Fowlers Bay, with most records between Fleurieu and Eyre Pens, including Kangaroo I. (Hitchcock 1959; Baxter 1989; SA Bird Reps; Aust. Atlas). **WA** Occasional records Nullarbor coast; widespread along most of coast from Israelite Bay N to Dampier Arch. Aust. Atlas shows scattered records farther N to Eighty Mile Beach; historical records in Kimberley Div. round Broome, Lacepede Is, King Sound and Admiralty Gulf (Hitchcock 1959; Serventy & Whittell 1976; Aust. Atlas; HASB). Recorded inland at Northam, Mar. 1943, after cyclone (Masters & Milhinch 1974).

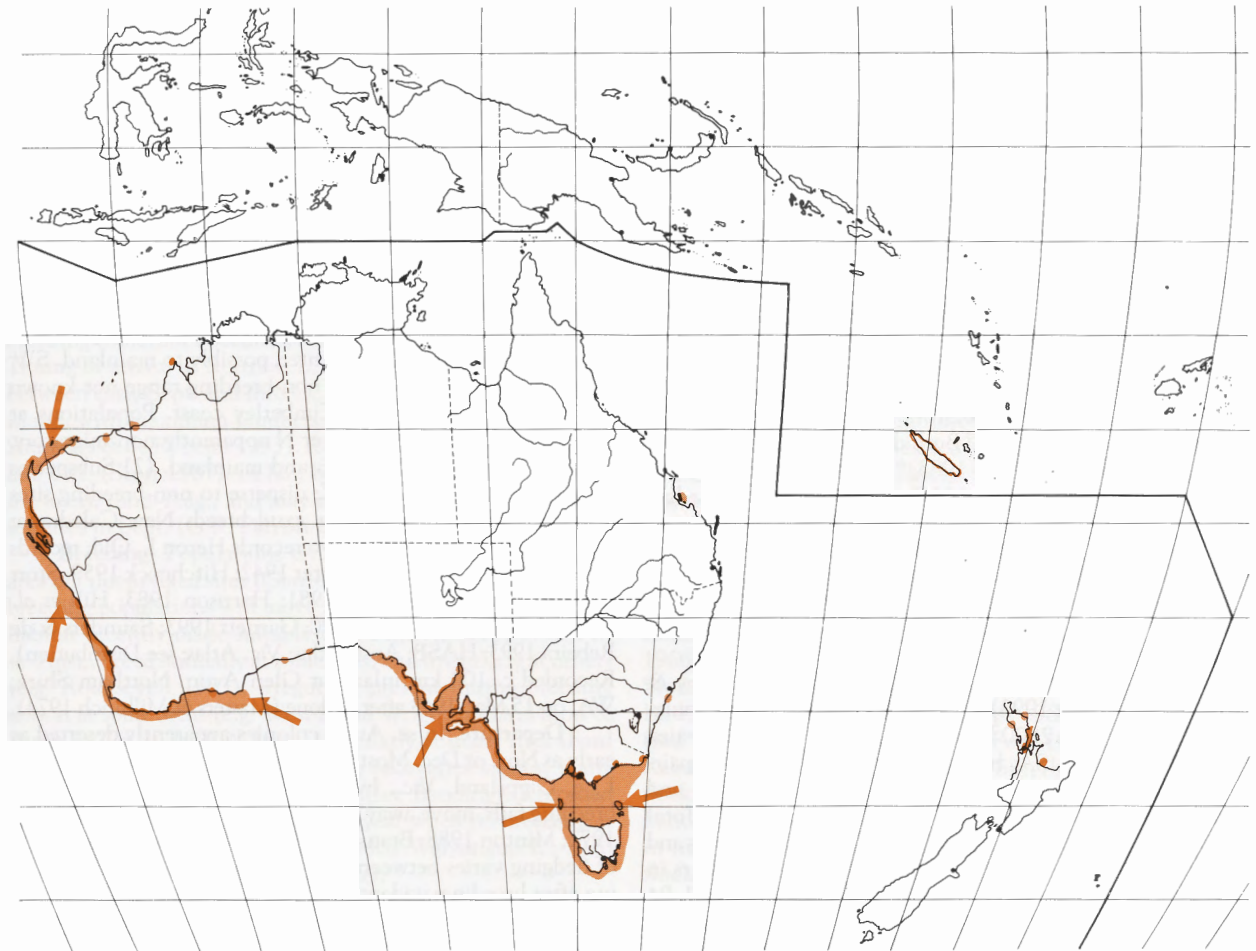
Norfolk I. Remains of either this species or Little Tern found 15 Nov. 1975 (McKean *et al.* 1976).

NZ Restricted to NI, mainly in N; formerly recorded SI. **NI** Between Whangarei Harbour and C. Rodney on e. coast, and in Kaipara Harbour. Farther N recorded Miranda (Firth of Thames), Port Waikato and round Tauranga (Oliver; CSN; NZ Atlas). Records Whangaroa and Whangape Harbour doubtful (G.R. Parrish). Oliver also mentions records from Manukau and Raglan Harbours.

Breeding Aust. In Vic., scattered records in East Gippsland, with most colonies in Shallow and Corner Inlets

and Westernport and Port Phillip Bays; in Tas. (summarized in Rounsevell 1983), mainly on e. coast, but also elsewhere; widespread in SA and WA, from Arch. of the Recherche, N to Dampier Arch., with isolated record from Lacepede Is.

Known breeding sites (+ = where last recorded breeding <1970 or date unknown): **Vic.** Mallacoota¹; Lakes Entrance²; Corner Inlet (McLaughlin's Beach³; Dream I.⁴; island NE of Clonmel I.³; island SW of Mann's Beach¹⁺; off Port Albert²; Clonmel I.⁵; Sunday I.³; Snake I.⁶⁺); Westernport Bay (Ram I.^{3,7,8}; Tortoise Head, French I.⁵); Port Phillip Bay (Mud Is.^{2,9}; Altona Bay⁶⁺; Laverton Saltworks¹⁰⁺; mouth of Little R.⁶⁺; Werribee Sewage Farm¹¹; Avalon Saltworks¹²⁺; Limeburner's Bay¹³⁺; Stingaree Bay¹³⁺; Sand I.¹⁴; Edwards Pt, formerly¹⁴). **Tas.** Furneaux Grp (North-east R.¹⁵; Patriarch's Inlet¹⁶; Cameron's Inlet¹⁶; Logan's Lagoon¹⁶; Chalky I.¹⁶; Little Chalky I.¹⁶; Oyster Rocks¹⁷; Beagle Reef¹⁶); Bridport¹⁸; Waterhouse I.¹⁶; Little Musselroe Bay¹⁶; C. Naturaliste¹⁶; Anson's Bay¹⁶; Humbug Pt¹⁶; St Helens Pt¹⁶; Scamander¹⁶; Swan R.¹⁶; Coles Bay¹⁹; Lisdillon Beach¹⁶; Little Swanport²⁰; Prosser R.¹⁶⁺; Sandspit R.¹⁶; Marion Bay¹⁶; Mortimer Bay¹⁶; Seven Mile Beach (formerly)¹⁶⁺; Barilla Bay¹⁶; The Neck¹⁶⁺; Port Davey²¹; Bond Bay²²⁺; Kelly Basin¹⁶; C. Sorell¹⁶; Tiddy's Beach¹⁶⁺; Pilot Bay¹⁶; Granville Harbour²³; Pedder R.¹⁶⁺; Hunter I.¹⁶; Three Hummock I.¹⁶; Walker I.¹⁶⁺; Robbins I.¹⁶⁺; Perkins I.¹⁶; Black R.²¹; King I. (Yellow Rock¹⁶⁺; Lavinia¹⁶⁺; Sea Elephant¹⁶). **SA** Courie I.²⁴; islet c. 2 km NW of Nora Creina Bay²⁴; islet c. 10 km SE of Robe²⁴; Doorway Rock, Robe²⁵; headland c. 1.5 km



NW of Robe²⁴; Baudin Rocks²⁶; Wild Dog Is, The Coorong⁶⁺; Trevarrow I., The Coorong⁶⁺; mouth of Murray R.¹⁹; Wright I., Victor Harbour⁶⁺; West I.²⁷; Kangaroo I. (including Kingscote, C. du Couedic, West Bay)^{6,19+}; Buckland Park⁶⁺; Price Saltfields²⁸; Coobowie Inlet¹⁹; Troubridge I.²⁹; Middle I.¹⁹; North Neptune I.⁶⁺; Whyalla Saltfields^{30,31}; Sir Joseph Banks Is (Hareby I.; Kirkby I.; Langton I.; Stickney I.)^{6,19+}; Taylor I.⁶⁺; Sleaford Bay¹⁹; Lipson Cove⁶⁺; Venus Bay⁶⁺; Black Rocks¹⁹; Port Whidbey¹⁹; Port Douglas (Rabbit I.; Brothers Is; other islets)^{32,33+}; Coffin Bay³⁴⁺; Pearson I., Investigator Grp³⁵; Streaky Bay¹⁹. **WA** Six Mile I., Arch. of the Recherche³⁶; Esperance Bay (possibly)³⁷; L. Kubitch³⁸; Stokes Inlet^{39,40}; Glasse I., Bremer Bay⁴⁰; Mt Groper¹⁹; near Denmark⁴⁰; Sandy I., off Pt D'Entrecasteaux^{40,41}; S. Ruffy Rock, Augusta¹⁹; Seal I., C. Leeuwin⁶⁺; Boundary I., Peel Inlet⁴²; Mandurah⁴³; L. Walyungup⁴⁴⁺; Safety Bay⁴⁵; Penguin I. (probably)⁴⁴⁺; Garden I.⁶⁺; Fremantle (Rouse Head, North Mole)⁴⁷⁺; Pelican Pt, Swan R.⁴⁸; Causeway, Swan R.⁴⁹⁺; Rottnest I. (L. Bagdad⁵⁰; Pearce Is⁵⁰; C. Vlamingh⁵¹; Herschell L.⁵¹; Government House L.⁵¹; West End⁵¹; Ricey Beach⁵¹); point opposite Edward I.⁵²⁺; point opposite Wedge I.⁵²⁺; Cervantes Is¹⁹; Whitlock I.⁵³⁺; Boullanger I.⁵³; Houtman Abrolhos (East Wallabi I.⁶⁺; West Wallabi I.⁵⁴; Morley I.⁵⁵⁺; Wooded I.⁵⁶⁺; Pelsaert I.^{57,58}); Denham⁶⁺; Dirk Hartog I.⁶⁺; Dorre I.⁶⁺; Koks I.⁶⁺; Carnarvon Blowholes⁵⁹; Pt Quobba⁶³⁺; L. MacLeod⁴³; Low Pt⁶⁰⁺; Mushroom I., off Barrow I.⁶¹; C. Preston⁶⁰⁺; Bird I., Dampier Arch.⁶⁺; Tern I.⁶²; Serrurier I.⁶²; Lacedpede I.⁶⁺ (REFERENCES: ¹ Vic. Atlas; ² Vic. Bird Rep. 1987; ³ Lane 1981; ⁴ Minton 1992; ⁵ Minton 1993; ⁶ HASB; ⁷ Vic. Bird Rep. 1982; ⁸ Loyn 1978; ⁹ Menkhorst *et al.* 1988; ¹⁰ Watson 1955; ¹¹ Vic. Bird Rep. 1984; ¹² J. Starks & J. Frisch; ¹³ Lane *et al.* 1984; ¹⁴ Barter *et al.* 1988; ¹⁵ Tas. Bird Rep. 19; ¹⁶ Rounsevell 1983; ¹⁷ Tas. Bird Rep. 13; ¹⁸ Tas. Bird Rep. 18; ¹⁹ Aust. Atlas; ²⁰ Tas. Bird Rep. 15; ²¹ Tas. Bird Rep. 16; ²² White 1985; ²³ Tas. Bird Rep. 21; ²⁴ Bransbury 1992; ²⁵ McCulloch 1987; ²⁶ Bonnin 1982; ²⁷ Paton & Paton 1977a; ²⁸ Cox & Close 1977; ²⁹ Lashmar 1987; ³⁰ Cox 1974; ³¹ SA Bird Rep. 1972–73; ³² Gill 1985a; ³³ Gill 1985b; ³⁴ SA Bird Rep. 1965; ³⁵ Hornsby 1978; ³⁶ Johnstone & Smith 1987; ³⁷ Kitchener *et al.* 1975; ³⁸ Jaensch *et al.* 1988; ³⁹ Daw 1984; ⁴⁰ Lane 1984a; ⁴¹ Lane 1984b; ⁴² Jaensch 1989; ⁴³ Jaensch & Vervest 1987; ⁴⁴ Ford 1967; ⁴⁵ Dunlop *et al.* 1988; ⁴⁶ Abbott 1980; ⁴⁷ *West. Aust. Bird Notes*; ⁴⁸ Bailey & Hale 1985; ⁴⁹ Stranger 1992; ⁵⁰ Bremner 1991; ⁵¹ Saunders & de Rebeira 1993; ⁵² Ford 1965; ⁵³ Ford 1978; ⁵⁴ Johnstone & Storr 1994; ⁵⁵ Johnstone 1992; ⁵⁶ Johnstone & Coate 1992; ⁵⁷ Burbidge & Fuller 1989; ⁵⁸ Fuller & Burbidge 1992; ⁵⁹ Howard 1983; ⁶⁰ Storr 1984a; ⁶¹ Sedgwick 1978; ⁶² J.N. Dunlop; ⁶³ Storr 1985). **NZ** Since 1984, breeding apparently confined to three sites in Northland: Papakanui Spit, Kaipara Harbour (2 pairs, 1993–94); Mangawhai (5 pairs, 1993–94); Waipu (2 pairs, 1993–94) (G.R. Parrish & G.A. Pulham). Previously recorded Tauranga (CSN 23), Pakiri, Te Arai and Ruakaka (CSN; G.R. Parrish & G.A. Pulham). Said to have once bred Canterbury (NZCL).

Status Rare in Aust., endangered in NZ (Molloy & Davis 1992; Garnett 1993). **Populations Aust.** Total population estimated at c. 2000 breeding pairs: in Vic., <250 pairs; Tas., 100–150 pairs; SA, hundreds of pairs; WA, >1400 pairs (Hill *et al.* 1988). However, c. 15,000 reported Sholl and Stewart Is, WA (Serventy & Whittell 1976). **NZ** Total population, 1994, 28 birds, comprising nine breeding pairs and ten juveniles and immatures; 18 pairs in 1950s, eight pairs in 1970s, 3–4 pairs in early 1980s, and nine pairs in 1993–94 (G.R. Parrish & G.A. Pulham). **Change in range** In Aust., no apparent reduction in range or in numbers (Brouwer & Garnett

1990). However, in Vic., well-established colonies in Port Phillip and Westernport Bays have been deserted (C.D.T. Minton); numbers nesting on Mud Is declined from up to 100 nests in late 1960s to early 1970s, to ≤10 nests by late 1980s (Menkhorst *et al.* 1988). Numbers round Hobart thought to have declined (Fletcher & Newman 1980). Numbers round Rottnest I. similar to those recorded in 1930s (Saunders & de Rebeira 1993). May have expanded range into SA in mid-twentieth century (Eckert 1970). In NZ, formerly common Marlborough and Canterbury; Oliver listed several locations S of 40°S where Fairy Terns recorded: Rangitikei R., Waikanae R., Papaitonga L., Porangahau (all NI); Wairau Bar, L. Ellesmere and along rivers in Canterbury (in SI).

Main threat to populations is persistent disturbance by human recreational activities at breeding sites, which can cause birds to leave nests, allowing gulls and other predators to eat eggs, or result in chilling or overheating of eggs; may cause birds to desert colony. Nests sometimes destroyed intentionally or accidentally by people on trail-bikes and horses (Fletcher & Newman 1980; Newman 1981; Rounsevell 1983; Hill *et al.* 1988; Saunders & de Rebeira 1993; J.N. Dunlop). On Rottnest I., in 1958, Terns nested on airstrip and most eggs and many adults killed by planes; even when colony beside, not on, runway, it was still seriously disrupted by aircraft and buses (Storr 1964b; Saunders & de Rebeira 1993). On mainland, foxes sometimes eat eggs and young (J. Reside).

MOVEMENTS Poorly known, partly migratory and partly non-migratory; relationship between breeding and non-breeding ranges not known. Where non-migratory, possibly make shorter movements between breeding and non-breeding areas (Hill *et al.* 1988). Claims that Terns nomadic (Green 1989) or sedentary (Hitchcock 1959; HASB) not supported. Three subspecies, all recorded HANZAB region: (1) Nominate *nereis* breeds s. and w. mainland Aust. and Tas. In SA, appear not to move regularly and numerous at all times in some areas; no evidence for suggestion that SA populations move to non-breeding areas of Gulfs and lakes at mouth of Murray R. Movements of Vic. populations not known, probably local; occur seasonally at breeding areas, but reporting rates do not indicate regular long-distance movement. Tas. populations migratory, moving away in winter, possibly to mainland. SW. Aust. populations migratory; non-breeding range not known but thought to include w. Kimberley coast. Populations at Houtman Abrolhos and farther N apparently non-migratory, though move between islands and mainland. (2) Subspecies *davisae* breeds Northland, NZ; disperse to non-breeding sites in Northland. (3) Subspecies *exsul* breeds New Caledonia; movements not known but two records Heron I., Qld; records in ne. Qld not confirmed (Souter 1942; Hitchcock 1959; Storr 1960; McKean 1978; Lane 1981; Harrison 1983; Hill *et al.* 1988; Brouwer & Garnett 1990; Garnett 1993; Saunders & de Rebeira 1993; HASB; Aust. Atlas; Vic. Atlas; see Distribution). Recorded c. 100 km inland at Glen Avon, Northam Shire, WA, on 15 Mar. 1943 after cyclone (Masters & Milhinch 1974).

Departure In se. Aust., colonies apparently deserted as early as Nov. or Dec. Most birds left successful colony at Rigby I., e. Gippsland, Vic., by mid-Dec. 1989 (Owen 1990). If breeding fails, move away from site, rather than re-lay (Napier 1972; Minton 1988; Bransbury 1992) (cf. Little Tern). Timing of fledging varies between years (Minton 1986). Some flocking after breeding evident in Vic. in late Jan. and Feb. (Lane 1981). In some areas, seasonal pattern of occurrence varies between years (e.g. Watson 1955). In WA, recorded leaving

colony as early as mid-Dec. (Ford 1967; Abbott *et al.* 1978); in Eucla Div., recorded till Mar. (except for unconfirmed June records) (Storr 1987). Leave Walyungup L. after nesting cycle finished, then stay for a few months at nearby Safety Bay before moving N; colonies deserted earlier when water levels dropped and breeding islet connected to shore (Ford 1967). Elsewhere on Swan Coastal Plain, occur till mid-May, exceptionally till June (Storr 1960; Storr & Johnstone 1988). Begin to leave Rottnest I., Feb. or Mar., though some remain as late as early June (Saunders & de Rebeira 1993). Nestlings move from Walyungup L. to estuaries and coast within months of banding (Ford 1967). In NZ, birds breeding e. coast (Mangawhai, Waipu), form post-breeding flocks on e. coast, late Dec. to end Mar., then move to Kaipara Harbour, late Feb. to July; movements of birds breeding Papakanui Spit not known but appear to remain near breeding site (G.R. Parrish & G.A. Pulham).

Non-breeding In se. Aust., leave from some areas: e.g. in Hobart, abundant Sept.–Jan., absent Feb.–Aug. (Hitchcock 1959) with a few records in Tas. mid-winter (e.g. Tas. Bird Rep. 1975); elsewhere in SE, do not migrate but possibly less numerous in some areas, e.g. Port Phillip Bay, Vic., Mar.–Aug. (Hitchcock 1959). Most records of large groups or concentrations in Vic. in Sept.–Mar. (Lane 1981). In WA, absent from SW during non-breeding period (Storr 1960); at least some move N (see Banding) and probably account for flocks recorded off nw. Aust. (e.g. Abbott 1979); large flocks recorded between Pt Cloates and Cossack and smaller numbers farther N (Serventy & Whittell 1976). Elsewhere in WA, do not migrate and numbers roughly stable throughout year (e.g. Houtman Abrolhos, Storr 1960). In NZ, main wintering area is Tapora, Kaipara Harbour (G.R. Parrish & G.A. Pulham).

Return In Vic., not seen near colonies till at least Sept. (Lane 1981); first seen Rigby I., East Gippsland, Sept.–Nov. in years when Terns bred there (Reside *et al.* 1989; Owen 1990). Timing of arrival varies between years at some locations, e.g. Werribee (Minton 1985). Recorded Tas. as early as Aug., and in Sept. (Tas. Bird Reps 1974, 1983, 1991, 1992). In sw. WA, recorded Swan Coastal Plain from Sept. (Storr & Johnstone 1988); birds in breeding plumage at Walyungup L., where breeding sometimes occurs, as early as late Sept. (Ford 1967). Timing of arrival at Rottnest I., WA, varies from year to year, between early Sept. and into Oct.; after return, disperse round island, with maximum numbers in Dec. or Jan. (Storr 1964b; Saunders & de Rebeira 1993). Recorded Eucla Div., WA, from late Oct. (Storr 1987). In NZ, birds disperse from non-breeding areas, June–Aug., and may make irregular visits to breeding sites in Sept. (G.R. Parrish & G.A. Pulham).

Breeding Populations tend to breed within same local area but not at fixed sites (Garnett 1993). Suggested that some breeding populations will move to other breeding areas where habitat recently made suitable (e.g. Minton 1990, 1992). In se. Aust., breed annually at some sites, and irregularly at others (e.g. Rounsevell 1983); irregularly present during breeding season at some areas (e.g. West I. and Wright I., SA, Paton & Paton 1977a,b). In WA, breed irregularly at many sites (Ford 1967; Abbott *et al.* 1978). Banding recoveries suggest many occur near natal colonies as adults (see Banding). Recorded breeding away from natal colony in year when no breeding at natal colony site, e.g. nestling banded Walyungup L., WA, bred Rottnest I. 1961–62 (Ford 1967).

Banding, Colour-marking Birds banded as nestlings or runners recovered years later near banding site, e.g. in Vic., recovered >12 years later 13 km from banding site, and >15

years later 29 km from banding site (ABBBS 1980, 1982a). Some Vic. birds banded as nestlings in summer, recovered at or near banding site in winter (ABBBS 1985a,b). Birds banded as runners and nestlings also recovered far from natal area, e.g. nestling banded Beachport, SA, recovered c. 12 years later, c. 410 km E at Werribee, Vic. (ABBBS 1969); runner banded Sir Joseph Banks Grp, SA, recovered >2 years later 136 km ESE on Yorke Pen., SA (ABBBS 1982b); nestling banded L. Walyungup, WA, recovered 260 km NNW, >17 years later (ABBBS 1977). At least some movement between areas, e.g. one banded Queenscliff, Vic., recovered French I. and Corner Inlet (Vic. Bird Rep. 1983). Maximum recorded displacement between natal and breeding sites: SA, c. 77 km (ABBBS 1971).

Other records

38S144E	02	P	U	71	282	88	ABBBS
38S144E	03	1+	U	105	270	84	ABBBS

FOOD Almost entirely fish; plant material, crustaceans and gastropods also recorded, possibly from stomachs of fish (R.P. Scofield). **Behaviour** Catch fish by PLUNGING in shallow water (Hitchcock 1937; Oliver); observed diving from heights of up to 5 m (Peter 1994). Fly to and fro 3–10 m above sea, hovering on rapidly beating wings with bill pointing down; dive at angles of 60° to almost 90°, with wings held in steep V before plunging into water, rising again after a few seconds (D.W. Eades; G.R. Parrish). May accompany shoals of predatory fish that are feeding (Halse & Halse 1988). Swallow fish head first (HASB).

Adult Plant material; Animals: Molluscs: gastropods⁴; Crustaceans⁴; Fish^{1,2,5–10}: Anguillidae: elvers *Anguilla*¹¹; Carangidae: skipjack⁶; Clupeidae: sardines²; Hemiramphidae: garfish²; Mugilidae: mullet³; Pleuronectidae: flounder *Rhombosolea*¹¹ Retropinnidae: smelt⁶. (REFERENCES: ¹ Cleland 1924; ² Sutton 1927; ³ Hitchcock 1937; ⁴ Hitchcock 1959; ⁵ Storr 1964b; ⁶ Ford 1967; ⁷ McCulloch 1987; ⁸ Bremner 1991; ⁹ Oliver; ¹⁰ HASB; ¹¹ G.R. Parrish & G.A. Pulham). Sand (Sutton 1927).

Young First fed only 0.75 h after hatching (Moon 1979). Fish: Engraulididae: anchovy *Engraulis* (Moon 1979); Gobiidae: *Favonigobius lentiginosus* (G.R. Parrish & G.A. Pulham). At a nest with one chick, 5–6 day old chick fed 1 fish/117 min (n=6). At a nest with two chicks, when chicks 14–15 days old, one fed four times in 132 minutes and other five times; when 22–23 days old, larger chick fed six times in 6 h and smaller chick, six times. When chicks mobile, seen to pick small animals from shells and seaweed (G.R. Parrish & G.A. Pulham).

SOCIAL ORGANIZATION Little studied but many casual observations. Gregarious. In Aust., usually in small to large flocks, generally of 10–50, but up to 150, birds; sometimes in twos or singly (e.g. Warham 1957; Ford 1965; Storr 1966; Cooper 1975; Napier 1978; Lane 1981; Rounsevell 1983; Storr & Johnstone 1988; Owen 1990, 1991; Reside 1993; Tas. Bird Reps 1973, 1983; Vic. Bird Reps 1985, 1986–87). Often feed and roost in small groups (e.g. Ford 1965; Saunders & de Rebeira 1993; Storr & Johnstone 1988), though occur in large flocks in nw. WA (Serventy & Whittell 1976; HASB); on Lancelin I., WA, c. 500 roosted together at night in autumn; in nw. WA, flocks said to contain 2000–3000 birds and, one flock said to contain 15,000 birds (these estimates larger than current estimated total Aust. population and need confirmation). In Vic., large groups or concentrations usually seen Sept.–Mar. (Lane 1981). In NZ (total population only 28

birds), usually in pairs (e.g. Oliver; CSN 21, 24), sometimes singly (e.g. CSN 23–26, 29, 30); form flocks after breeding, e.g. roosting flocks of seven adults and three immatures in June, and 13 in May (Goffin 1978; Chamberlin & Dowding 1985; Oliver). Will roost and feed with Little Terns (e.g. Goffin 1978; Owen 1990, 1991; Reside 1993) and other species of waders (e.g. Chamberlin & Dowding 1985). In NZ, single bird once associated with Little Terns all year, though was sometimes rebuffed (CSN 25). On Houtmans Abrolhos, WA, often found in mixed flocks with Roseate Terns *Sterna dougallii* (Storr *et al.* 1986).

Bonds Poorly known. In Vic., courtship seen: Sept. (Owen 1990); Oct., with prospecting for nests by late Oct. (Owen 1991); late Oct., with one pair courting and copulating 22 Nov.; also seen late Dec. (Reside 1993). In Tas., pairs noted displaying mid-Sept. (Tas. Bird Rep. 10) and carrying fish, 4 Oct. (Newman 1981). In WA, birds display soon after they arrive in Sept–Oct. and long before nesting (Storr 1964b, 1966); fish-carrying display flights recorded late Nov. and one bird seen displaying with fish, mid-Dec. (Ford 1965); on Penguin I., Shoalwater Bay, displays seen Sept.–Apr. (Dunlop *et al.* 1988). Interbreeding with Little Tern reported in Aust. (Cox & Close 1977; Vincent 1983; Hill *et al.* 1988); in NZ one seen courting Little Tern (CSN 24). Displays seen from early, and throughout much of, breeding season. **Parental care** Both sexes incubate and attend young (Bryant 1932; CSN 23, 39; G.R. Parrish & G.A. Pulham). In Fairy–Little Tern pairs, both sexes incubate (Cox & Close 1977). Parents continue to feed chicks after fledging (Saunders & de Rebeira 1985) with one seen being fed at 35 days and another begging at 50 days (G.R. Parrish & G.A. Pulham).

Breeding dispersion Solitary or colonial. **Aust.** Usually colonial (e.g. Storr *et al.* 1986; Hill *et al.* 1988; Reside *et al.* 1989; HASB; Aust. NRS), but also nest solitarily (Serventy 1943; Napier 1972, 1978; Vincent 1983; Skira & Brothers 1987; Hill *et al.* 1988; Bransbury 1992; see Distribution). Colony sizes vary: 2–400 pairs; ten colonies in Vic., average of 53 birds; of 29 colonies in Tas., 40 birds (Aust. Atlas); for breeding sites, see Distribution. Colonies tend to occur in traditional areas rather than at fixed sites (Garnett 1993). Though nesting sites at some localities seem traditional (Napier 1972; Fletcher & Newman 1980; Newman 1981; Aust. NRS), sites often abandoned after 1 year, even if breeding successful (Saunders & de Rebeira 1993). Often nest in association with other species (see Breeding), especially Little Terns in se. Aust. (e.g. Reside *et al.* 1989; Owen 1990, 1991; Reside 1993; Aust. Atlas); at one site, colonies c. 100 m apart, and species never seen to mix (Napier 1972). Nests fairly well spaced (Storr 1964b) or close together (Whitlock 1919; Napier 1972; Owen 1991); some as little as 30 cm apart (Aust. NRS); most nests <1 m apart, their distribution depending on dryness of mud (Cox & Close 1977). At one site, a few isolated nests c. 10–15 m from main colony (Aust. NRS). **NZ** Most records of one or two nests (CSN).

Roosting Recorded resting in flock on beach at night (Ford 1965); for flock sizes, see above. Incubating adults sleep during long stints (G.R. Parrish & G.A. Pulham).

SOCIAL BEHAVIOUR Little studied but many casual observations. Colonies easily disturbed, which can result in desertion of colony (e.g. Saunders & de Rebeira 1993; HASB; see Breeding). **Flock behaviour** Synchronous flights common (HASB). Breeding not synchronized (e.g. Ford 1967; Napier 1972; Reside *et al.* 1989; see Breeding). In colony, incubating

birds, and their mates if standing near them, all appear to face same direction (Bryant 1932). Also see Parental anti-predator strategies.

Agonistic behaviour When nesting, neighbouring pairs seldom squabble; one nesting bird sat on neighbour's nest but there was no conflict (Storr 1964b). Non-breeding birds may be tolerated to within 1 m of nest. Disputes usually between incubating pair or pair with chicks, and pairs that have not started nesting or have lost nest. Usually involves resident pair aerially chasing intruders from territory (G.R. Parrish & G.A. Pulham). **Alarm** When disturbed at nesting sites, birds react aggressively and vocally, even before or after nesting (Serventy & Whittell 1976; HASB). At one site, when alarmed, whole flock flew out to sea (Bryant 1929). At another site, before breeding but with courtship in progress, birds flew and called overhead when approached, some flying close to heads of intruders and others landing, keeping wings half-raised and ready to fly (Sharland 1938).

Sexual behaviour In early breeding period, pairs and small groups often seen courting and displaying, including fish-carrying pursuit flights, fish-parading and courtship feeding (Storr 1964b, 1966; Ford 1965; Newman 1981; Rounsevell 1983; Owen 1990, 1991; Reside 1993). In Aust., birds in resting flocks bicker noisily (Storr 1964b); not observed in NZ (G.R. Parrish & G.A. Pulham). Display flights seen in which two birds flew rapidly, pursuing each other, calling repeatedly, and each holding small fish crosswise in bill; once, a pair landed and presented fish and later a pair nested at this site (Ford 1967; HASB). **Courtship feeding** Male feeds female (G.R. Parrish). Fish carried crosswise in bill (HASB). During brooding, male offers fish to either female or chick and, if both reject it, male eats it (G.R. Parrish & G.A. Pulham). **Greeting** At nest-relief, incoming bird usually calls and lands 1–4 m away; relieved bird may then leave immediately, but often picks up and moves shells, while walking up to 5 m from nest (G.R. Parrish & G.A. Pulham). Incoming bird may feed other before taking over incubation (Bryant 1932; HASB). In mixed Fairy–Little Tern pairs, incoming bird hovered briefly over nest, alighting directly on eggs after incubating partner rose, or incoming bird landed near nest and walked up to it, whereupon incubating bird flew or walked away; birds sometimes rubbed bills at change-over and incoming bird sometimes called after landing near nest (Cox & Close 1977). **Copulation** Before copulation, male stands behind female, with wings held partly out and down and head erect, and moves head rhythmically from side to side; male often holds fish. Female crouches, with wings held out (not so far as male), breast on ground and tail raised, and swings head from side to side (but not so vigorously as male). Displaying lasts up to 5 min. Male then mounts and copulates, copulation lasting 3–5 s. Usually male stands on back of female, but one male held position by flying above female. If carrying fish, male may present it before, during or after copulation (G.R. Parrish & G.A. Pulham). On Rottneest I., several males, with fish in bills, seen returning to beach where flock was resting and soliciting members of flock by crouching behind them one at a time; these advances generally ignored or repulsed but one bird (assumed to be female) crouched and male performed pre-copulatory behaviour, with tail raised, then mounted female; before male dismounted, female seized fish and flew off, with male in pursuit (Storr 1964b). During pre-copulatory behaviour, one male called and dangled a fish over rump and nape of female; when male mounted, female took fish, and after copulation, male flew off and female swallowed fish (Bremner

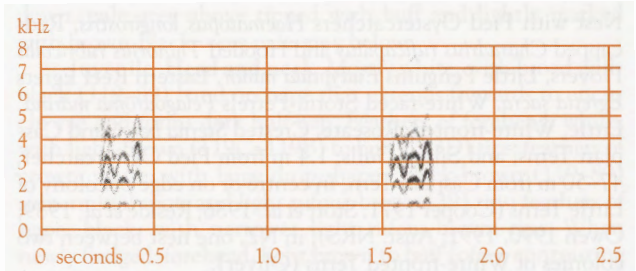
1991). In an attempted copulation, male called during pre-copulatory behaviour and, with fish in bill, walked in slow circles round female.

Relations within family groups In clutches of two, some competition for food when chicks 9–10 days old; both usually run to parent returning with food, but larger chick usually arrives first and is fed. When 22–23 days old, chicks move a lot and siblings usually not found near each other; parents appear to feed larger chick more often (G.R. Parrish & G.A. Pulham).

Anti-predator responses of young At hatching, chicks stay crouched in nest; later, move away from nest and shelter among seaweed or some other cover, or in a scrape they make themselves. When disturbed, lie still with neck and head straight out. At times, chicks try to escape by hurrying towards water; adults sometimes strike at such moving chicks, forcing them to freeze (Le Souëf 1902; Barrett 1916; Bryant 1932; Newman 1981; HASB; G.R. Parrish & G.A. Pulham). In Aust., chicks said to call incessantly when handled (Bryant 1932); in NZ, chicks freeze when handled and when put back on ground. **Parental anti-predator strategies** Once chicks start to wander, at least one parent remains nearby and chicks not left unattended for long periods until 14–15 days old (G.R. Parrish & G.A. Pulham). Attack intruders, calling noisily; will fly close but usually do not make contact. Become extremely agitated when people nearby (Dickison 1937). On Pelsaert I., take off from nests well before intruder reaches breeding area (Storr 1964b). Parents and flock circle overhead, calling, and some birds dive repeatedly (Barrett 1916; Whitlock 1919; Warham 1960; CSN 23; Aust. NRS); sometimes swoop to within c. 0.5 m of observer's head and snap bills; calls apparently attract other birds nearby; once, intruder stayed nearby and incubating birds stood in flock near nests (Bryant 1932). Sexes said to react differently: female crouches lower to ground and remains still, while male readily leaves nest to drive off intruder (G.R. Parrish & G.A. Pulham). Settle on eggs a few minutes after disturbance over (Dickison 1937); partners of incubating birds may stand as group near colony or stand near sitting mates (Bryant 1932). Also see Alarm (above). Defecate in defence; foreign objects, such as cameras placed near nest, are soon splashed with excreta (Saunders & de Rebeira 1985; HASB). Adults will lead young to safety (Bryant 1932). Drive gulls away with aerial chases (McCulloch 1987); also recorded chasing off Variable Oystercatchers *Haematopus unicolor*, New Zealand Dotterels *Charadrius obscurus*, Bar-tailed Godwits *Limosa lapponica*, Silver Gulls *Larus novaehollandiae*, Kelp Gulls *Larus dominicanus*, Caspian *Sterna caspia* and White-fronted *Sterna striata* Terns and Rock Doves *Columba livia* (Aust. NRS; G.R. Parrish & G.A. Pulham).

VOICE Not well known; no studies. Noisy when breeding (Buller 1888; Storr 1964b; HASB); birds bicker noisily in resting flocks at colonies in Aust. (Storr 1964b), though not seen to do so in NZ. Call when flying over intruders (Whitlock 1919; Bryant 1929, 1932; Sharland 1938; Serventy & Whittell 1976; Saunders & de Rebeira 1993; Campbell). Both birds call repeatedly during Fish-flights (Ford 1967); and when returning with fish (Bryant 1932). Adults call to make chicks that have been hiding move (call different from that made when swooping) (Bryant 1932). Calls similar to those of Little Tern (Cox & Close 1977) but said to be distinguishable with practice (Aust. RD). **NON-VOCAL SOUNDS:** Snap bill when swooping at intruders (Bryant 1932).

Adult CHITTERING: uttered constantly when foraging (Saunders & de Rebeira 1993); probably shown by two calls,



A H. Crouch; Beachport, SA, Nov. 1977; P39

made in flight, in sonagram A. However, said to be usually silent when hunting, only occasionally uttering *crek-crek* (Buller 1888). **Other calls** Alarm Call said to be high-pitched (HASB). Utter harsh cry when person approaches colony slowly (Bryant 1932). Male with fish in bill uttered soft melodious song or called softly before copulation, different from usual rasping *kreek kreek* (Glancy 1977; Bremner 1991).

Young Call when parents arrive with food (G.R. Parrish). Silent when hiding from potential predators (Bryant 1932). A chick, tethered as a lure in attempt to photograph parents, called incessantly (Bryant 1932).

BREEDING In Aust., not well known; no major studies; 91 records in Aust. NRS up to Oct. 1993. Detailed study in Northland, NZ (G.R. Parrish & G.A. Pulham). In Aust., breed colonially, occasionally solitarily (Napier 1978). In NZ, total population small and breed solitarily or in small groups; not seen with White-fronted Terns (G.A. Pulham *contra* NZRD). Known to hybridize with Little Terns (Cox & Close 1977).

Season Season begins progressively later with increasing latitude (Hitchcock 1959). **Aust.** Sept.–Mar. in s. Aust., earlier in n. areas of WA; later nesting may be a result of disturbances at colonies (HASB). **vic.:** Nov.–Feb. (Bryant 1932); eggs, mid-Oct. to late Feb., most in Dec. and Jan. (Aust. NRS); at Rigby I., laying begins late Oct. to late Nov. (Reside *et al.* 1989; Owen 1990, 1991). **TAS.:** eggs, early Oct. to late Dec. and in late Jan.; young, late Jan. and early Feb. (Napier 1972, 1978; Rounsevell 1983); eggs, mid-Oct. to mid-Jan., most in Nov. and Dec. (Aust. NRS). **SA:** eggs, early Jan. (White 1916); early Nov. to late Jan. and in early Mar. (Aust. NRS). **WA:** eggs, late Aug., late Sept. and early to mid-Nov. (Le Souëf 1902; Whitlock 1919; White 1921; Lane 1984a); eggs and young in mid-Aug. and Dec. (Aust. NRS); Rottneest I.: laying, early Nov. to early Feb. (Storr 1964b). **NZ** Nov.–Feb.; laying: first clutches from 15 Nov. to 17 Dec.; re-lay to 13 Jan. (G.R. Parrish & G.A. Pulham).

Site Coastal. On ground (see Habitat). On sand, shell fragments, shell-grit, shingle or gravel; sandy patches among rocks or on rocky flats; in area spangled with tiny flowers, among stunted plants, clumps of *Arctotheca populifolia* and pigface (Barrett 1916; Whitlock 1919; Bryant 1932; Lane 1984a; Aust. NRS); on banks of seaweed (Lashmar 1987). In NZ, 24 of 28 nest-scrapes were on slightly raised ridges or mounds of shells; all nests in areas free of vegetation (other than a few seedlings) and large debris (G.R. Parrish & G.A. Pulham). Claim of nesting on farm dam at Turkeith, Vic., c. 35 km inland needs confirmation (Brown 1950). Sites may be altered by strong winds while nesting (G.R. Parrish & G.A. Pulham). Tend to breed in same area but not at fixed sites, though same site can be used from year to year (see Movements: Breeding; Social Organization: Breeding dispersion).

Nest with Pied Oystercatchers *Haematopus longirostris*, Red-capped *Charadrius ruficapillus* and Hooded *Thinornis rubricollis* Plovers, Little Penguins *Eudyptula minor*, Eastern Reef Egrets *Egretta sacra*, White-faced Storm-Petrels *Pelagodroma marina*, Little, White-fronted, Roseate, Crested *Sterna bergii* and Caspian Terns, and Silver Gulls; 1.4 m from Pied Oystercatcher, 47–50 m from Caspian Tern, in centre or on edge of colony of Little Terns (Cooper 1971; Storr *et al.* 1986; Reside *et al.* 1989; Owen 1990, 1991; Aust. NRS); in NZ, one nest between two colonies of White-fronted Terns (Oliver).

Nest, Materials Scrape in substrate; sometimes beside driftwood or other debris, usually on lee side (Napier 1972; McCulloch 1987; Aust. NRS); unlined, or sometimes lined with small shells or pieces of shells (Warham 1956; Storr 1964b), red and brown algae (Aust. NRS); saucer of *Zostera* (Aust. NRS). In NZ, birds said to surround nest with coloured shells that match colour of eggs (Guthrie-Smith 1936) and one nest said to be surrounded by shell fragments collected by birds (NZRD); not noted by G. R. Parrish & G. A. Pulham. On a sandspit, nests placed in rows (White 1916). **MEASUREMENTS** (cm): diameter, 7–10.2; depth, 1.3–5 (Le Souëf 1902; Aust. NRS). In NZ, birds seen making scrapes 2 days before laying; trial scrapes usually made within a few metres of final site (G. R. Parrish & G. A. Pulham). Both members of one pair searched for and inspected site, and excavated scrape; scrape formed by bird lowering chest and kicking out with its feet; one bird then sat in scrape for up to 20 min, while other stood nearby; 2 days later, laid in another scrape 2 m away (G. R. Parrish & G. A. Pulham).

Eggs Oval to elongate oval or ovoid, some rather pointed at smaller end; close-grained, smooth, lustreless; pale grey with buff or green tinge, dull white, faint creamy white, or pale coffee-brown; with evenly distributed rounded freckles and spots, and a few irregular small blotches of black or brownish black, and underlying markings of faint bluish-, purplish- or inky-grey; others sparingly dotted and spotted with different shades of brown or brownish black, with an irregular zone of large inconspicuous blotches of same hue on thicker end or round middle of shell. Some eggs have short irregular streaks or hair-lines; others, especially when heavily blotched, may be penumbral or with one colour partly overlying another (North; Oliver; G. R. Parrish & G. A. Pulham). **MEASUREMENTS, WEIGHT:** Summarized in Table 1.

Table 1

	Length	Breadth	Weight	Ref.
Aust.	35.5 (1.88; 32.8–38.1; 10)	25.3 (0.37; 24.9–25.9)	10.2 (10–10.5; 9)	1,3
SA	35.6 (31.7–39.0; 34)	25.2 (23.6–26.8)	–	2
Tas.	35.2 (1.31; 33.5–38.0; 10)	24.2 (23.1–25.5)	–	3
NZ	34.9 (32.5–39.7; 13)	25.5 (24.3–26.5)	12.8 (10.8–15.0; 9)	4
	34.5, 35.8	25.5, 26.4	–	5

(1) North; (2) Hitchcock 1959; (3) Aust. NRS; (4) G. R. Parrish & G. A. Pulham; (5) Oliver.

Clutch-size Usually one or two; rarely, three or even four (Barrett 1916; Storr 1964b; Napier 1972; Aust. NRS); proportion of C/2, 16–54% (Storr 1964b). In Northland NZ, mean 1.77 (n=54) (G. R. Parrish & G. A. Pulham).

Laying Highly synchronous within colonies (Newman 1981; Owen 1990). Eggs usually laid at intervals of 1–2, but up to 4 days (G. R. Parrish & G. A. Pulham). At Rigby I., Vic., one brood per season (Reside *et al.* 1989; Owen 1990); Bryant

(1932) says almost certainly raise two broods in a season but no supporting evidence from other sources. Will re-lay after failure, at same site (Bryant 1932; Aust. NRS); one pair re-laid 26 days after loss of clutch (CSN 38); in NZ, earliest a pair re-laid was 12 days after loss of clutch and re-laying occurred to mid-Jan.; re-laying occurred after loss of eggs but not chicks (G. R. Parrish & G. A. Pulham).

Incubation By both sexes (Bryant 1932; CSN 39). In Northland, female for 58.7 min (28.7; 15–143; 41) (includes 18 incompleting periods when observer left but bird still on nest); male for 38.4 (16.6; 5–61; 34) (including one incomplete period); one female seen to stay on nest all night (G. R. Parrish & G. A. Pulham). For first 2 days, incubation of first egg not continuous. To turn eggs, sitting bird rotates through 360° while shuffling body; sometimes also prods eggs with bill. On windy days, face into wind; sand may gather against body of sitting bird, which removes sand by fluffing feathers and shaking (G. R. Parrish & G. A. Pulham). **INCUBATION PERIOD:** In Aust., 19–21 days (Napier 1972); first chicks appeared 21 days after first eggs laid (Owen 1990); in NZ: 22–25 days (n=4) (G. R. Parrish & G. A. Pulham); 22 days (n=2) (CSN 38). Recorded incubating infertile eggs for up to 42 days (G. R. Parrish & G. A. Pulham). In many instances, one egg of two-egg clutches fails to hatch (Le Souëf 1902).

Young Semi-precocial. Hatch in down. When 2–3 days old, chicks move to another scrape <5 m from nest; when 6 days old, more mobile and move up to several hundred metres from nest, seeking shelter under flotsam or sitting in scrape they had dug themselves; when 22–23 days old, can be very mobile, one brood moving over c. 2 ha during a 6 h observation period (HASB; G. R. Parrish & G. A. Pulham). **Parental care, Role of sexes** Brooded till at least 6 days old; brooding periods, 44.7 min (26.1; 12–87; 9); on Days 5 and 6, left unbrooded for 16 min (7–32; 6); on Day 7, not brooded (G. R. Parrish & G. A. Pulham).

Fledging to maturity **FLEDGING PERIOD:** In NZ, 22–23 days (G. R. Parrish & G. A. Pulham); 20 days (n=2) (CSN 39); in Aust., first fledgelings appeared 21 days after first chicks hatched (Owen 1990). By Day 21 some able to fly 2–3 m; by Day 23, able to fly up to 100 m (G. R. Parrish & G. A. Pulham).

Success Human disturbance a major cause of desertion and failure at some colonies; gulls take eggs from nests vacated when people disturb colonies; some eggs trampled by people (Lane 1981). Storms, floods, high tides and wind-blown sand destroy colonies; one colony nesting on airstrip destroyed by planes; trail bikes destroy nests (Storr 1964b; Napier 1972, 1978; Rounsevell 1983; Aust. NRS).

PLUMAGES Prepared by D. I. Rogers. Young fledge in summer and begin protracted complete post-juvenile moult in autumn, attaining distinctive first immature non-breeding plumage. Moult to a plumage like adult non-breeding in second summer; moults in second year poorly known but plumage superficially like adult non-breeding (but differing in timing of primary-moult) through this period. Adults moult twice annually: a complete post-breeding (pre-basic) moult to non-breeding plumage, which is held from about Mar. to July; and a partial (pre-alternate) moult to breeding plumage, which is held from about Sept. to Feb. Attain adult plumage in third year. Nominate *neris* described below.

Adult breeding (Third and subsequent alternate). **Head and neck** Crown and nape, black (89), forming half-cap, and becoming slightly duller when dark-brown (121) bases of feathers exposed slightly with wear. Black of cap extends forwards

through eye to end as rounded or rather square black lobe on basal third of lores, about the same size as or slightly larger than eye. Forehead and rest of head and neck, white; junction of white forehead and black crown, straight, extending back at sides as rounded white notch level with front or middle of eye. **Upperparts** Mostly pale grey (c86), slightly paler on upper mantle. Uppertail-coverts and lower rump, white. Occasionally have very narrow and diffuse white fringes to longest subscapulars and tertials, but these inconspicuous. **Underparts** White. **Tail** White, sometimes with grey-white wash on t1. **Upperwing** Mostly pale grey (c86); p10 has dark-grey (c83–c82) outer web. When fresh, secondaries subtly paler than coverts, and have narrow and diffuse white tips that can form white trailing-edge. Primaries have white shafts and broad white inner edges, latter forming white line c. 3–4 mm wide along lower edge of folded primaries, tapering from about p7 and not reaching tip of wing. Outer 2–4 primaries are retained from non-breeding plumage; at start of breeding season, outer primaries barely darker than inner primaries, but become contrastingly darker as overlying pale-grey bloom lost with wear; at end of breeding season, outer primaries, mid-(84) to dark (83) grey contrasting distinctly with pale-grey inner primaries (but never as conspicuous as in Little Tern). Corresponding outer greater primary coverts also retained from non-breeding plumage, but do not change colour so markedly with wear and thus seldom contrast as much. **Underwing** White; all remiges translucent. Inner webs of outer primaries have glossy pale-grey (86) line alongside shaft (see Little Tern: Recognition); these usually inconspicuous, but when wing at full stretch in dull light, they may be partly exposed.

Adult non-breeding (Third and subsequent basic). Differences from adult breeding: **Head and neck** Crown, white, heavily blotched by scattered black (82–89) feathers, especially at rear, covering 40–70% of crown (feathers have largely concealed white bases). Hindcrown and nape, black (82–89); feathers have broader white bases than in adult breeding and these more likely to be slightly exposed as white flecking; black of nape extends less onto hindneck. Dark loreal patch similar; meets black of hindneck and nape to form half-cap distinctly broader than in non-breeding Little Tern. **Upperparts** Mostly pale grey (86), like adult breeding, but broader zone of grey-white on upper mantle, with slightly less black on nape; often gives impression of grey-white collar. Rump and uppertail-coverts, pale grey (c86); lateral uppertail-coverts can be tinged grey-white. **Underparts** White. **Tail** Mostly white, but t1 pale grey (c86) grading to grey-white on t3–t4. **Upperwing** Often similar to adult; c. 50% of birds have faint narrow cubital bar, formed by partly exposed grey (84) bases to shortest 1–2 rows of lesser secondary coverts. Appearance of primaries varies with stage of moult (see Field Identification). **Underwing** As adult breeding.

Downy young Vary greatly and not yet studied thoroughly. At least two morphs, both of which may occur in the same clutch. In all chicks, down short and matted, and colour may fade a little with wear. In darkest birds: upperparts and top of head, buff (124) to light brown (119C, 223C) with black-brown (119) speckling and streaking (covering up to c. 20% of dorsum), a black-brown (119) median crown-stripe, two pairs of lateral crown-stripes (the lower, narrow and often broken) and large dark blotches at base of wing-pads; underparts, white. Other birds: upperparts, paler grey-brown (c119D) with sparser black-brown speckling. palest chicks: white except for scattered dark-brown (121–119) flecking on crown and sides of back. Subspecies *exsul* (from G.R. Parrish & G.A. Pulham):

down, pale grey above tipped with buff and lightly marked with brown-black; very pale-grey below.

Juvenile Head and neck Mostly white, with broad dull-black (119–89) band on nape that extends forwards to encircle eye and forms dark half-cap. Feathers of forehead, white, with light-brown (119C–119B) to buff (223D) tips; feathers of crown, white, with large drop-shaped black-brown (119–89) subterminal spots and light rufous-brown (39) tips; feathers of nape, black, with narrower light rufous-brown tips. When newly fledged: forehead, light brown to buff (often contrasting with clear white spot just in front of and above eye), grading to light rufous-brown crown, which is neatly speckled with black; nape, black, scalloped or barred buff, and paler than rest of half-cap. Appearance changes markedly with wear as all tips to feathers of top of head bleach to off-white and are gradually lost (most rapidly from nape); forehead and crown become white, with neat black streaking or speckling on crown, broadening at rear to merge with solidly black half-cap. **Upperparts** Ground-colour of mantle, white, grading to pale grey (86) on back and scapulars. Upper mantle unmarked, appearing as distinct pale half-collar; rest of mantle, back and scapulars boldly marked by broad U-shaped black-brown (119) submarginal lines. U-shaped marks least convex on mantle (where they may appear as heavy speckling rather than scalloping) and most convex on scapulars, which are also barred dark brown (c119A). When newly fledged, fringes and distal parts of scapulars, and feathers of lower mantle and back, strongly suffused buff (118–124), obscuring much of pale-grey ground-colour; buff lost rapidly. Rump and uppertail-coverts, grey-white to white, with faint buff (124) tinge at tips of feathers when fresh; feathers of central rump can have faint dark-brown (121) subterminal smudges. **Underparts** White; when newly fledged, feathers of sides of upper breast can have buff (124) fringes and, sometimes, faint brown (119B) subterminal bars (as, and continuous with, mantle). **Tail** Mostly white, sometimes with faint grey tinge to centres of inner 1–4 feathers. Rectrices have dark-brown (121) subterminal chevrons, broadest on outer webs; these markings typically 2–3 mm wide and 6–8 mm long, forming broken subterminal bar at tail-tip. When fresh, distal 1–2 cm of rectrices tinged buff (118–124). **Upperwing** Tertials, as longest scapulars. Alula, median primary coverts and shortest 2–3 rows of lesser secondary coverts, grey (84) to dark grey (83) with narrow light-grey (85–86) fringes; form dark cubital bar and leading-edge that becomes darker as light-grey fringes lost with wear. Greater, median and longest lesser secondary coverts, pale grey (86); most (but not outer greater secondary coverts) have varying, usually bold, dark-brown (119A–119A) submarginal chevron or U-shaped line; also, when fresh, broad buff (123C–124) fringes, narrowest on outer greater secondary coverts. Buff fringes bleach to white and gradually lost with wear, accentuating contrast with dark leading-edge. Secondaries have white inner webs and broad white tips to outer webs; rest of feather typically pale grey (86, usually subtly darker on outer feathers) but varies from grey-white to light grey (85); usually appear wholly pale in flight (cf. Little Tern). Inner four primaries, pale grey (86) with white tips and inner edges; on outer primaries, ground-colour grades to grey or dark grey (83), white inner edges broaden and white tips become narrower. White inner edges form broad white line along lower edge of folded primaries that tapers distally and (unlike adult) reaches tip of wing. With wear, grey sheen to outer 3–4 primaries (especially p10) lost, outer primaries then appearing grey-black (82–83), and with dark primary coverts, alula and cubital bar form dark leading-

edge. Greater primary coverts, as primaries, but without white inner edges, and inner coverts have narrow buff (124) tips at fledging. **Underwing** Like adult, but inner webs of outer primaries have darker-grey (84–83) lines bordering shafts; these may be exposed as darker-grey smudges at wing-tip and beside shaft of p10.

First immature non-breeding (First basic). Similar to adult non-breeding but pattern of crown distinctive: mostly white (rarely, suffused pale grey at rear), flecked or narrowly streaked by short black-brown (119) shaft-streaks on distal half of each feather; streaking neat and evenly distributed, covering no more than c. 20% of crown. Black patch on lores shorter (not extending so close to bill) than in adult. Until Apr., retained juvenile plumage in wing also distinctive: worn dark-grey cubital bar, alula, outer primaries and primary coverts form dark leading-edge contrasting with new median and greater secondary coverts.

Second immature non-breeding (Second basic). Only one specimen examined (WAM A18889). Collected Jan. of second summer. Like adult non-breeding (at this time, adults in full breeding plumage).

Second immature breeding (Second alternate). Only one specimen examined (SAM 30536). Like adult breeding but differed in primary-moult (see Moults).

BARE PARTS Based on photos (Pringle 1987; Hill *et al.* 1988; Moon 1988; Flegg & Longmore 1995; unpubl.: J.N. Davies; D.W. Eades; D. Graham; G.R. Parrish; P. Pert; G.A. Pulham; D.I. Rogers). Information on distribution of black on bill of adults also taken from skins (sources as Moults, Measurements), which retain bill-pattern seen in live birds. See Geographical Variation for other subspecies.

Adult breeding Iris, black-brown (119). Legs and feet, orange (17) to dark orange (16–116) with black (82–89) claws. Bill varies: In Dec.–Jan. (uncommonly Nov.–Feb.), orange-yellow (18) to yellowish orange (17, 106) grading to buff-yellow (53) or straw-yellow (57) at tip (many retain small black [89] tip from non-breeding till Nov. or, rarely, Dec.). During Jan.–Feb. (typically when feeding chicks), develop narrow dark-grey (83) to black (82–89) band on base of culmen, extending to level of nasal groove. In Feb.–Mar., develop dark subterminal band (see Adult non-breeding). **Adult non-breeding** Iris, legs and feet, as adult breeding. Bill: In Mar.–May: yellow (57–157) to dull orange-yellow (c17) (less orange than adult breeding) with black (82–89) subterminal band 7–12 mm wide and dull-black base to bill, broadest (up to 8 mm wide) on upper mandible; dark subterminal band and base often bisected by dirty-yellow (57) cutting edges. During winter, black at base recedes to narrow band on base of culmen, projecting along nasal groove to near nostrils. By Aug., most adults have clear black subterminal band, extending to tip of bill in some, and have little black at base of bill. **Downy young** Iris, black-brown (119). Bill, dull pink (c6, c221D, c14) to dark pink (c3, c4) with small dark grey-brown (c121) to grey-black (82) tip, and dark-grey (83–82) or dusky grey-brown (c121) base to upper mandible. Feet, dull reddish-pink (c3–4, c6) with dark-grey (83–82) smudges on joints of toes. Older chicks develop darker bill, with cream (54) strip along cutting edges; legs, dull orange (G.R. Parrish & G.A. Pulham). Eckert (1970) reported yellow or brownish-yellow tinge to feet. **Juvenile** Iris, black-brown (119). Bill varies: in some (perhaps only recently fledged birds), mostly black (82–89) with cream (54) cutting edges and (only in very young birds), bright-yellow gape; in others (possibly only older birds), bill

yellowish brown (c24) grading to dark-grey (83) base, tip and culmen. Legs, brown (c28) to yellowish brown (c24, c123). **First immature non-breeding** Iris, black-brown (119). Bill, brown (c123) grading to dark grey-brown (c119A, 121) or dull-black (82) culmen, tip and base; usually have yellow-brown (c24), dirty yellow (–) or orange-yellow (18) streaks or smudges on sides and cutting edges, so that pattern resembles subdued version of adult non-breeding. Feet, yellow-brown (c123) at first, like juvenile; begin to develop orange tinge to toes in winter (about June). Single label (WAM) suggests brown tinge remains on bill and front of tarsus and toes till at least Jan. of second summer, but not known when adult colour attained.

MOULTS Based mostly on skins (AM, CM, HLW, MV, NMNZ, QVM, SAM, TMAG, WAM) and 193 records of primary-moult from Vic. banding study (VWVG). Refers to nominate *neretis* except where stated.

Adult post-breeding (Third and subsequent pre-basic). Complete. Moult begins with p1 and on forehead, typically in Jan.; a few do not start until Mar. Apparently little or no overlap of moult and breeding. Non-breeding appearance typically attained Mar.–Apr. Tail mostly centrifugal, but t6 often moulted before t5; finished after moult of body, but before primaries. Primaries outwards, with 1–2 (rarely three) growing concurrently. Moult of primaries takes c. 6 months; average PMS 1.6 (3.47; 0–11; 10) in early Jan., 32.5 (7.48; 13–50; 43) by 28–29 Mar., 48.2 (3.47; 38–50; 42) by 26 June. Usually finishes Aug.–Sept., overlapping with start of pre-breeding moult; earliest record of completed moult 14 June, latest record of active moult, 28 Sept. In subspecies *davisae*, moult may begin slightly earlier; develop indistinct mottled leading-edge to black cap towards end of Dec., when adults still have chicks; females appear to begin moult of forehead before males (G.A. Pulham & G.R. Parrish). Not known if variation between sexes occurs in other subspecies. Timing of moult appears to differ in subspecies *exsul*: PMS 21–45 in three collected Dec.–Jan. **Adult pre-breeding** (Second and subsequent pre-alternate). Partial. Moult all feathers of head, body and tail, most upperwing-coverts and inner 6–8 primaries; secondaries and outer 2–4 primaries and their coverts retained from non-breeding plumage. Primaries outwards; tail centrifugal (like adult post-breeding). Moult of primaries begins before that of body, beginning early June and finishing about the end Sept. Timing varies: earliest record 22 Mar., latest 22 Nov. Pre-breeding moult of inner primaries begins before post-breeding moult of outer 1–2 primaries finished. Timing of start of moult of body poorly known as few data from June or July; none have started by early May but all have begun body-moult by early Aug. and some in almost complete breeding plumage; most have full breeding plumage by end Sept. In subspecies *davisae*, appear to moult fewer primaries; breeding adults examined in this study had retained 5.5 (0.75; 5–7; 8) outer primaries from non-breeding plumage. Moult of body may begin earlier, as extent of black mottling in cap gradually increases from mid-Apr. to early June, and breeding plumage of cap fully developed by mid-June (G.A. Pulham & G.R. Parrish). Little information for subspecies *exsul*; extent of moult similar; one adult began pre-breeding moult of primaries and cap in early July. **Adult, Third series of primaries** (Presumably pre-supplemental). Some adults replace inner 1–3 primaries in a third outwards moult, Aug.–Oct., often or always before pre-alternate moult of primaries finished. Found in only three of 130 adults examined June–Oct. The primaries that are replaced

are fresh, so little or no difference in wear between primaries replaced in pre-supplemental and pre-alternate moults. Thus number of birds performing pre-supplemental moult might easily be underestimated, but it does not occur as often as in Little Tern. **Post-juvenile** (First pre-basic). Complete or nearly so; moult all feathers of head, body, tail and wing except perhaps outer few primaries and greater primary coverts in some. Moult begins in scapulars, Feb.–Mar.; some have attained first immature non-breeding appearance by Apr.; others retain full juvenile plumage till start Apr. and still retain a few juvenile feathers in upperparts and many tertials and upperwing-coverts by start July. Primaries outwards; begins late Feb. to Apr.; during winter, moult of primaries slow and sometimes suspended briefly. Some still have 2–5 juvenile outer primaries by end Sept. or early Oct. Not known when moult finished; in single specimen examined, finished by Jan. of second summer. **Subsequent moults of immatures** Poorly known. Moult through second spring and summer (from at least Oct. to Jan.); moult all head and body, and at least six inner primaries (primary-moult of WA specimen, N⁶O⁴, 21 Jan.); probably a complete second pre-basic. Timing and extent of moults in second year (12–24 months old) not clear and may vary; available data are confusing but suggest moult-strategy differs from that of adults, e.g. birds 16–18 months old had primaries N⁶O⁴, N⁷2¹O¹ and N¹3¹N⁸ on 26 June (VWVG); specimen in second alternate on 18 Dec. (of third summer), N⁶O¹N²4¹. Known-age retraps (VWVG) confirm that timing of moults is like adult after third autumn.

MEASUREMENTS *Nominate nereis*. (1–4) Skins; T1 = length of central rectrix; Tail = length of tail to tip of t6; Bill D(G) = depth of bill at gonydeal angle (AM, HLW, MV, QVM, SAM, TMAG, WAM): (1) Vic. and se. SA, adult breeding, with fresh outer primaries and breeding tail; (2) Vic. and se. SA, adult non-breeding, with worn outer primaries and non-breeding tail; (3) WA, adult breeding; (4) Tas., adult breeding.

	MALES	FEMALES	
WING	(1) 186.8 (3.82; 180–193; 17) (2) 177.0 (3.25; 172–183; 8) (3) 180, 182, 185 (4) 194.2 (3.59; 189–197; 4)	182.4 (3.50; 177–189; 13) 175.7 (6.65; 170–185; 4) 180.4 (6.21; 173–189; 7) 184, 186, 188	** ns ns *
T1	(1) 44.9 (2.45; 40–49; 21) (2) 45.8 (4.66; 43–54; 5) (3) 44.0 (2.19; 41–47; 6) (4) 47.3 (2.87; 45–51; 4)	43.8 (1.92; 40–47; 13) 43.8 (1.94; 41–46; 6) 43.0 (2.45; 39–47; 9) 41, 43, 43	ns ns ns ns
TAIL	(1) 91.0 (7.37; 82–101; 16) (2) 80.0 (4.83; 73–84; 4) (3) 85, 93, 93 (4) 96.3 (3.86; 91–100; 4)	82.0 (5.83; 74–89; 11) 72.0 (5.15; 65–76; 5) 78.7 (3.35; 74–82; 7) 82, 82, 84	** ns ** ns
BILL	(1) 33.6 (1.26; 31.7–36.5; 19) (3) 33.3 (1.31; 32.0–34.6; 4) (4) 33.6, 34.5	31.1 (0.95; 29.6–32.6; 16) 31.7 (1.25; 30.4–33.5; 6) 31.3, 31.6	** ns *
BILL D(G)	(1) 6.62 (0.23; 6.1–7.0; 20) (3) 6.65 (0.36; 6.3–7.3; 6) (4) 7.0, 7.0, 7.6	6.27 (0.24; 6.0–6.6; 9) 6.2 (0.20; 5.9–6.5; 8) 6.2, 6.8, 7.0	** * ns
TARSUS	(1) 16.7 (0.84; 15.0–19.2; 25) (3) 16.6 (0.32; 16.1–16.9; 7) (4) 16.7 (0.35; 16.4–16.9; 6)	16.3 (0.33; 15.7–16.8; 16) 16.3 (0.65; 15.4–17.4; 10) 16.0, 16.2, 16.3	* ns ns
TOE C	(1) 18.9 (0.82; 17.8–20.8; 25) (3) 19.3 (0.96; 17.8–21.0; 6) (4) 18.1, 18.9	18.7 (0.60; 18.0–19.7; 15) 18.4 (0.74; 17.3–19.5; 8) 17.7, 18.7, 19.2	ns ns ns

Geographical variation within *nominate nereis* negli-

gible, but small samples from Tas. have significantly longer wing and deeper bill than those from Aust. mainland. Length of wing decreases significantly with wear; t6 (= Tail) significantly shorter in non-breeding plumage than in breeding plumage. Adults have significantly longer wing and bill than juveniles, deeper bill and much more deeply forked tail (see below).

Nominate nereis. (5) Subadults, skins; sexes combined; Immatures = First immature non-breeding, with worn juvenile p10 and fresh first-basic tail (sources as above).

	JUVENILES	IMMATURES
WING	(5) 173, 179, 180	173.8 (5.76; 168–183; 5)
T1	(5) 43.5 (1.91; 41–45; 4)	43.3 (2.06; 41–46; 4)
TAIL	(5) 60.3 (7.68; 49–66; 4)	–
BILL	(5) 23.7, 27.2, 28.5	31.1 (0.73; 30.3–32.5; 4)
BILL D(G)	(5) 5.7, 6.3, 6.5	6.36 (0.36; 5.8–6.8; 4)
TARSUS	(5) 16.7, 17.1, 17.3	16.6 (0.42; 15.8–17.0; 4)
TOE C	(5) 17.6, 19.1, 19.4	18.6 (0.95; 17.8–19.8; 4)

Nominate nereis. (6) Vic., live, unsexed; Immatures = First immature non-breeding, with juvenile p10. Wing F = wing with fresh outer primaries; Wing W = wing with worn outer primaries.

	ADULTS	IMMATURES
WING F	(6) 187.0 (5.84; 174–196; 40)	170, 173, 179
WING W	(6) 182.5 (4.41; 170–192; 83)	175.7 (2.78; 170–177; 6)
BILL	(6) 32.8 (1.35; 29.0–38.2; 134)	29.2 (2.60; 25–33; 8)
THL	(6) 66.9 (1.98; 62.5–70.4; 75)	62.8 (1.86; 60.9–64.5; 4)

Subspecies davisae and *exsul*. (7–9) Skins, sexes combined (AM, CM, MV, NMNZ): (7) Adult breeding, with moderately worn p10 and tail; (8) First immature non-breeding, with worn juvenile p10, fresh first-basic tail; (9) Ages combined.

Samples (table below) too small for detailed analysis, but *subspecies davisae* has longer wing than *nominate nereis*; *subspecies exsul* has shorter Wing, T1 and Bill, and less deep bill (Bill D[G]), than *nominate nereis*. Geographical variation in length of tarsus and toe apparently negligible. Additional measurements of *davisae* and *exsul* in Hitchcock (1959) and White (1937); their data mostly similar to above. Wing of adult breeding *exsul*, presumably with fresh outer primaries, 170 (160–175; 6) (Hitchcock 1959).

	<i>Subspecies davisae</i>	<i>Subspecies exsul</i>
WING	(7) 196, 199, 199 (8) –	– 156.0 (6.98; 148–165; 4)
T1	(7) 48, 50 (8) –	42 41.0 (1.55; 40–44; 6)
TAIL	(7) 80.5 (7.05; 74–88; 4) (8) –	78 69.5 (4.93; 64–75; 4)
BILL	(9) 30.7 (1.49; 28.8–32.2; 4)	29.0 (1.28; 26.9–30.4; 6)
BILL D(G)	(9) 6.4, 6.9	6.35 (0.37; 5.8–6.9; 6)
TARSUS	(9) 16.1 (0.73; 15.2–16.8; 4)	16.6 (0.31; 16.1–17.0; 6)
TOE C	(9) 18.8 (1.25; 17.6–20.5; 4)	17.5 (1.34; 15.2–18.9; 6)

WEIGHTS *Nominate nereis*. (1) Adults (MV, SAM, WAM); does not include males of 40 and 51.5 g.

	MALES	FEMALES	
(1)	72.2 (5.16; 68–80; 6)	72.4 (5.52; 64–80; 11)	ns

(2–4) Vic., live (VWSG): (2) Juveniles, Jan.; (3) Immatures, including birds in first- and second-basic plumages; (4) Adults.

UNSEXED			
(2)		62, 62, 66	
(3)		68.0 (4.68; 61–76; 16)	
(4)	MAR.	70.9 (3.18; 63–78; 68)	
(4)	JUNE	70.9 (4.12; 58–81; 94)	
(4)	SEPT.–OCT.	69.3 (4.37; 65–79; 10)	
(4)	DEC.–JAN.	68.2 (2.19; 65–72; 8)	

Above data suggest variation in weight with sex and season is negligible. Subspecies *exsul*: adult males, 72, 57; immature females (in first basic), 64, 64 (MV). No information available for adult subspecies *davisae*.

STRUCTURE Wing, long, narrow and pointed. Eleven primaries: p10 longest, p9 8–13 mm shorter, p8 22–30, p7 34–49, p6 51–64, p5 69–74, p4 82–95, p3 96–110, p2 108–124, p1 117–132; p11 minute, concealed by primary coverts. Wing of juveniles slightly less pointed, p9 c. 5 mm shorter than p10. Eighteen secondaries, including 4–5 tertials. Tail, short, deeply forked (see Measurements); in breeding plumage, tip of t6 falls between tips of p8 and p9 on folded wing. Bill, long (about length of head), straight and pointed; culmen gently decurved; gonydeal angle weak (barely noticeable in juveniles), half-way along bill. Tarsus, short, slender; scutellate. Feet small; front toes fully webbed (though webs strongly indented in centres); outer toe 84% length of middle, inner 67%, hind 27%.

RECOGNITION In the hand, pattern of outer primaries allows reliable separation from Little Tern (q.v.).

GEOGRAPHICAL VARIATION Three subspecies recognized, differing mainly in size (see Measurements); also in some details of timing and extent of moults (see Moults) and some plumage characteristics. Geographical variation within nominate *neréis* of Aust. negligible, though small samples from Tas. have significantly longer wings and deeper bills than birds from mainland Aust. Populations from WA were once considered a separate subspecies, *horni*, differing from e. coast populations in having paler upperparts (Mathews), but no such difference visible in much larger samples now available.

Subspecies *davisae* of NZ has significantly longer wing than other subspecies. Pre-alternate moult of adults apparently begins earlier than in nominate *neréis* and involves fewer primaries (see Moults). Adult breeding has much larger black blotch on posterior lores than do other subspecies, varying from rounded (like typical *neréis*) to rather square; typically 1.5–2 times as broad as eye, and often constricted in front of eye, appearing as a rather square patch joined to eye by a narrow black line. Black of cap may extend lower on hindneck than in other subspecies; grey of mantle often extends to the cap. Mantle, scapulars, back and upperwing, light grey (c85), consistently darker than in other subspecies. In non-breeding plumage, loreal patch slightly smaller than in breeding plumage (in nominate *neréis* no seasonal change). Adults attain wholly

yellow bill by mid-June (G.A. Pulham & G.R. Parrish) (nominate *neréis* retains black tip or subterminal band to bill for much longer; see Bare Parts); other seasonal changes in colour of bill like nominate *neréis*.

Subspecies *exsul* of New Caledonia (and possibly Loyalty Is and other unknown sites in sw. Pacific Ocean) has occurred in HANZAB region as vagrant (n. Qld). Plumages most resemble nominate *neréis*, differing mainly by much shorter wing, tail and bill, and in timing of moults. Adult breeding has slightly larger black loreal patch than nominate *neréis* (though smaller than in subspecies *davisae*). Upperparts usually paler grey (c86) than in nominate (difference too subtle for reliable subspecific identification). Said to have larger black tip to bill and more white on forehead (White 1937); both characters difficult to analyse because they vary seasonally, but *exsul* may indeed have larger black tip to bill; one specimen finishing post-breeding (pre-basic) moult and starting pre-breeding (pre-alternate) moult of primaries had black tip 15 mm wide (tip 6–12 mm in nominate *neréis* at similar stage of moult). Differ markedly in first immature non-breeding, when crown wholly white, or with only traces (on rear-crown) of dark flecking and shaft-streaks.

Occasional hybridization between nominate *neréis* and Little Tern reported in se. SA (Cox & Close 1977) and thought to occur in Gippsland Ls, Vic. (J. Reside). In breeding plumage, claimed hybrids said to differ from nominate *neréis* in: (1) black of lores tapers to point, closer to bill than to eye; (2) white of sides of forehead extends farther over eye; and (3) bill has black tip. No information on pattern of primaries, and their identification further complicated by a few nominate *neréis* that retain black tip to bill well into summer (see Bare Parts). Some in aberrant plumage may also pose problems: SAM B30617 has black on lores tapering to blunt point but in all other respects is a typical *neréis*; a few Little Terns moulting into breeding plumage also show loreal pattern superficially like that illustrated for hybrids by Cox & Close (1977) and Sharland (1938: Pl. 2).

REFERENCES

- ABBBS. 1969. *Aust. Bird Bander* 7: 40–4.
 — 1971. *Aust. Bird Bander* 9: 17–19.
 — 1977. *Corella* 1: 39–41.
 — 1980. *Corella* 4: 41–3.
 — 1982a. *Corella* 6: 20–3.
 — 1982b. *Corella* 6: 46–8.
 — 1983. *Corella* 7: 66–8.
 — 1985a. *Corella* 9: 67–9.
 — 1985b. *Corella* 9: 127–30.
 Abbott, I. 1979. *Corella* 3: 93–102.
 — 1980. *West. Aust. Nat.* 14: 189–93.
 —, et al. 1978. *West. Aust. Nat.* 14: 64–5.
 Anon. 1982. *Vict. Wader Stud. Grp Bull.* 5: 34.
 Bailey, M., & B. Hale. 1985. *West. Aust. Bird Notes* 36: 7–8.
 Barrett, C. 1916. *Emu* 16: 52–4.
 Barter, M., et al. 1988. *RAOU Rep.* 50.
 Baxter C.I. 1989. *An Annotated List of the Birds of Kangaroo Island*. S. Aust. NPWS, Kingscote, Kangaroo I.
 Bingham, P. 1977. *Aust. Bird Watcher* 7: 99–100.
 Bonnin, M. 1982. *S. Aust. Orn.* 29: 23–4.
 Bransbury, J. 1992. *S. Aust. Orn.* 31: 97.
 Bremner, M.H. 1991. *West Aust. Bird Notes* 58: 7–8.
 Brouwer, J., & S. Garnett. 1990. *RAOU Rep.* 68.
 Brown, A.G. 1950. *Emu* 50: 105–13.
 Bryant, C.E. 1929. *Emu* 29: 110–2.
 — 1932. *Emu* 31: 273–7.
 Buller, W.L. 1888. *History of the Birds of New Zealand*. Second edn; Author, Lond.

- Burbidge, A.A., & P.J. Fuller. 1989. *Corella* 13: 57–61.
- Chamberlin, S., & J. Dowding. 1985. *Notornis* 32: 324–5.
- Cleland, J.B. 1924. *S. Aust. Orn.* 7: 172–84.
- Cooper, R.P. 1971. *Aust. Bird Watcher* 4: 1–4.
- 1975. *Aust. Bird Watcher* 6: 17–34.
- 1978. *Birds of a Salt-Field*. ICI, Melbourne.
- Cox, J.B. 1974. *S. Aust. Orn.* 26: 142–4.
- , & D.H. Close. 1977. *Emu* 77: 28–32.
- Crawford, D. 1975. *S. Aust. Orn.* 26: 193–5.
- Daw, A. 1984. *West. Aust. Bird Notes* 29: 11.
- Dickison, D.J. 1937. *Emu* 37: 65.
- Dunlop, J.N., et al. 1988. *Corella* 12: 93–8.
- Eckert, J. 1970. *S. Aust. Orn.* 25: 142–4.
- Flegg, J., & N. Longmore. 1995. *Reader's Digest Photographic Field Guide: Birds of Australia*. Readers Digest, Sydney.
- Fletcher, A.W.J., & O.M.G. Newman. 1980. *Tas. Bird Rep.* 9: 17–19.
- Ford, J. 1965. *Emu* 64: 181–203.
- 1967. *West. Aust. Nat.* 10: 153–7.
- 1978. *West. Aust. Nat.* 14: 53.
- Fuller, P.J., & A.A. Burbidge. 1981. *Dept. Fish. Wildl. West. Aust. Rep.* 44.
- , — 1992. *Corella* 16: 47–58.
- Garnett, S. 1993. *RAOU Rep.* 82.
- Garstone, R. 1978. *West. Aust. Nat.* 14: 62–4.
- Gill, C.L. 1985a. *Corella* 8: 115–16.
- 1985b. *Corella* 8: 117–8.
- Gillham, M.E. 1963. *West. Aust. Nat.* 9: 29–46.
- Glancy, P. 1977. *Bird Observer* 545: 34.
- Goffin, R.B. 1978. *Notornis* 25: 331.
- Green, R.H. 1989. *Birds of Tasmania*. Potoroo, Launceston, Tas.
- Guthrie-Smith, H. 1936. *Sorrows and Joys of a New Zealand Naturalist*. Whitcombe & Tombs, Lond.
- Halse, S.A., & N.J. Halse. 1988. *West Aust. Nat.* 17: 97–109.
- Harrison, P. 1983. *Seabirds: An Identification Guide*. Croom Helm, Sydney.
- Hill, R., et al. 1988. *RAOU Rep.* 53.
- Hitchcock, W.B. 1937. *S. Aust. Orn.* 14: 64–6.
- 1959. *S. Aust. Orn.* 22: 87–106.
- Hornsby, P.E. 1978. *S. Aust. Orn.* 27: 280–4.
- Hoskin, E.S., & K.A. Hindwood. 1964. *Emu* 63: 335–6.
- Howard, M.J. 1983. *Aust. Bird Watcher* 10: 86–98.
- Jaensch, R.P. 1989. *West. Aust. Bird Notes* 49: 2–4.
- , & R. Vervest. 1987. *West. Aust. Bird Notes* 44: 1–3.
- , et al. 1988. *RAOU Rep.* 30.
- Johnstone, R.E. 1992. *Corella* 16: 160–2.
- , & K. Coate. 1992. *Corella* 16: 155–9.
- , & L.A. Smith. 1987. *Corella* 11: 93–4.
- , & G.M. Storr. 1994. *Corella* 18: 56–60.
- Kilpatrick A.G. 1932. *Emu* 32: 30–1.
- Kitchener, D.J., et al. 1975. *Rec. West. Aust. Mus. Suppl.* 1.
- Lane, B.A. 1981. *A Preliminary Report on the Fairy Tern (Sterna nereis) Breeding Colonies in Victoria*. Unpubl. Rep., Melbourne.
- , et al. 1984. *Birds of Port Phillip Bay*. Min. Plan. & Environ. Coastal Unit Tech Rep. 1.
- Lane, S.G. 1984a. *Aust. Bird Watcher* 10: 231–2.
- 1984b. *Corella* 8: 64–6.
- Lashmar, A.F.C. 1987. *Corella* 11: 89–92.
- Le Souëf, S. 1902. *Emu* 2: 106–8.
- Loyn, R.H. 1978. *Emu* 78: 11–19.
- Macdonald, N. 1953. *Notornis* 5: 84.
- Masters, J.R., & A.L. Milhinch. 1974. *Emu* 74: 228–44.
- McCulloch, E.M. 1987. *Aust. Bird Watcher* 12: 100–1.
- McKean, J.L. 1978. *Aust. Bird Watcher* 7: 161.
- , et al. 1976. *Notornis* 23: 299–301.
- Menkhorst, P.W., et al. 1988. *Corella* 12: 72–7.
- Minton, C.D.T. 1985. *Vict. Wader Stud. Grp Bull.* 9: 31.
- 1986. *Vict. Wader Stud. Grp Bull.* 10: 39.
- 1988. *Vict. Wader Stud. Grp Bull.* 12: 29.
- 1990. *Vict. Wader Stud. Grp Bull.* 14: 42–5.
- 1992. *Vict. Wader Stud. Grp Bull.* 16: 45–7.
- 1993. *Vict. Wader Stud. Grp Bull.* 17: 41–2.
- Molloy, J., & A. Davis. 1992. *Setting Priorities for the Conservation of New Zealand's Threatened Plants and Animals*. Dept. Cons. NZ, Wellington.
- Moon, G.J.H. 1979. *The Birds Around Us*. Heinemann, Auckland.
- 1988. *New Zealand Birds in Focus*. Weldon, Auckland.
- Morris, A.K. 1992. *Aust. Birds* 26: 71–81.
- 1993. *Aust. Birds* 26: 121–33.
- Munro, M. 1971. *Notornis* 18: 202–6.
- Napier, J.R. 1972. *Aust. Bird Watcher* 4: 103–9.
- 1978. *Aust. Bird Watcher* 7: 155–6.
- Newman, O.M.G. 1981. *Tas. Bird Rep.* 10: 24–6.
- Owen, R. 1990. *A Report on the Management of Little Terns (Sterna albifrons) in the Bairnsdale Region During the 1989/90 Breeding Season*. Vic. Dept. Cons. Environ., Bairnsdale, Vic.
- 1991. *A Report on the Management of Little Terns (Sterna albifrons) in the Bairnsdale Region During the 1990/91 Breeding Season*. Vic. Dept. Cons. Environ., Bairnsdale, Vic.
- Paton, D.C. 1973. *S. Aust. Orn.* 26: 77–84.
- Paton, J.B., & D.C. Paton. 1977a. *Corella* 1: 65–7.
- , — 1977b. *Corella* 1: 68–9.
- Peter, J.M. 1990. *RAOU Rep.* 74.
- 1994. *Aust. Bird Watcher* 15: 228.
- Pringle, J.D. 1987. *The Shorebirds of Australia*. Angus & Robertson, Sydney.
- Reside, J. 1993. *Results of the 1992/93 Little Tern (Sterna albifrons) Breeding Season in East Gippsland*. Unpubl. Rep. to Vic. Dept. Cons. Nat. Resources, Lakes Entrance, Vic.
- , et al. 1989. *A Report on the Management of Little Terns (Sterna albifrons) in East Gippsland During the 1988/89 Breeding Season*. Vic. Dept. Cons. Forests Lands, Bairnsdale, Vic.
- Rounsevell, D.E. 1983. *Tas. Bird Rep.* 12: 9–16.
- Sandland, P.T. 1937. *Emu* 37: 144–9.
- Saunders, D., & P. de Rebeira. 1993. *Birds of Rottnest Island*. Authors, Guildford.
- Sedgwick, E.H. 1978. *West. Aust. Nat.* 14: 85–108.
- Serventy, D., & H.M. Whittell. 1976. *Birds of Western Australia*. Univ. West. Aust. Press, Perth.
- Serventy, V.N. 1943. *Emu* 42: 235–41.
- Sharland, M.S.R. 1938. *Emu* 38: 1–7.
- Skira, I.J., & N.P. Brothers. 1987. *Corella* 11: 83–4.
- Souter, T.G. 1942. *S. Aust. Orn.* 16: 15–17.
- Storr, G.M. 1960. *Emu* 60: 135–7.
- 1964a. *Emu* 63: 297–303.
- 1964b. *Emu* 64: 48–60.
- 1966. *Emu* 65: 209–21.
- 1976. *Aust. Bird Bander* 14: 35–8.
- 1984a. *Rec. West. Aust. Mus. Suppl.* 16.
- 1984b. *Rec. West. Aust. Mus. Suppl.* 19.
- 1985. *Rec. West. Aust. Mus. Suppl.* 21.
- 1987. *Rec. West. Aust. Mus. Suppl.* 27.
- , & R.E. Johnstone. 1988. *Rec. West. Aust. Mus. Suppl.* 28.
- , et al. 1986. *Rec. West. Aust. Mus. Suppl.* 24.
- Stranger, R.H. 1992. *West. Aust. Nat.* 19: 66.
- Sutton, J. 1927. *S. Aust. Orn.* 9: 5–29.
- Thomas, D. 1979. *Tasmanian Bird Atlas*. Univ. Tas., Hobart.
- Vincent, J. 1983. *Aust. Bird Watcher* 10: 35–60.
- Warham, J. 1956. *Emu* 56: 83–93.
- 1957. *Emu* 57: 78–81.
- Warham, P. 1960. *Aust. Bird Watcher* 1: 98–101.
- Watson, I.M. 1955. *Emu* 55: 224–48.
- White, C.M.N. 1937. *Bull. Br. Orn. Club* 57: 110–11.
- White, G. 1985. *Birds and Other Vertebrates of South West Tasmania*. Author, Sydney.
- White, H.L. 1921. *Emu* 20: 186–9.
- White, S.A. 1916. *Emu* 16: 1–15.
- Whitlock, F.L. 1919. *Emu* 18: 240–53.



Volume 3, Plate 41

Fairy Tern *Sterna nereis* (page 725) Nominate *nereis* unless stated

1 Adult breeding; 2 Adult breeding, subspecies *davisae*; 3 Adult breeding, austral spring, showing bill in transition to breeding; 4 Adult non-breeding; 5 Downy young, light morph; 6 Downy young, dark morph; 7 Juvenile; 8 Early stages of moult from juvenile to first immature non-breeding; 9 Early stage of moult from juvenile to first immature non-breeding, subspecies *exsul*; 10 Adult breeding, worn plumage; 11 Adult non-breeding; 12 Juvenile; 13 Late stage of moult from juvenile to first immature non-breeding

Little Tern *Sterna albifrons* (page 709)

14 Adult breeding, population breeding se. Aust.; 15 Adult showing head and bill in transition to or from breeding plumage; 16 Adult non-breeding; 17 Juvenile; 18 Early stage of moult from juvenile to first immature non-breeding; 19 Adult breeding, Asian population; 20 Adult non-breeding; 21 Juvenile; 22 Late stage of moult from juvenile to first immature non-breeding