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## Order CHARADRIIFORMES

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

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

Thinocoridae	seedsnipes; four species, S. America.
Pedionomidae	Plains-wanderer; monotypic, Aust.
Scolopacidae	sandpipers, snipes and allies; c. 85 species, cosmopolitan.
Rostratulidae	painted snipes; two species, s. America and Old World.
Jacanidae	jacanas; seven species, pantropical.
Chionididae	sheathbills; two species, Antarctica and subantarctic islands.
Burhinidae	thick-knees, stone-curlews; nine species, widespread in Old World and two in Neotropics.
Haematopodidae	oystercatchers; c. 11 species, worldwide in tropics and temperate regions.
Recurvirostridae	avocets and stilts; about seven species, worldwide in tropical and temperate regions.
Ibidorhynchidae	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.
Rhynchospididae	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. Pteroclidae (sandgrouse) probably sister-group of Charadriiformes (e.g. Fjeldså 1976, 1977; Sibley & Ahlquist 1990; BWP), though whether best placed within Charadriiformes or in separate order is debated. Flamingoes (Phoenicopteridae) and divers (Gaviidae) have also been treated as Charadriiformes (Olson & Feduccia 1981; Fjeldså 1976, 1977) but DNA-DNA hybridization studies (Sibley & Ahlquist 1990) inconsistent with these theories. Affinities to other orders still controversial; DNA-DNA hybridization has suggested closest links are to large waterbirds, such as storks, herons and allies, Pelicaniformes, Procellariiformes, penguins, grebes, divers (Gaviidae) and also Falconiformes. All these were combined in huge order Ciconiiformes by Sibley & Ahlquist (1990).

Taxonomy and relationships reviewed in Sibley & Ahlquist (1990), Christian *et al.* (1992) and BWP (and references therein). Recent reviews have included: patterning of downy young (Jehl 1968; Fjeldså 1976, 1977), osteology (Strauch 1978; Mickevitch & Parenti 1980; Olson & Steadman 1981), DNA-DNA hybridization (Sibley *et al.* 1988, Sibley & Ahlquist 1990) and electrophoresis of tissue proteins (Christian *et al.* 1992). The studies of allozymes, DNA-DNA hybridization and the most recent osteological study of the entire order (Strauch 1978) have agreed in finding two or three well-knit, monophyletic assemblages within the Charadriiformes: scolopacids and allies (Thinocoridae, Pedionomidae, Scolopacidae, Rostratulidae, Jacanidae) and charadrids and allies (Chionididae, Burhinidae, Haematopodidae, Recurvirostridae, Ibidorhynchidae, Charadriidae, Pluvianellidae, Dromadidae, Glareolidae, Stercorariidae, Rhynchospididae, 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 charadrids (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 schizorbinal nostrils, schizognathous palates, well-developed vomer, lachrymals fused with ectethmoid 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 Glenn 1955); caeca present. Legs usually rather long; hind toe small or lacking in most but all toes greatly elongated in Jacanidae. Feathers with small thin afterfeathers. Normally two moults annually: complete post-

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

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

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## Family LARIDAE skuas, jaegers, gulls and terns

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

**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

<sup>1</sup> 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, Chionididae, Burhinidae, Haematopodidae, Recurvirostridae, Charadriidae, Glareolidae and

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

### Plate 23

Oriental Pratincole *Glareola maldivarum* (page 366)

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

Australian Pratincole *Stiltia isabella* (page 373)

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

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

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

See subfamily accounts for summaries of social organization and breeding.

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## Subfamily STERNINAE terns and noddies

Cosmopolitan group of seabirds, with narrow pointed wings and long pointed bills, ranging in size from Little Tern *Sterna albifrons* (20–28 cm) to Caspian Tern *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 common 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. albostriata* placed in *Sterna* rather than *Chlidonias* (following Mees 1977; Lallas & 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 expensor secondarium (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 rhaphotheca 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 pteryiae 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*, *albostriata*, *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.<sup>1</sup> 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.

<sup>1</sup> 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).

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**Sternula vittata Antarctic Tern**

COLOUR PLATES FACING PAGES 640 &amp; 641

*Sternula vittata* Gmelin, 1789, Syst. Nat. 1 (2): 609 — ‘Insula Nativitatis Christi’ = Christmas Harbour, Iles Kerguelen.

The specific name is directly from the Latin *vittatus*, banded, striped (from *vitta*, ribbon, band), referring to the white facial streak that divides the black cap from the grey chin and throat.

OTHER ENGLISH NAMES Wreathed Tern, Subantarctic Tern, Kingbird, King-Bird, Tristan Tern.

POLYTYPIC Nominate *vittata* breeds S of 46°S in Indian Ocean, on Heard and Prince Edward Is, Iles Kerguelen and Crozet, and Bouvetøya; subspecies *bethunei* Buller, 1896, breeds Macquarie I., NZ subantarctic islands (Snares, Antipodes, Bounty, Auckland and Campbell Is), and Stewart I. and outlying islands; subspecies *georgiae* Reichenow, 1904, breeds South Georgia, and presumably South Orkney and South Sandwich Is; subspecies *gaini* Murphy, 1938, breeds South Shetland Is and, presumably, Antarctic Pen. and outlying islands. Extralimitally: subspecies *tristanensis* Murphy, 1938, breeds N of 41°S in the South Atlantic Ocean, on Tristan da Cunha and Gough Is, and in the Indian Ocean at Iles Amsterdam and St Paul; possibly also on Stag I., South Africa (see Geographical Variation).

**FIELD IDENTIFICATION** Length 32–36 cm; wingspan 72–79 cm; weight 140–160 g. Medium-sized, rather bulky sea tern. General shape and proportions similar to Arctic *Sternula paradisaea* and Kerguelen *S. virgata* Terns but bigger and bulkier, with heavier bill, legs and feet. Adult plumages similar to Arctic Tern but juvenile and first-year plumages similar to Kerguelen and White-fronted *S. striata* Terns. Adult in breeding plumage, distinctive: light grey above, with black cap and white cheek-stripe; white rump and tail, without obvious contrasting dark edges to outer rectrices; grey below, with translucent remiges and narrow tapering black trailing-edge to primaries; and bright red bill, legs and feet. Adult in non-breeding plumage has diagnostic combination of white forehead and crown, usually extensively smudged grey underbody, and dark-red bill, legs and feet. Juvenile, distinctive; coarsely marked black and buff above, with broad dark triangle on inner forewing, and dusky outer primaries and coverts contrasting with much paler secondaries and inner primaries; and brown-buff wash and fine dark peppering from chin to lower breast. Sexes alike. Some seasonal variation. Juvenile distinct. Immature separable.

**Description** **Adult breeding** Forehead, crown and nape, black, forming neat cap extending to level with bottom of eye, and with narrow white wedge between cap and gape; bordered below by prominent narrow white cheek-stripe extending to sides of nape; chin, throat and lower cheeks, light-grey. Narrow white collar on hindneck (usually not seen in flight). Saddle and tertials, light grey, with narrow white scapular and tertiaries crescents when fresh. Rump and tail, mostly white, contrasting strongly with grey saddle; outer few rectrices have darker grey edges, but tail usually appears uniformly pale, and darker edges not normally visible (unless close); when perched, tail ends short of wing-tips on many, but level with or slightly beyond in some. In flight: upperwing appears light grey, with narrow white trailing-edge on secondaries (tapering onto inner primaries) and narrow blackish trailing-edge to outer primaries (tapering toward secondaries). At rest, folded wing, light grey, as rest of upperparts; primaries, slightly darker, silvery grey, with, in fresh plumage, fine white upper edge, petering out well short of wing-tip. Chin to lower belly, light grey,

sharply demarcated from white vent and undertail-coverts. Underwing, white, with narrow dark-grey stripe on leading primary, and clear-cut narrow blackish trailing-edge to outer primaries, tapering well in towards secondaries; in fresh plumage, inner two-thirds of dark trailing-edge finely edged white. From below, remiges, strongly translucent (outer primaries slightly less so), with dark trailing-edge and dark streaks bordering shafts of primaries prominent. Remiges can also appear translucent from above, with primaries and outer secondaries often appearing to flash paler than rest of upperwing, especially when viewed against dark background. Bill, legs and feet, bright red. Iris, dark brown. **Adult non-breeding** Differ from adult breeding by: Head and neck, white, with black band extending from in front of eye and broadening across ear-coverts to nape; and with black streaking on hindcrown, or black streaking or mottling over most of crown; black band often has diffuse lower border and lower nape can be mottled with white; from head-on, forehead and crown form large white oval. Tail, white, with grey sides. Underbody, white, with distinctive, and usually extensive, grey smudging on breast, belly and flanks, reduced in some to broad smudgy band across breast and along flanks; some may briefly have wholly white underbody between moults. Bill, bright to dark red or red-black, with small black tip and small black area at base of upper mandible on some. Legs and feet, bright red to dark red or brown-red. **Juvenile** Cap, black, with buff wash on anterior lores and lower forehead, and coarse black-and-buff streaking on forehead, crown, and, sometimes, nape; rest of head and neck, white, finely tinged buff and peppered brown on hindneck, chin, throat and sides of neck, grading to whitish cheeks. With wear, forehead, crown, lores, cheeks and hindneck become paler and whiter as buff and brown tones reduced or lost. Saddle and tertials, light grey, coarsely barred black-and-buff (appearing black-and-white when plumage worn). Rump and uppertail-coverts, white, finely barred dark when fresh, and contrasting strongly with dark saddle. Tail, white, with contrasting dark-grey edges to outer few rectrices and barred black-and-buff tip; shorter and less deeply forked than in adult. At rest, secondary coverts, light grey, with coarse black bars and lines and narrow buff tips; folded primaries, silvery

grey, with prominent thin tapering white line along upper edge, petering out near wing-tip. In flight, upperwing-pattern distinctive: has prominent dark triangle from base of wing to carpal, paler dusky grey triangle on outerwing (formed by dusky-grey outer primaries, coverts and alula), and contrasting paler greyish-white triangle over rest of wing, with apex at carpal joint; and narrow white trailing-edge tapering onto inner primaries, and narrow blackish trailing-edge to outer primaries (similar to adult, though often slightly shorter). Underbody, white, with buff wash and fine brown peppering from chin to lower breast and foreflanks, forming diffuse patches at sides of breast (obvious in flight); sides of vent and undertail-coverts tipped brown when fresh. Underwing, as adult, though dark trailing-edge often slightly shorter; and outer primaries less translucent. Bill, black, often tinged red-brown at base. Legs and feet, orange-red to dull brown-red. **First immature non-breeding** As adult non-breeding but retain heavily marked juvenile wing, tertials and tail; underbody, white. Bill, black. Legs and feet, black, tinged red. Field characters of subsequent immature plumages not known (but see Plumages).

**Similar species** Main risk of confusion is with Arctic Tern, especially in non-breeding plumages. In ALL PLUMAGES, Arctic differs by: (1) smaller and slimmer, with smaller head; (2) shorter, slimmer bill, with straighter culmen and less prominent gony; (3) shorter and distinctly finer legs; (4) proportionately slightly longer narrower wings, with finer more tapered outerwings; (5) longer, more deeply forked tail; (6) more buoyant, less steady and purposeful flight, with more fluttering or more thrusting wing-beats and distinct pause on upstroke; (7) distinctive stepped-hover feeding flight (see text for Arctic Tern); (8) slightly paler grey upperparts; (9) black trailing-edge to outer primaries tends to be slightly longer, and never finely edged white; (10) outer primaries more translucent, with finer dark streaks when viewed against light; and (11) darker grey-black and more prominent edges to outer few rectrices (Antarctic generally lacks or has only slightly darker edges, though some have tail-pattern approaching that of Arctic). In NON-BREEDING PLUMAGES, further differs from adult non-breeding Antarctic by combination of: narrow dark cubital bar (sometimes lacking), black bill and white underbody. In ADULT BREEDING PLUMAGE, also differ by paler-grey underparts. Juvenile and first immature non-breeding Antarctic Tern, can be confused with same of White-fronted Tern, which is most easily distinguished by: (1) slightly larger and bulkier, with clearly longer bill and legs; (2) much thicker and more prominent white upper edge to folded primaries; (3) dark corners to tail; (4) usually much paler and less prominent dusky trailing-edge to underside of primaries, which is always shorter, less clear-cut and does not taper inwards; (5) underbody, white, without buff; and (6) in first immature non-breeding, have more extensive black half-cap covering most of crown and leaving smaller white area on forehead. On Prince Edward Is and Iles Crozet and Kerguelen, often confused with Kerguelen Tern, which differs by: smaller and more compact, with slightly shorter and finer bill; slightly shorter and broader wings; much shorter and less deeply forked tail, always falling short of wing-tips at rest; and finer legs. In ADULT BREEDING PLUMAGE, Kerguelen Tern differs by: (1) darker grey above and below, with more contrasting white trailing-edge to upperwing; (2) bolder white cheek-stripe; (3) mostly grey tail, contrasting with white or grey-white rump and uppertail-coverts; (4) grey (not white) underwing, with less clear-cut black trailing-edge to outer primaries; and (5) darker-red bill, legs and feet, often with small black tip to bill and irregular black patches on

culmen. In ADULT NON-BREEDING, Kerguelen best distinguished by: differences in colour, wing and tail as in adult breeding and: (1) forecap, duller, greyish-white; (2) underbody generally more extensively and uniformly dark-grey; and (3) bill, darker red, or black, and legs and feet always black. **JUVENILES:** Kerguelen best distinguished by: (1) buff on underbody appears darker and more extensive, extending to vent (to lower breast on Antarctic), and is more heavily peppered and barred dark; (2) rump and uppertail-coverts, slightly duller, off-white, contrasting with mostly grey tail; (3) upperwing broadly similar, but secondaries greyer and darker, contrasting less with rest of wing; trailing-edge to remiges, pale buff (not white) and narrower; and (4) dark trailing-edge to primaries on underwing less clear-cut and tapering. **FIRST IMMATURE NON-BREEDING:** Kerguelen best distinguished from same age of Antarctic by wing and tail as in juvenile; also acquire much grey on sides of breast and flanks while still with much buff juvenile plumage (Antarctic Tern acquires white underbody with post-juvenile moult).

Gregarious; normally seen in small groups, occasionally in larger flocks of up to 30 birds when feeding. Associate with other terns. Marine, though occur inland when breeding. On breeding islands, usually seen resting on rocky, stony or sandy beaches or feeding close inshore over kelp beds, just beyond surf-zone. Often tame, allowing close approach. Horizontal carriage and trotting gait as other commic terns. Normal flight similar to that of White-fronted Tern, lacking buoyancy of Arctic: steady and direct, with deep regular wing-beats appearing slower, deeper and less thrusting or fluttering than Arctic. When foraging, patrol back and forth 3–8 m above surface and, on sighting prey, hover then plunge; also dip to surface to snatch prey; plunge less often, but more decisively, than Arctic. Occasionally scavenge along tidelines and follow ships for scraps. Often quite noisy; commonest calls include shrill high-pitched *trr-trr-kriah* or trilling *kree-er*; also soft rattling note.

**HABITAT** Coasts and islands of Antarctic and subantarctic seas, preferring embayments with rocky shores or cliffs and inshore waters, often supporting large beds of kelp. Outside breeding season, some may move into pelagic zones far from land, and occasionally occur on temperate coasts of Africa and South America, with adjacent cold-water current.

Prefer to breed in rocky areas, either very near coast or short distance inland, including ledges and crevices of sheer cliffs, boulders at base of cliffs, rocky ridges, spits and peninsulas, headlands, stacks, rocky islets, pinnacles, moraines, raised lava-platforms, rock fields by fresh water, and boulder-beaches (Stead 1948; Downes *et al.* 1959; Bailey & Sorensen 1962; Swales 1965; Warham 1969; Parmelee & Maxson 1974; Berruti & Harris 1976; Burger 1978; Sagar 1978; Kaiser *et al.* 1988; Parmelee 1992). Rarely at other sites, including beaches of gravel, coarse shingle and sand (Downes *et al.* 1959; Parmelee & Maxson 1974; Sagar 1991). Extralimitally, on Tristan da Cunha, formerly bred on sandy beaches until introduction of rats forced Terns to breed on inaccessible cliff-ledges (Elliott 1957). Also recorded nesting on outwash-flat below glacier (Downes *et al.* 1959). May nest among sparse vegetation.

Forage inshore, mostly in kelp-zone up to 200 m from shore. In coves, bays, inlets, harbours and off estuaries, and often in heavy surf (Downes *et al.* 1959; Bailey & Sorensen 1962; Parmelee & Maxson 1974; Berruti & Harris 1976; Burger 1978; Warham & Bell 1979; Sagar 1991), and in straits and gorges separating islands (Robertson & van Tets 1982). May occasionally feed much farther out to sea (Downes *et al.* 1959;

Brooke *et al.* 1988). During winter, may forage in patches of open unfrozen inshore water (Parmelee 1988); or in open water along edge of ice (Parmelee 1992). Feed by plunging below surface of water (Sagar 1978; Warham & Bell 1979). Rarely feed on land: recorded diving in brackish coastal ponds (Berruti & Harris 1976); once observed picking items from wet sand after waves receded (Downes *et al.* 1959) and once observed probing fissures in rocks (Robertson & van Tets 1982). In South Africa, recorded scavenging in intertidal zone (Urban *et al.* 1986), and on Tristan da Cunha, seen probing ground in grassy pasture (Ryan 1985). Do not normally follow ships (Parmelee 1992), but may feed on scraps behind ships (Falla 1937).

Mostly roost or loaf on rocks on mainland coasts and islands, usually on ledges or in cavities of steep sea-cliffs and stacks, or rocky ridges; less often on sheltered beaches of coves and estuaries (Downes *et al.* 1959; Parmelee & Maxson 1974; Robertson & van Tets 1982; Ryan 1985; Brooke *et al.* 1988); also at edge of frozen lagoon (Downes *et al.* 1959). Occasionally on water of calm seas when foraging offshore, but remain on wing if sea too rough (Brooke *et al.* 1988). May perch on floating objects, including kelp stipes, wood and oil drums (Sinclair 1978; Brooke *et al.* 1988). Also on post of jetty (Bailey & Sorensen 1962).

#### DISTRIBUTION AND POPULATION

Widespread in

subantarctic and Antarctic regions of South Atlantic and s. Indian Oceans, and in seas S of NZ. In s. Indian Ocean, coast of Antarctica and Antarctic Pen., S to c. 68°S; range N to se. coasts of South America, from Tierra del Fuego to Rio de Janeiro; and s. African coasts, N to 30°S on Atlantic coast (round Hondeklip Bay) with stragglers farther N; and erratically on Indian Ocean coasts to Durban (Watson *et al.* 1971; Watson 1975; Blake 1977; Brooke *et al.* 1988; Woehler *et al.* 1990). Vagrant Aust.; not recorded mainland NZ (Latham 1979). Claim of single, mouth of Waikanae R., NZ, 8 Nov. 1981, possibly misidentified Arctic or Common S. *hirundo* Tern (Latham 1986). Breed Stewart I. (CSN). Listed as straggler to Chatham Is (Fleming 1939) but confirmation needed (NZCL).

**Aust.** Two records, both specimens. Adult in non-breeding plumage, Metricup, WA, 35 km SSW of Busselton, 21 July 1978 (WAM A15670; previously incorrectly identified as Common Tern); single, probably adult, found dead, South Casuarina I., off Kangaroo I., SA, 23 Nov. 1982 (SAM B36933).

**Breeding** Summarized in Table 1. Earlier summary in Watson *et al.* (1971). Extraliminally, breed Tristan da Cunha, Gough I., and Iles Amsterdam and St Paul (Watson *et al.* 1971). Reported breeding Stag I., off Algoa Bay, South Africa (see Geographical Variation). Early breeding records from Wilhelm II Land, Antarct-ica, misidentified Arctic Terns (Murphy 1938; Watson 1975).

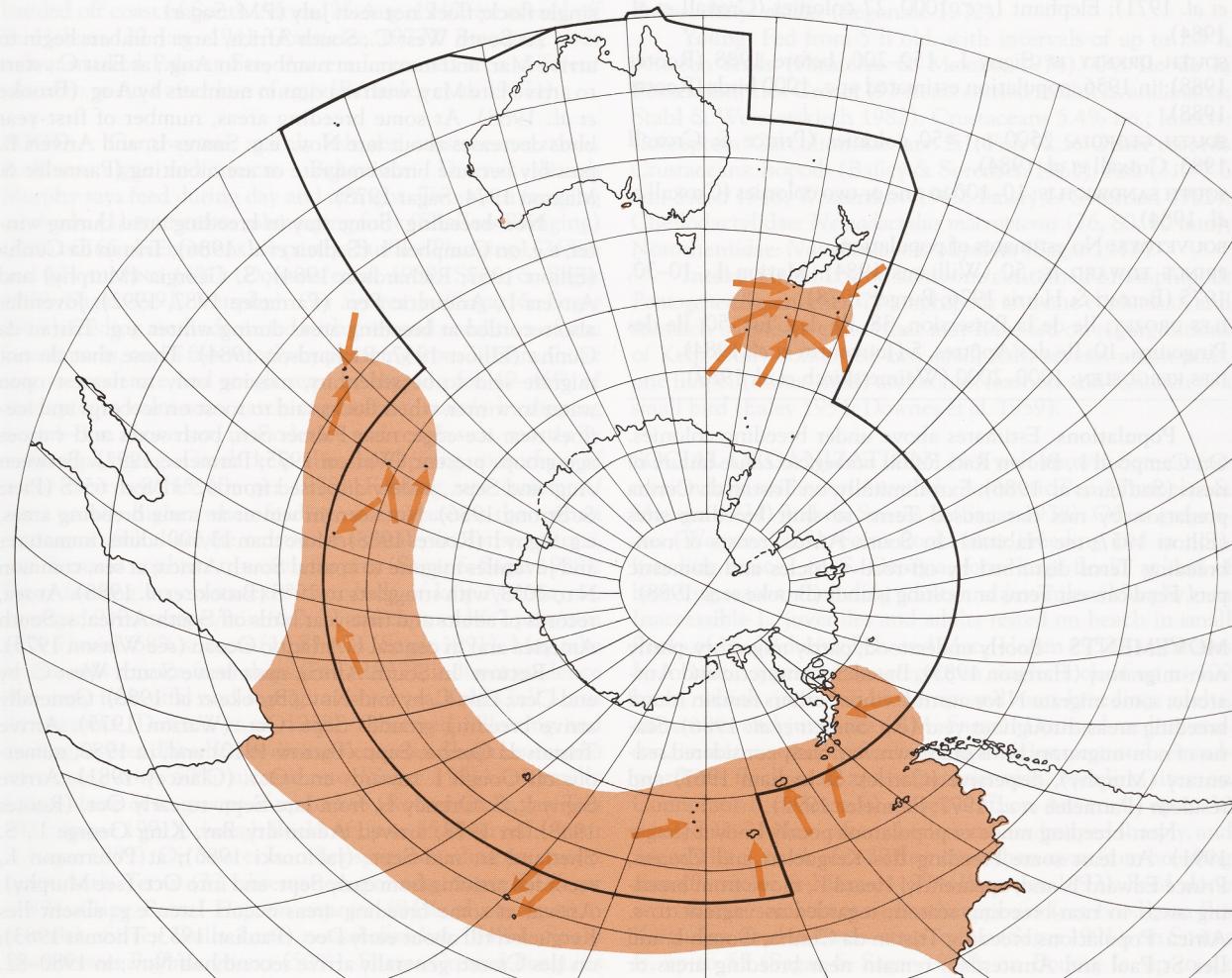


Table 1. (Pairs unless stated.)

**HEARD I.**: 48 nests in Stephenson Glacier moraine, 1983 (Woehler 1991); 13 nests in same area, 1987–88 (Woehler 1991).

**MACQUARIE I.**: 40, 1979 (Rounsevell & Brothers 1984).

**NZ SUBANTARCTIC ISLANDS**: <1000. Snares Is, 70, 1984–85 (P.M. Sagar & C.M. Miskelly); Bounty, Antipodes, Auckland and Campbell Is (Robertson & Bell 1984); Stewart I.: at Islet Cove, Port Pegasus, and offlying islets, including Moggy, Putauhina (= Stage) and Solomon Is (Blackburn 1965; Robertson & Bell 1984; CSN; NZCL). Breeding on Big South Cape I. (Oliver) not substantiated (Blackburn 1965).

**ANTARCTIC PEN. AND ASSOCIATED ISLANDS**: 1500 in 73 colonies (Croxall *et al.* 1984) including: Stonington I., possible site; Debenham Is; C. Calmette, possible site; Avian I.; Léonie I.; Lagotellierie I.; Horseshoe I.; Webb I.; Detaillé I., possible site; Argentine Is; Petermann I.; Hovgaard I.; Booth I.; Joubin Is; Dream I.; Wienecke I.; Doumer I.; Cormorant I.; Anvers I.; Paul I.; Melchior Is; Brabant I.; Leige I.; unnamed island next to Gaston Is; Monument Rocks; Trinity I.; C. Kater Doumer I.; Tower I.; Hope Bay; Cockburn I.; Seymour I.; Snow Hill I. (Watson *et al.* 1971).

**SOUTH SHETLAND IS**: 35,000 in 44 colonies (Croxall *et al.* 1984) including: Bridgeman I.; Penguin I., 18 (Jablonski 1980); King George I. (Admiralty Bay region: 652 nests [Jablonski 1986]); Nelson I., Greenwich I.; Half Moon I.; Deception I. (Watson *et al.* 1971); Elephant I.: c. 1000, 27 colonies (Croxall *et al.* 1984).

**SOUTH ORKNEY IS**: Signy I., 150–200, before 1988 (Rootes 1988); in 1936, population estimated at c. 1000 birds (Rootes 1988).

**SOUTH GEORGIA**: 2500 in ≥50 colonies (Prince & Croxall 1983; Croxall *et al.* 1984).

**SOUTH SANDWICH IS**: 10–100 in one or two colonies (Croxall *et al.* 1984).

**BOUVETØYA**: No estimates of population.

**PRINCE EDWARD IS**: 50 (Williams 1984); Marion I., 10–30, 1975 (Berruti & Harris 1976; Burger 1978).

**ILES CROZET**: Ile de la Possession, 38; Ile de L'Est, 50; Ile des Pingouins, 10; Ile des Apôtres, 5 (Jouventin *et al.* 1984).

**ILES KERGUELEN**: 1000–2000 (Weimerskirch *et al.* 1989).

**Populations** Estimates above under breeding colonies. On Campbell I., Brown Rats *Rattus norvegicus* cause failure of nests (Sadleir *et al.* 1986). Extraliminally, on Tristan da Cunha predation by rats has caused Terns to shift breeding sites (Elliott 1957; see Habitat). In South Africa, roosts of non-breeding Terns disturbed by off-road vehicles and domestic pets. Feral cats eat Terns at roosting islands (Brooke *et al.* 1988).

**MOVEMENTS** Poorly understood; partly migratory, partly non-migratory (Harrison 1983). Breed Subantarctic and Antarctic; some migrate N for austral winter, others remain round breeding areas throughout year (e.g. Sadleir *et al.* 1986). Status of non-migratory birds unknown; variously considered sedentary (Murphy), dispersive (Carrick & Ingham 1967) and resident (Parmelee *et al.* 1977; Parmelee 1992).

Non-breeding range of populations poorly known (Sagar 1991). At least some breeding Iles Kerguelen and Crozets, Prince Edward Is and, apparently, Heard I., move from breeding areas in non-breeding season; regarded as vagrant to s. Africa. Populations breeding Tristan da Cunha, Gough I. and Iles St Paul and Amsterdam remain near breeding areas or

move to non-breeding areas off s. Africa; vagrant to St Helena. On S. Georgia, some remain throughout year, others move to non-breeding areas off e. coast of s. South America (Brazil, Uruguay, Argentina); some also move to Cape Province, South Africa. Populations breeding on subantarctic islands of NZ and Aust. said not to migrate, but few (<6) recorded Snares Is during recent visits in July, and birds probably move elsewhere, possibly to sea. At least some breeding S. Orkney and S. Shetland Is, move to non-breeding areas off s. Argentina and, probably, to Cape region of Chile (Falla 1937; Liversidge 1957; Blackburn 1965; Cooper 1976; Blake 1977; Prince & Payne 1979; Falla *et al.* 1981; Harrison 1983; Urban *et al.* 1986; Murphy; P.M. Sagar; see Banding). On Antarctic Pen., remain in some breeding areas and appear to move away from others in non-breeding period (Parmelee 1987a, 1992; see Murphy).

**Departure** Usually, young fledge and they and adults leave Jan.–May. Disperse from S. Georgia, June; from Heard I. by June; pattern at least 1 month later on Iles Crozet (Carrick & Ingram 1967; Watson 1975). However, on Ile aux Cochons and elsewhere in Iles Crozet, influx recorded from mid-Mar., possibly birds that have left other colonies in the group (Derenne *et al.* 1976). Absent Iles Kerguelen from about end Apr. (Paulian 1953; Watson 1975; Thomas 1983). Leave Signy I., S. Orkney Is, Mar.–June, depending on conditions (Rootes 1988); adults and young gone from Petermann I., May (Murphy). On Snares Is, Mar., all ages appear to congregate in single flock; flock not seen July (P.M. Sagar).

At South West C., South Africa, large numbers begin to arrive Mar. and maximum numbers in Aug.; at East C., start to arrive late May, with maximum numbers by Aug. (Brooke *et al.* 1988). At some breeding areas, number of first-year birds decreases about late Nov., e.g. Snares Is, and Anvers I., possibly because birds emigrate or are moulting (Parmelee & Maxson 1974; Sagar 1978).

**Non-breeding** Some stay in breeding areas during winter, e.g. on Campbell I. (Sadleir *et al.* 1986), Tristan da Cunha (Elliott 1957; Richardson 1984), S. Georgia (Murphy) and Anvers I., Antarctic Pen. (Parmelee 1987, 1992). Juveniles also recorded at breeding areas during winter, e.g. Tristan da Cunha (Elliott 1957; Richardson 1984). Those that do not migrate said to be sedentary, moving only to nearest open water in winter, when flocks said to roost on icebergs and ice-floes near ice-edge; near Palmer Strn, both sexes and various age-groups present (Watson 1975; Parmelee 1992). Between Aug. and Sept., widely dispersed from 62°31'S to 65°S (Pietz & Strong 1986). Not seen in winter at some breeding areas, e.g. Signy I. (Rootes 1988). More than 13,500 adults, immatures and juveniles migrate to coastal South Africa; at sea, common N to 30°S, with stragglers to 29°S (Brooke *et al.* 1988). At sea, records of adults and first-year birds off South Africa, s. South America and in central s. Atlantic Ocean (see Watson 1975).

**Return** In South Africa, most leave South West C. by end Oct.; East C. by mid-Nov. (Brooke *et al.* 1988). Generally arrive breeding grounds Sept.–Oct. (Watson 1975). Arrive Tristan da Cunha, Sept. (Barrow 1910) and, in 1980, numerous off Gough I. towards end Oct. (Clancey 1981). Arrive Signy I., S. Orkney Is, from late Sept. to early Oct. (Rootes 1988). In 1978, arrived Admiralty Bay, King George I., S. Shetland Is, mid-Sept. (Jablonski 1986); at Petermann I., recorded arriving from early Sept. and into Oct. (see Murphy). Arrival at some breeding areas occurs later, e.g. absent Iles Kerguelen till about early Dec. (Paulian 1953; Thomas 1983); on Iles Crozet, generally arrive second half Nov.; in 1980–82,

arrived late Oct. (Weimerskirch & Stahl 1988); main return Heard I., apparently Dec. (Downes 1952; Carrick & Ingham 1967). On Snares Is, 1976–77, adult numbers stable Nov. and Dec., increased sharply in Jan., with maximum numbers Feb. (Sagar 1978); recently, greatest numbers Mar., with c. 100 at one roost (P.M. Sagar). On Anvers I., Antarctic Pen., recorded staying in area with deep snow, despite apparently suitable alternative areas, till snow melted and breeding began (Parmelee & Maxson 1974). In Dec., possible record from c. 161°E in Antarctica, far from known breeding areas (Dow & Neall 1968).

**Breeding** Outside breeding range, a few seen South Africa (Brooke *et al.* 1988). Some evidence of high fidelity to breeding area (Parmelee & Maxson 1974), though banded birds recorded moving between colonies (see Banding). On Palmer Arch., often move breeding sites between and within seasons (Parmelee 1992). First- and second-year birds and non-breeding adults recorded in breeding areas during breeding period (Parmelee & Maxson 1974; Sagar 1978; Parmelee & Rimmer 1985). On Snares Is, not observed more than about 1 km from shore (Sagar & Sagar 1989).

**Banding, Colour-marking** No recoveries from birds banded Iles Crozet and Kerguelen (Weimerskirch *et al.* 1985), Snares Is (P.M. Sagar & C.M. Miskelly) or Palmer Arch. (Parmelee 1992). Adult banded South Africa, 18 June 1983, recovered breeding Ile du Chat, Gulf du Morbihan, Iles Kerguelen, 6 Feb. 1985 (Sagar 1991). Extralimitally, juvenile banded off coast of South Africa, 25 Aug. 1940, recovered off St Helena, 20 Jan. 1941 (Parmelee 1977). Breeding birds colour-marked Palmer Stn, Anvers I., moved to a different island to re-nest after loss of eggs (Parmelee *et al.* 1977a).

**FOOD** Carnivorous; mainly fish and crustaceans; rarely, molluscs, algae and insects. **Behaviour** Diurnal, though Murphy says feed during day and at night. Two main foraging methods: (1) PLUNGING: submerging fully (Shallow Plunging) (70% of 166 observations) or partly (Surface Plunging) (26%); and (2) DIPPING (4%) (Downes *et al.* 1959; Sagar & Sagar 1989; Sagar 1991; Murphy). On Snares Is (Sagar & Sagar 1989), feeding methods varied with prey and condition of sea. In calm seas, catch fish mostly by plunging from 3–10 m above sea; in moderate and rough seas, by dipping for 40–46% of attempts. In calm seas, catch crustaceans, mainly by dipping from 1–3 m above sea; in moderate and rough seas, mostly by surface plunging. Catch kelp flies by dipping to surface of water near beaches (Burger 1978). Feeding rate (attempts/min) usually higher when feeding on crustaceans than when feeding on fish, because crustaceans usually in dense swarms, and Terns do not have to search for prey (Sagar & Sagar 1989). Terns feeding on crustaceans over beds of kelp *Macrocystis*, averaged 9.4 attempts/min (6.2; 7) and captured 6.7 prey/min (4.7; 7) with 68% success (10.8%; 7) (Sagar 1991). May take food scraps thrown from ships (Falla 1937); indirect evidence that may take offal and regurgitations from Kelp Gull *Larus dominicanus* (Downes *et al.* 1959). Observed following and feeding on prey disturbed by diving Kerguelen Shags *Leucocarbo verrucosus*, with 50% success rate (Sagar 1991). Normally forage alone or in groups of up to 5–6 (Robertson & van Tets 1982; Sagar 1991), though flocks of up to 55 observed (Sagar & Sagar 1989). On Snares Is, other species feeding on crustaceans with Terns (32 observation periods; Sagar & Sagar 1989): Cape Petrel *Daption capense* (94% of observation periods), Silver Gulls *Larus novaehollandiae* (84%), Sooty Shearwaters *Puffinus griseus* (50%), Snares Crested Penguins

*Eudyptes robustus* (28%), Common Diving-Petrels *Pelecanoides urinatrix* (22%), Fairy Prions *Pachyptila turtur* (16%), Buller's Albatross *Diomedea bulleri* (13%), Shy Albatross *Diomedea salvini* (9%); though few interspecific interactions, large flocks of Sooty Shearwaters displaced Terns feeding on swarms of crustaceans (Sagar & Sagar 1989). High winds and rough seas affect feeding: on Snares Is (Sagar & Sagar 1989), overall rate of capture and feeding success significantly reduced with rough seas and increasing wind-speed, reducing the rate of attempt, capture and success of Terns feeding on fish, and the success of Terns feeding on crustaceans.

**Adult** On Heard I. (16 stomachs; Ealey 1954, Downes *et al.* 1959): Annelids: polychaetes: Polynoidae: *Hermadion magahelaensi* 4 no.; Molluscs: shell 1; gastropods 4; Crustaceans: amphipods: Hyperidae: *Hyperia spinigera* 1; Eusiridae: *Pontogeneiella* most; isopods: Sphaeromatidae: *Cerceis* 2; Fish 1. **Other records** Crustaceans (Sagar & Sagar 1989; Sagar 1991; Murphy): isopods (Falla 1937; Segonzac 1972); amphipods (Falla 1937; Segonzac 1972; Robertson & van Tets 1982); euphausiids (Matthews 1929; Parmelee & Maxson 1974; Parmelee 1988): *Euphausia superba* (Valette 1906; Gain 1914); Insects: Diptera: Helcomyzidae: kelp flies *Paractora dreuxi* (Burger 1978); possibly Lepidoptera; Fish (Matthews 1929; Bailey & Sorensen 1962; Parmelee & Maxson 1974; Warham & Bell 1979; Robertson & van Tets 1982; Thomas 1983; Parmelee 1988; Sagar & Sagar 1989): Harpagiferidae: possibly *Harpagifer bispinis* (<50 mm, Burger 1978); Emmelichthyidae: *Emmelichthys nitidus* (Segonzac 1972).

**Young** Fed from 5 h old, with intervals of up to 2.5 h between feeds (Parmelee & Maxson 1974). On Ile de la Possession, Iles Crozet (93 items carried to chicks and mates; Stahl & Weimerskirch 1982): Crustaceans 5.4% no.; Insects: Coleoptera: Curculionidae larv. 2.1; Fish 92.5. **Other records** Crustaceans: isopods (Bailey & Sorensen 1962); Fish (5.1–7.6 cm, Stead 1948; Westerskov 1960; Bailey & Sorensen 1962); Cheilodactylidae: *Nemadactylus macropterus* (76, 80, 90 mm); Nototheniididae: *Notothenia microlepidota* (Sagar 1978).

**Intake** Heard I., stomachs: one contained 21 amphipods *Pontogeneiella*; another, 77 amphipods and one euphausiid; and stomach of one juvenile (that may have fed on regurgitations of Kelp Gull) contained two small fish, several amphipods, one limpet (minus shell) and bones, feathers and stomach of a small bird (Ealey 1954; Downes *et al.* 1959).

**SOCIAL ORGANIZATION** Not well known. Some information from studies on Anvers I., Antarctic Pen. (Parmelee & Maxson 1974) and on Snares Is (Sagar 1978). Often gregarious (Watson 1975). Form flocks after breeding and in non-breeding season; on S. Georgia, form large flocks at end of breeding season, including adults and juveniles (Murphy); on Inaccessible I., juveniles and adults rested on beach in small flocks of 15–20 during Feb. and Mar. (Hagen 1952); on Snares Is, in Mar., appear to congregate in single flock of up to 100 birds, which includes breeding and non-breeding adults, immatures and juveniles (P.M. Sagar). During breeding season, immatures stay in flocks; groups of first-year and second-year birds flock near, and sometimes visit, breeding sites: on Cormorant I., at least 50 on sea-cliff; on Anvers I., up to 30 roosted 22–27 Nov., after which numbers dropped sharply, and in early Dec., flock of c. 20 flew over, then away from breeding area (Parmelee & Maxson 1974; Parmelee 1992). Feed alone or in flocks, sometimes with other species (see Food); on Iles Kerguelen, feed in flocks of up to five (Sagar 1991); on Snares Is, up to 55 (Sagar & Sagar 1989); on Bounty Is, up to six

(Robertson & van Tets 1982); usually seen fishing in small parties (Watson 1975; Urban *et al.* 1986). On Iles Kerguelen, seldom aggressive when feeding near Kerguelan Terns (Sagar 1991). Away from colonies, few other details of sizes of flocks: group of four seen late Sept.; five and 14, Nov.–Dec. (Williams & Burger 1978); four adults, one immature and one juvenile roosting on rock, late Jan.; flock of five adults, three immatures and one juvenile feeding, Feb. (Miskelly 1984); in s. Africa, roosts of two to c. 4500 (Brooke *et al.* 1988).

**Bonds** Assumed to be monogamous. Little known of timing of pair-formation. On Campbell I., courting appears to occur throughout year (Sadleir *et al.* 1986); co-ordinated flights by pairs, and apparent pairing, observed Oct.–Nov. (Bailey & Sorensen 1962). On Anvers I., apparent courtship activities and pairing seen mid-winter; pair-bond possibly maintained between breeding seasons (Parmelee 1987, 1992). On Bounty Is., Fish-flights seen Nov. (Robertson & van Tets 1982). On Marion I., courtship flights seen late Feb. (Rand 1954). On Gough I., courtship feeding and prospecting for nest-sites seen Oct. (Clancey 1981). On S. Georgia, mating seen late Nov. (Murphy). **Parental care** Both parents incubate, defend nest, and guard and feed young; female possibly incubates and broods for longer periods; at one nest, male hunted more (Parmelee & Maxson 1974; Parmelee 1977; Sagar 1978); male said to be bolder and more aggressive to intruders (Murphy). Parents tend young after fledging: for several weeks (Watson 1975); for at least 3 days, after which parents and chicks left breeding area (Sagar 1978). On Anvers I., two adults still defending recently fledged young in Mar. (Parmelee *et al.* 1977); on Campbell I., juveniles seen to be fed by parent in Apr. (Bailey & Sorensen 1962); parents recorded feeding flying young (Hagen 1952).

**Breeding dispersion** Solitary or colonial. Colonial breeding recorded: Snares Is (Stead 1948), Heard I. (Downes *et al.* 1959), Brabant I. (Parmelee & Rimmer 1985), S. Georgia (Prince & Croxall 1983), Elephant I., Gibbs I. (Furse 1979), Petermann I. (Murphy), Booth-Wandel I. (Menegaux 1907), S. Shetland Is (Jablonski 1980), S. Orkney Is (Clarke 1913; reported in error as *S. hirundinacea* [Murphy]); and, extralimitally on Tristan da Cunha and Gough I. (Hagen 1952; Swales 1965; Clancey 1981; Richardson 1984) and Iles St Paul and Amsterdam (Segonzac 1972). Solitary nesting recorded: Macquarie I. (Anon. 1987; T. Howard) and, extralimitally, on Tristan da Cunha (Hagen 1952) and, formerly, Gough I. (Swales 1965). On Snares Is, usually solitary; at one site, closest nests 10 m apart (Sagar 1978). On Iles Kerguelen, of 29 breeding pairs, nine nested singly, with rest in small colonies of up to eight pairs; minimum distance between nests, 3 m (Sagar 1991). On Penguin I., S. Shetland Is, solitary or colonial in groups of 2–6 pairs (Jablonski 1980); on Booth-Wandel I., most nesting groups not more than 6–10 birds close to each other (Menegaux 1907). On Palmer Arch., solitary nesting not uncommon but most nest in small colonies of 2–12 pairs and colonies >40 pairs unusual; nests usually several metres apart but sometimes c. 1 m; at colony on Bonaparte Pt., nests close together: 23 nests in c. 300 m<sup>2</sup> (Parmelee & Maxson 1974; Parmelee 1992). On Elephant I., nests c. 10 to 15+ m apart (Furse 1979). On S. Orkney Is, nests said to be rarely <12 m apart (Valette 1906) or fairly close together (Clarke 1913). Often change breeding grounds between seasons (Parmelee 1992). Sometimes breed near other species (see Breeding). **Territories** Pair defends immediate area round nest and young (e.g. Parmelee & Maxson 1974; Sagar 1978). Said also to defend courtship territory (Gebauer *et al.* 1990).

When birds arrive at start of breeding season, many areas still covered with snow. On Anvers I., attracted to old nesting grounds despite cover of snow; and, on Nelson I., flock of up to 30 defended snow-covered beach, which was later used for nesting (Parmelee & Maxson 1974). On Snares Is, defence noted 9–11 days (n=3 nests) before laying (Sagar 1978), and said to continue throughout breeding (NZRD). On Campbell I., observed swooping at intruders early Sept. (Sadleir *et al.* 1986). When nests close together, territories often only a few square metres in size. When non-incubating bird stands guard, perches close to nest; at more isolated nests, non-incubating bird ranges more widely (Parmelee & Maxson 1974). On Iles Kerguelen, seldom aggressive when feeding close to Kerguelan Terns (Sagar 1991) though said to defend good feeding grounds from other terns (NZRD). **Home-range** Feed inshore and have rather small foraging range (Parmelee 1987).

**Roosting** At night and during day (Brooke *et al.* 1988); on Snares Is, large numbers roost during day (P.M. Sagar). Gregarious (for size of flocks, see above). On S. Georgia, said to feed at sea during day and at night (Murphy). Roosting sites in non-breeding season in s. Africa studied by Cooper (1976) and Brooke *et al.* (1988): Terns that feed inshore roost ashore on low flat rocks (usually headlands) or on sandy beaches, often with other species of terns and gulls; during daylight, birds constantly fly to and from roosts; Terns foraging offshore, to edge of continental shelf and often >150 km from land, stay at sea, probably roosting on water, floating wood, or stipes of kelp *Ecklonia maxima*; most often seen roosting at sea in calm seas. In winter, flocks rest on icebergs and ice-floes near ice-edge. On islands, seen resting on ledges of cliffs during day (Robertson & van Tets 1982) and at night (Murphy). During breeding season on Snares Is, first-year birds and non-breeding adults usually roost near nesting sites (though number of first-year birds at roosts decreased in late Nov.) (Sagar 1978). Pattern similar on Anvers I.: birds usually roosted on top of ridge covered by snow near colony during evening and early morning; numbers of adults increased Nov.–Feb. One nesting male, when not incubating, feeding or chasing terns and skuas, stood guard within 1 m or so of nest or at a favorite perch 30 m away, where others in colony also perched (Parmelee & Maxson 1974). On S. Georgia, flocks form on beaches at first gusts of blizzards, each bird scraping into sand by squatting and turning until it has formed sheltering dugout (Murphy).

**SOCIAL BEHAVIOUR** Detailed study on King George I., S. Shetland Is (Gebauer *et al.* 1990; see Gebauer 1989 for further details); some information from studies on Anvers I., Antarctic Pen. (Parmelee & Maxson 1975) and on Snares Is (Sagar 1978). Birds in colonies become accustomed to hides. Reaction to human intrusion into colonies mild compared with that of Arctic Terns (Parmelee & Maxson 1974). Visual signals of agonistic, territorial and sexual behaviours very similar to those of Arctic Tern (Gebauer *et al.* 1990); agonistic and sexual behaviours of Common Tern (see BWP) observed in both Antarctic (and Kerguelen) Terns, particularly Bent Postures, Erect Postures, aerial courtship, with high- and low-flights followed by glides, Passing Ceremony and courtship feeding; pair-formation and nest attendance behaviours of Antarctic Tern appear generally very similar to those of Kerguelen Tern (Weimerskirch & Stahl 1988).

**Agonistic behaviour** Some behaviours similar to those of Common Tern (see above). Pairs viciously defend nesting territory against own and other species; colonies rarely quiet (Parmelee & Maxson 1974; Sagar 1978; see Parental anti-

predator strategies). On Anvers I., immatures rarely land near nests as, when they do, they are driven off by nesting adults (Parmelee & Maxson 1974). **Threat** Bird guarding nest often challenges neighbour with BILL-DOWN THREAT DISPLAY: calls loudly, pressing body forward with tail up and bill pointed down, and holds closed wings low, somewhat away from body; neighbour assumes similar posture; birds usually threaten for only a few seconds, though threats often repeated; sometimes threats last for over 1 min. When Tern flies low overhead, guarding bird threatens with BILL-UP THREAT DISPLAY, which is like Bill-down Threat Display, but bill pointed skyward as well as downward; sometimes takes to air to give chase. Incubating bird also assumes Bill-up Threat Display and often leaves nest to chase (Parmelee & Maxson 1974). Most common threats, from low to high intensity (Gebauer *et al.* 1990): CROUCH (Fig. 1) where body tilted forward; SLANT (Fig. 2) where bill pointed up (appears similar to Bill-up Threat Display); BOWING (Fig. 3); and AGGRESSIVE UPRIGHT (Fig. 4). Also defend territories using BENT POSTURE (Fig. 5): Tern presents black cap, raises tail, lowers wings and tilts and moves bill away, and gives territorial calls (Gebauer *et al.* 1990). Sagar (1978) mentions that birds dive fiercely and perform bill clicking (Sagar 1978). **Appeasement** Postures appear to include tilting of head and turning bill away (Gebauer *et al.* 1990). **Fighting** Occasionally, threatening birds attack, though appear not to injure each other. Fight on ground or chases can lead to aerial fighting (Parmelee & Maxson 1974; Gebauer *et al.* 1990). Interact

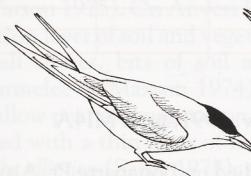


Figure 1 Crouch

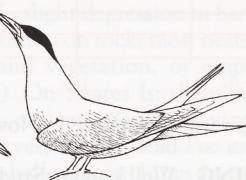


Figure 2 Slant

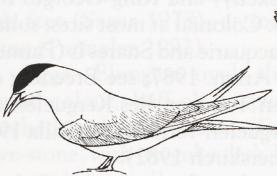


Figure 3 Bowing

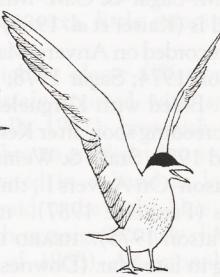


Figure 4 Aggressive Upright

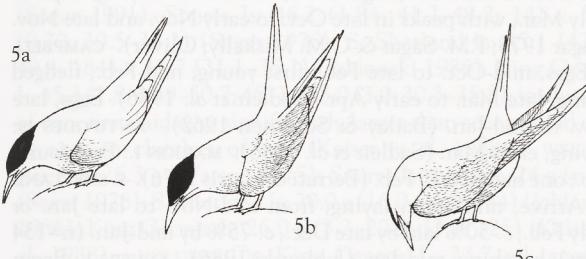


Figure 5 Bent Posture

aggressively with other species in circumstances other than those mentioned in Parental anti-predator strategies (see below). Rarely, may chase or be chased by Kerguelen Terns (Sagar 1991). On Gough I., often attacked Common Noddies

*Anous stolidus* in air near shore, but reason not known (Swales 1965). **Alarm** On Gough I., adults chase and mob skuas whenever they encounter them; do so singly, in pairs, or in flocks, both in and out of breeding season and near or away from nest; sometimes attack in retaliation after skua has attempted to steal food or has attacked eggs or young (Swales 1965).

**Sexual behaviour** Includes high and low courtship flights and ground courtship, including Greeting Ceremony, Bent Posture, Scraping, Parading and courtship feeding (Gebauer *et al.* 1990). **Pair-formation, Courtship, Courtship feeding** Before laying: pairs seen in COURTSHIP FLIGHT, with male carrying small fish held crosswise in bill; pair lands briefly in several places before settling; fish offered to female. After fish taken and eaten, both birds appear to test several sites by pressing breasts to ground, while scraping with feet. Eventually select a site and one bird continues pressing and scraping while other stands by (Sagar 1978). During courtship feeding, female will lower wings and give Begging Calls (Gebauer *et al.* 1990); once incubation has started, male rarely presents fish (Parmelee 1992). Another recorded ground display is PARADING (Fig. 6), where male takes small steps and, during display, lowers wings, and raises and tilts head (Gebauer *et al.* 1990). Fish-flights and Courtship Flights also mentioned by Rand (1954), Bailey & Sorensen (1962), Robertson & van Tets (1982) and Sadleir *et al.* (1986). **Greeting GREETING CEREMONY** (Fig. 7): includes ERECT and BENT POSTURES and in-

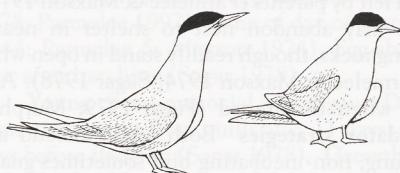


Figure 6 Parading

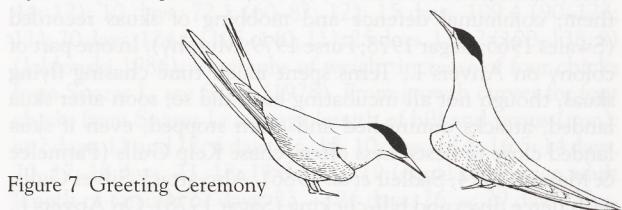


Figure 7 Greeting Ceremony

volves lowering wings, raising tail and tilting head (Gebauer *et al.* 1990). Behaviour during change-over varies. Most commonly, incubating bird suddenly flies from eggs to be replaced by mate later; in another simple form, incubating bird walks off nest and relieving bird settles immediately; sometimes, relieving bird arrives and tries to nudge mate off eggs, but is not always successful. Incubating bird occasionally picks up pebbles, bits of lichen, or soil and tosses them to side or back over shoulder; this behaviour often precedes change-over and incubating bird can pick up and toss material for several minutes before standing and walking off eggs. After moving off nest, departing bird then usually picks and tosses material nearby, not flying off until mate arrives, goes to eggs and settles. Rarely, arriving bird presents small fish to incubating mate; this sometimes preceded change-over (Parmelee & Maxson 1974). Similar change-over described by Sagar (1978): bird flies in and calls before landing near nest; incubating bird then flies from nest as partner flies to nest. When parent arrives at nest with food for chicks, adults greet each other briefly: both point bills and tails up just before food passed to brooding bird (Parmelee & Maxson 1974). **Copulation** Seen

6 days before laying (Sagar 1978). Erect Posture and displacement preening followed copulation (Gebauer *et al.* 1990).

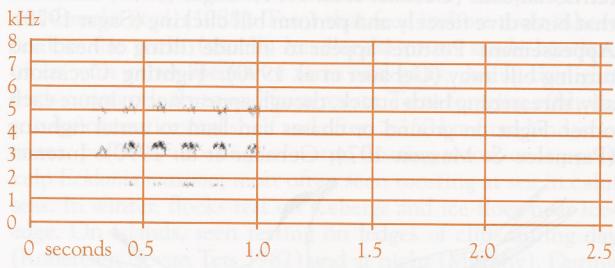
**Relations within family groups** Chicks being brooded initiate feeding by emerging from beneath adult or popping head out. Newly hatched young beg by thrusting head upward while opening and closing mouth; also beg by rubbing bill against bill of parent; chicks successfully fed when 5 h old. Fish either passed from foraging parent to brooding parent before being fed to young, or given directly to young (Parmelee & Maxson 1974; Parmelee 1992). In typical feeding sequence: adult flies towards nest from sea with fish held crosswise in bill, calling when 10–20 m from nest; when it lands, begging chick runs out from vegetation and immediately fed fish, which it quickly swallows whole, head first; adult then flies off and chick returns to vegetation. When two chicks present, first to reach parent is given fish; after several feeds, first chick less responsive to call of incoming parents, which allows sibling to be fed (Sagar 1978). If one chick refuses food, it is given to other or eaten by adult (Parmelee & Maxson 1974). In one brood of two, fledged older chick accompanied parents when feeding and occasionally roosted on exposed rock near nesting site; after younger chick also fledged, both chicks seen flying with parents (Sagar 1978). Another juvenile gave apparent food calls before being fed by parent; food transferred on water not on wing; after transfer, both flew off, young swallowing fish while flying (Bailey & Sorensen 1962). **Anti-predator behaviour of young** When 2–3 days old, run from scrape and hide in nearby rocks when left by parents (Parmelee & Maxson 1974); at about this age may abandon nest to shelter in nearby vegetation or among rocks, though readily stand in open when adults present (Parmelee & Maxson 1974; Sagar 1978). Also recorded freezing when threatened (Furse 1979; Murphy). **Parental anti-predator strategies** Both adults defend and guard nest and young; non-incubating bird sometimes guards nest (Parmelee & Maxson 1974). Pursue skuas and try to strike them; communal defence and mobbing of skuas recorded (Swales 1965; Sagar 1978; Furse 1979; Murphy). In one part of colony on Anvers I., Terns spent much time chasing flying skuas, though not all incubating birds did so; soon after skua landed, attacks diminished and often stopped, even if skua landed close to nests. Less often, chase Kelp Gulls (Parmelee & Maxson 1974; Sadleir *et al.* 1986). Also attack Silver Gulls, with fierce dives and bill-clicking (Sagar 1978). On Anvers I., no interactions seen when nesting close to nesting Southern Giant-Petrels *Macronectes giganteus* (Parmelee & Maxson 1974). Adults mob human intruders (Furse 1979): fly over colony, calling loudly, swooping and dive-bombing but seldom striking, even if chicks handled (Bailey & Sorensen 1962; Parmelee & Maxson 1974; Murphy); when person close to eggs, Terns swoop and call, accompanied by bill-clicking; usually attack from behind (Bailey & Sorensen 1962).

**VOICE** Not well known. Gebauer (1992) distinguishes 13 calls but does not describe them. Colonies noisy and rarely quiet; birds spend much time calling, threatening and chasing (Parmelee & Maxson 1974). Short call given before parent lands when bringing fish to chick (Sagar 1978). Loud calling by bird on guard beside incubating mate (Parmelee & Maxson 1974). When chicks handled, parents fly overhead protesting (Parmelee & Maxson 1974). Fish Call, used in territorial and sexual circumstances, differs in phonetic structure and frequency from Fish Calls of other terns and could be isolating mechanism (Gebauer 1992). Can call while holding fish in bill (Bailey & Sorensen 1962). **NON-VOCAL SOUNDS:** Click

bills while swooping at other birds and people near nest (Sagar 1978); when person near nest, calls accompanied by sharp clicking of bill (Bailey & Sorensen 1962).

**Adult ALARM CALL:** Described as chattering, like rattle of pebbles or gritting of teeth (Murphy) or screaming, scolding and squawking (Bailey & Sorensen 1962); given in flight when people enter territory or after alighting nearby. **BEGGING CALL:** Shrill *ki-ki-ki...* (T. Howard); see sonogram A. **Other calls** Shrill high-pitched *trr-trr-kriah* described as normal call (Watson 1975; Murphy); high-pitched call by incubating bird, apparently to summon mate (Murphy), may be same call. Foraging bird gave churring call when chasing off other Terns (Sagar 1991). Constant shrill squeaking while fishing (Mawson 1915).

**Young** Chick called within 5 h of hatching; calling subsided when fed, increasing c. 1 h later; call much during first day (Parmelee & Maxson 1974). Calls of flying young said to be sweet and mellow (Murphy). Juvenile gave apparent food calls before being fed by parent (Bailey & Sorensen 1962).



A T. Howard; Macquarie I.; Nov. 1991; priv. MI4A

**BREEDING** Well known. Studied on Bonaparte Pt, Anvers I., Antarctic Pen. (Parmelee & Maxson 1974), Snares Is (Sagar 1978; P.M. Sagar & C.M. Miskelly) and King Georges I., S. Shetland Is (Kaiser *et al.* 1988). Colonial at most sites; solitary nesting recorded on Anvers, Macquarie and Snares Is (Parmelee & Maxson 1974; Sagar 1978; Anon. 1987; see Breeding dispersion). Breed with Kerguelen Terns on Iles Kerguelen and Crozet, breeding soon after Kerguelen Terns leave (Falla 1937; Crawford 1952; Stahl & Weimerskirch 1982).

**Season** On Anvers I., time from first egg to last fledging, 132 days (Parmelee 1987). **ILES CROZET:** Laying begins late Dec. (Watson 1975). **HEARD I.:** Earliest eggs, mid-Jan., latest hatching in late Mar. (Downes *et al.* 1959), though laying said to begin late Dec. (Watson 1975). **ILES KERGUELEN:** Laying, late Dec. to mid-Feb. (Sagar 1991). **SNARES IS:** Laying, Sept. to early Mar., with peaks in late Oct. to early Nov. and late Nov. (Sagar 1978; P.M. Sagar & C.M. Miskelly; Oliver). **CAMPBELL I.:** Eggs, mid-Oct. to late Feb.; first young, mid-Feb.; fledged young, late Mar. to early Apr. (Sadleir *et al.* 1986). Eggs, late Nov. to mid-Jan. (Bailey & Sorensen 1962). **ANTIPODES IS:** Laying, early Mar. (Sadleir *et al.* 1986). **MARION I.:** Eggs found Feb.; one hatched 15 Feb. (Berruti & Harris 1976). **S. SHETLAND IS:** Arrive, mid-Sept.; laying, from mid-Nov. to late Jan. or early Feb.; c. 50% laid by late Dec., c. 75% by mid-Jan. (n=134 nests); hatching, mid-Jan. (Jablonski 1986). **ANVERS I.:** Begin nest-scraping, Oct.; eggs, mid-Nov. to late Feb.; hatching, Dec.–late Feb.; fledging, late Dec. to late Mar.; at one colony laying peaked 14–18 Nov.; at another, hatched 6–18 Dec. Breeding prolonged, unusually in polar region. **PETERMANN I.:** Egg, 14 Nov. (Parmelee 1987, 1992).

**Site** On moraines or scree slopes, cliffs, rocks, exposed

tops of ridges, rock-strewn beaches, rock fields by fresh water, ridges of beaches or low areas behind beach, at mouth of stream; in exposed position, on tops and sides of rocks, ledges of cliffs, rocky prominences, on turf; in vegetated crevices of rocks, on ground among rocks, between blocks of stone, coarse shingle, occasionally in gravel on beach or litter on beaches, among tufts of *Poa astonii*; some nests may have screening of light vegetation giving slight protection from weather (Downes et al. 1959; Parmelee & Maxson 1974; Watson 1975; Sagar 1978, 1991; Kaiser et al. 1988; Parmelee 1992; Oliver). On Iles Kerguelen, nests 6 m (1–20; 29 nests) asl and 32 m (1–200; 29) from sea (Sagar 1991); on Iles Crozet: 58 m asl (32.5; 5 nests) and 84 m from sea (63.4; 5) (Stahl & Weimerskirch 1982). In some areas, breeding sites appear traditional (Parmelee & Maxson 1974); in other areas, often change breeding sites between seasons and rarely use old scrapes (Parmelee 1992). Quickly abandon site after loss of eggs to skuas and re-nest at different sites (Parmelee et al. 1977). On Bonaparte Pt, nest near skuas, Southern Giant-Petrels and Kelp Gulls; one nest within 20 m of cluster of seven Giant-Petrel nests (Parmelee & Maxson 1974). On Snares Is., nearly all nests near (often within 3 m) groups of nesting Silver Gulls; and South Polar Skuas *Catharacta maccormicki* breed within 50 m of Terns (Sagar 1978). Probably both sexes select site; appear to test several places by pressing breasts onto ground while scraping with feet (Sagar 1978).

**Nest, Materials** Shallow scrape in pebbles or shells (Watson 1975). On Anvers I., slight depression in bare rock or in thin layer of soil and vegetation on rock; most nests contain small stones, bits of soil and vegetation, or empty shells (Parmelee & Maxson 1974). On Snares Is.: slight scrapes in shallow peat and vegetation, or vegetation in crevice of rock, lined with a thin layer of leaves, usually dead *Poa astonii* and *Hebe elliptica* (Sagar 1978); shallow scratchings in tuft of *Poa astonii*, lined with blades of grass (Oliver). After selecting site, one bird continues pressing breast into ground and scraping with feet (Sagar 1978); at some sites, little scraping before laying (Parmelee 1992).

**Eggs** Elongate oval; slightly glossy (Watson 1975); ground-colour, buff-olive sparsely spotted with sepia and blotched with grey-brown (Falla 1937); brownish stone to olive-stone, with irregular dark-brown and light-brown blotches all over but usually concentrated in a band at larger end (Oliver); ground-colour also said to be light blue (Watson 1975). In clutches of two, each egg significantly different in colour and spotting (Kaiser et al. 1988). Additional descriptions in Kaiser et al. (1988). **MEASUREMENTS (mm):** Iles Kerguelen: 46.7 (1.87; 44.0–50.5; 19) x 33.0 (0.94; 31.3–34.6) (Sagar 1991). Snares Is.: 46.2 (1.84; 41.2–49.2; 14) x 32.1 (0.70; 30.5–33.2) (Sagar 1978). S. Shetland Is.: 45.1 (42.8–49.4; 184) x 33.7 (31.1–35.1) (Jablonski 1986). King George I., 45.3 (1.8; 40.9–50.7; 451) x 33.0 (3.0; 30.3–35.8); in clutches of two, first-laid eggs significantly larger than second-laid eggs or eggs in clutches of one (Kaiser et al. 1988). **WEIGHT:** Average 26.3 g (Watson 1975); Snares Is.: average, 24 g (n=6) (Sagar 1978); S. Shetland Is.: 20.0 g (16.0–25.0; 184) (Jablonski 1986); King George I., 26.0 g (3.2; 20.9–33.0; 125) (Kaiser et al. 1988). **VOLUME:** On King George I., 23.7 ml; average volume decreases during breeding season, mainly in first 30 days of laying period (Kaiser et al. 1988).

**Clutch-size** One to two; almost always one on some islands. A few records of three (Watson 1975; Parmelee 1992). On Antipodes and Heard Is., one egg (Downes et al. 1959; Sadleir et al. 1986). On Snares Is.: average 1.29: C/1 x 10, C/2

x 4 (Sagar 1978); S. Shetland Is.: average 1.37 (Jablonski 1986); King George I.: average 1.5 (Kaiser et al. 1988); Anvers I.: 27 x C/2, 10 x C/1; of the ten C/1 nests, seven abandoned from start; considering only eggs incubated, ratio of C/2 to C/1, 27:2 (Parmelee & Maxson 1974).

**Laying** Synchronous within, but not between, colonies; at Bonaparte Pt, laying spread over 14–16 days (Parmelee & Maxson 1974; Parmelee 1987). Laying interval for one clutch, 48.5–53 h; first egg laid between 06:30 and 10:00, second between 10:30 and 11:30 (Parmelee & Maxson 1974). High rate of predation results in re-laying (Parmelee 1987).

**Incubation** Both sexes incubate (Parmelee & Maxson 1974; Sagar 1978). At one nest on Anvers I., female did 76% incubation; incubating bird determines when change-over takes place. Before settling, Terns often kicked pebbles out of scrape with vigorous backward thrusts of legs and feet; pebbles and other tiny objects within and outside scrape worked over many times during course of incubation (Parmelee & Maxson 1974). Incubating birds sometimes scratch and pick at pebbles at scrape before settling (Parmelee & Maxson 1974). In two-egg clutches, incubation begins after first egg laid (Parmelee & Maxson 1974; Sagar 1978). When eggs from an abandoned nest were placed in a nest where eggs had been lost through predation, the replacement clutch was immediately accepted (Parmelee & Maxson 1974). **INCUBATION PERIOD:** From laying to hatching of last egg: 23–24 days (n=2; Parmelee & Maxson 1974), 24–25 days (n=6; Sagar 1978). Eggs hatched 1–3 days after first pipping; second eggs hatch 2–3 days after first (Sagar 1978; Parmelee 1992). Time of day of hatching, 02:00–09:00 (n=4; Parmelee & Maxson 1974). Egg-shells removed from nest after hatching (Sagar 1978).

**Young** Semi-preocial, nidifugous. Downy at hatching; primaries emerge from quills at c. 11 days; all down gone 1–2 days before fledging (Sagar 1978). **Growth** Weight of young at S. Shetland Is.: at 1 day, 15.8 (13–18; 24); 5 days, 34.1 (25–44; 17); 10 days, 72.1 (60–82; 12); 15 days, 109.4 (90–123; 11); 20 days, 124.6 (105–140; 11); 25 days, 124.2 (100–138; 8) (Jablonski 1986); for graphs of weight increase of four chicks from Snares I., see Sagar (1978). From growth curves for four chicks from Snares I.: average length of bill and tarsus (mm): at 2 days, 11 and 12; 6 days, 16, 15; 10 days, 18.5, 16.5; 14 days, 20, 17; 18 days, 23, 18; 19 days, –, 19 (equal to average adult length of tarsus); 22 days, 23, –; 26 days, 26, –; 29 days, 27, – (Sagar 1978). **Parental care, Role of sexes** Both sexes brood, female apparently doing more (Parmelee & Maxson 1974). Young brooded for 2 days before leaving nest and seeking shelter in nearby vegetation (Sagar 1978). For two young in a nest, hatched 52 h apart: moved about in nest within 5 h of hatching; left nest when c. 37 h old, venturing a few centimetres before returning to be brooded; by 72 h, older chick hid among nearby rocks when not brooded; by 100 h, did not return to nest-scrape; younger sibling abandoned scrape 6 h later, when 58 h old; both moved to rocks c. 5 m away (Parmelee & Maxson 1974). Young fed by both parents, bill to bill; fed irregularly, sometimes not for 2.5 h or more; while still being brooded, fed inside or outside scrape; after leaving nest, run from cover when adult arrives with food, returning to cover after being fed (Downes et al. 1959; Parmelee & Maxson 1974; Sagar 1978; Stahl & Weimerskirch 1982).

**Fledging to maturity** **FLEDGING PERIOD:** Chick-rearing period, 23–25 days (Parmelee 1987); four chicks fledged 27–32 days after hatching (Sagar 1978). Parents attend young for several weeks after fledging (Bailey & Sorensen 1962; Watson 1975); fed by parents for at least 3 days after fledging;

afterwards parents and young leave breeding area (Sagar 1978).

**Success** On Snares Is: from 14 eggs, ten (71%) hatched, five (36%) fledged; five chicks, all <5 days old, died during bad weather (Sagar 1978). On S. Shetland Is: from 184 eggs, 124 hatched (67%), or 0.93 chicks/nest; 71% chicks survived to 5 days, 50% to 10 days, and 33.3% to 25 days; most losses caused by avalanches of stones (Jablonski 1986). On King George I., hatching success averaged 48.3% (3.6–85.8%) with breeding success averaging 0.23 fledglings/breeding pair (Kaiser *et al.* 1988). On Anvers I.: from 57 eggs, 18 (31%) eaten and five (8%) directly or indirectly destroyed by observers. Important factors influencing breeding success: human disturbance, predation by skuas and gulls, and weather conditions (Kaiser *et al.* 1988). On Anvers I., 33–45% nests in centre of colony, where birds concentrated, destroyed by predators (Parmelee & Maxson 1974; Parmelee 1992). Skuas and gulls occasionally take eggs and chicks from unattended nests in small colonies; cannibalism of eggs reported from colonies disturbed by people (Watson 1975); predation of eggs and chicks by skuas increases after young of skuas hatch (Parmelee 1987). Eggs damaged by rats on Campbell I. (Sadleir *et al.* 1986). Early in season, freezes and spring snows can crack eggs or force nests to be abandoned (Parmelee 1992).

**PLUMAGES** Prepared by D.J. James. Medium-sized tern, maturing over about 2 years. Moult to juvenile plumage and fledge when 27–32 days old (Sagar 1978). Undergo partial post-juvenile moult to first immature non-breeding plumage, probably followed by partial pre-breeding moult to first immature breeding. Thereafter, a complete post-breeding and a partial pre-breeding moult each cycle produce non-breeding and breeding plumages, with distinct seasonal variation. Attain definitive plumage with second pre-basic moult to third non-breeding plumage. Age of first breeding not known. Sexes similar. Five subspecies and many insular populations. Following descriptions based on skins (AIM, AM, CM, MV, NMNZ) and photos (Harrison 1987; Pringle 1987; NZRD; unpubl.: M.J. Carter; D.W. Eades; T. Howard; P.M. & J.L. Sagar; A.J.D. Tennyson).

**Subspecies bethunei** Adult breeding (Third and subsequent alternate [summer]). Wing and tail renewed only once a year, in post-breeding moult, but because post- and pre-breeding moults overlap, wing and breeding plumage of head and body fresh at same time. **Head and neck** Forehead, upper lores, crown, nape and hindneck, black, forming neat cap that ends in broad U on lower hindneck; lower edge of cap sharply demarcated on sides of face (level with bottom of eye), and mostly straight, but dipping slightly lower in front of eye. Narrow white cheek-stripe extends from lores between cap and gape, under eye and across ear-coverts to side of nape; stripe narrows slightly in front of eye. Chin, throat and lower ear-coverts, pale grey (86 to pale 86), slightly paler than underparts. Contrast between cheek-stripe and lower cheeks not as bold as in Kerguelen and Black-fronted *S. albostriatus* Terns. Narrow white collar on lower hindneck separates cap from mantle. **Upperparts** Mantle and scapulars, light grey (from between 86 and 85 to nearly as dark as 85); mantle slightly paler than scapulars. Upper back, as scapulars, grading to pale grey (86) on lower back then to white on rump and uppertail-coverts. Rump has much more white than in Black-fronted and Kerguelen Terns, and does not contrast with tail. **Underparts** Breast, belly and vent, pale grey (slightly darker than 86); slightly darker than throat, though difference subtle. Flanks, slightly paler grey. Undertail-coverts, white, sharply

demarcated from vent, despite lack of strong contrast in colour. **Tail** Mostly white; t1–t4, white; t5 and t6 sometimes have faint dusting of pale grey (at darkest, between white and 86) along outer webs, with t5 intermediate between darker t6 and white t4. Grey on tail varies geographically (See Geographical Variation). **Upperwing** Coverts and tertials, as scapulars, except tertials have faint, very narrow white fringes at tips. Secondaries, white on inner web and pale grey, like coverts, on outer web, with broad white tips (c. 15 mm); in flight, upperwing appears pale grey, with even white trailing-edge. Primaries similar to those of Arctic Tern. P10 has grey-black (82) outer web (forming narrow dark leading-edge to outerwing in flight), mid-grey (c84) tip and band along shaft of inner web (c. 5 mm, one-third width of web) and white inner edge. P9 has mid-grey (84) outer web, and mid-grey (84) band (c. 5 mm wide) along shaft and round tip of inner web (hookback); inner two-thirds of inner web, white, tapering to point c. 30 mm from tip. P8–p6, similar, though area of grey on inner web (particularly hookback) becomes narrower and fainter on inner feathers. P5–p1, light grey (c85 on p5, becoming paler inwards, till p1 similar to scapulars) with narrow white edge to inner web, increasing slightly in width on inner feathers (note that Arctic Tern has hookback on p5 and lacks fine white tips to middle primaries; see Recognition). On folded wing, primaries contrastingly darker than upperparts, with narrow white line along upper edge of folded primaries, not reaching wing-tip. Shafts of primaries, white. With wear, grey of primaries darkens considerably, to dark grey (c83). **Underwing** Coverts, subhumerals and secondaries, white. Primaries, white, with distinct dark-grey trailing-edge to outer five primaries (trailing-edge slightly broader and more diffuse than that of Arctic Tern).

**Adult non-breeding** (Third and subsequent basic [winter]). As adult breeding, except for smaller black cap and whiter underparts. **Head and neck** Forehead, crown and anterior lores, white, faintly washed with pale grey; a few scattered feathers of crown have dark tips, which become larger to rear, and middle of lores scaled with black, together making transition to half-cap untidy. Black half-cap extends from nape and hindneck forward across upper ear-coverts and through eye to join black spot in front of eye on posterior lores; a few feathers round eye and ear have inconspicuous white edges; more prominent and profuse white edges on nape and hindneck can give distinctly streaked or mottled appearance. **Underparts** Pure white in some (skins; Downes 1952; Parmelee 1987); others have soft uneven wash of grey-white (between white and 86) on breast and belly. In any case, because post-breeding and pre-breeding moults overlap or follow closely, have white underparts only briefly; more often appear in transition, with smoky mix of grey and white. Apparent brevity of full non-breeding plumage likened to eclipse plumage of some male ducks (Parmelee 1987). It is possible that some populations or individuals do not develop white underparts and have smoky grey underparts only slightly paler than adult non-breeding.

**Downy young** Upperparts and top of head, light brown (c223C), heavily and irregularly blotched black-brown (119) with no distinct pattern. Chin, throat and most of underparts, dull light-brown (c27), finely mottled dark greyish-brown (grey 121) with unmarked circular off-white patch on belly.

**Juvenile** Distinctive; bright and boldly patterned: dark cap untidily streaked buff; upperparts, buff boldly barred brown; throat, breast and belly, buff lightly speckled brown. **Head and neck** Forehead and anterior lores, buff (124) with black-brown

(119) central streaks to feathers (appearing buff with dark streaking). Crown, black-brown (119) with buff (124) edges to feathers (appearing dark with buff streaking). Band round bottom of cap, from in front of eye, across ear-coverts and onto nape and upper hindneck, black-brown (119) with thin streaky buff (124) fringes, which are inconspicuous when fresh and quickly lost; band appears black. Cap not so sharply demarcated as in adult. Buff edges reduced with wear, making cap darker, and fade to white by onset of post-juvenile moult. Lower ear-coverts, chin, throat, foreneck, sides of neck, and lower hindneck, white, with buff (124) wash at tips of feathers, and lightly dusted dark brown (119A); buff wash strongest at base of bill and on throat and neck, and palest beneath cap, forming hint of pale cheek-stripe. White on lower hindneck forms hindcollar separating darker cap from mantle. Buff plumage fades to white with wear. **Upperparts** Mantle and scapulars, buff, boldly barred dark brown; feathers have buff (124) tips (2–3 mm wide), alternating buff and dark-brown (121) subterminal bars (each 3–5 mm wide; brown bars slightly wider than buff bars), and concealed white bases; mantle and anterior scapulars have two brown bars and one buff bar, posterior scapulars three brown bars and two buff. Tips worn off by time of post-juvenile moult of body, but barred pattern remains. Back, light grey (between 86 and 85) with dark-brown (121) subterminal bars and buff (124–118) tips to feathers, though bars ill-defined and back appears mottled when fresh; with wear, appears mottled rich ginger-brown (as tips wear and brown fades). Rump and uppertail-coverts, white, faintly washed pale buff (much paler than 124) with tiny dark-brown (119A) streaks at tips of feathers; buff wash and streaks lost about time of fledging, after which rump appears off-white. **Underparts** Feathers of breast and belly, white, with buff (124) wash distally, and fine short dark-brown (119A) streaks or brindling at tips; appears buff (strongest towards sides) with fine dark speckling; combination of buff and dark brown gives appearance of cinnamon or rust tinge at times, especially at sides (skins; Downes *et al.* 1959). With wear, buff fades rapidly and speckling lost. Flanks, undertail-coverts, thighs and vent, white; most feathers have inconspicuous fine dark peppering at tips. Axillaries, white. **Tail** Central rectrices (t1), white; t2–t5, pale grey (86) on outer web and white on inner web; t6, mid-grey (84) on outer web and white on inner web. All rectrices tipped buff (124) with fine brown (28) speckling round fringe at tip, and brown (28) subterminal chevron or bar separating tip from grey-and-white base. Pattern of tip of all rectrices similar, but varies considerably between individuals. From below, appears mostly white with light-grey (85) outer edge, and mottled or barred buff and brown at tip. **Upperwing** Lesser secondary coverts (except rear row), mid-grey (84) at base grading through dark grey (between 83 and 82) to dark brown (121) distally, and with broad buff (124) fringe (c. 2 mm wide). Median and rear row of lesser secondary coverts have better-defined dark-brown (121) subterminal bar separating mid-grey (84) base from broader buff (124) tip (c. 3 mm wide); subterminal bar, V-shaped on median coverts, straight on lesser coverts. Alula and greater coverts, similar to median coverts, but bases light grey (85). Lesser primary coverts, mid-grey (84) at base, grading to narrow dark-grey (83) subterminal band, with narrow buff (124) tip. Tertiaries, dark brown (121) with broad buff (124) tip and bars; bars become lateral spots basally. Secondaries, pale to light grey (between 86 and 85) on outer web, with broad white tips (c. 15 mm wide, forming prominent trailing-edge) and white inner web; on inner secondaries, grey paler than on

outer secondaries (near 86) and less sharply demarcated from white tips. Innermost secondary (usually s14) has buff (124) wash at tip and dark-grey (c83) subterminal chevron or bar. Inner primaries, mostly pale to light grey (between 86 and 85), outer primaries mostly mid-grey (84); all primaries have white shafts. P10: outer web, grey-black (82); inner web, dark grey (83) next to shaft (about one-third width of inner web), sharply demarcated from white on outer two-thirds of web, which ends c. 20 mm before tip. P9–p8 similar but outer web, dark grey (83), white on inner web ends c. 30 mm short of tip, and dark grey wraps round tip a little, onto inner edge, forming hookback. On p7, outer edge similar, but white not so sharply demarcated from hookback, and with narrow cream (92) edge (<1 mm wide) to distal inner web round hookback. Inner primaries become progressively paler grey (light grey [between 85 and 86 on p1]), and white inner edges extend to tips, so do not have hookbacks; p7–p1 have small apical spot of buff (124) mottling. When perched, narrow white line visible along top of folded primaries, almost reaching tip. **Underwing** Coverts and subhumerals, white. Secondaries, white, strongly translucent. Primaries appear mostly white, with narrow dark-grey (83) edge to outer primary and short dark line on trailing-edge of outer primaries (p10–p7 or p6); outer primaries less translucent than adult.

**First immature non-breeding** (First basic [winter]). Combine retained juvenile wing and tail with adult-like upperparts and white underparts. **Head and neck** Very similar to adult non-breeding. Chin and throat, white. **Upperparts** As adult, except at least sometimes feathers of back have dull-brown (c28) subterminal fringe of streaks, giving dirty appearance. **Underparts** White. **Tail** As juvenile, but buff tip lost. **Upperwing** Prominent broad dark cubital bar persists but buff tips to feathers fade to white or cream (c92) and are narrower. Greater and median coverts lose buff tips; become dark brown-grey (c79) with faintly darker subterminal marks. Alula and greater primary coverts become dark brown-grey (c79). Grey of primaries becomes darker and browner with wear (brownish 83). White tips persist on inner primaries. Tertiaries remain barred with buff tinge persisting. **Underwing** As juvenile.

**First immature breeding** (First alternate [summer]). Existence of a third plumage in first year not confirmed. Appearance of head and body does not change between end of post-juvenile (first pre-basic) moult and beginning of first post-breeding (second pre-basic) moult. Some outer rectrices may be replaced, probably in first pre-breeding (first pre-alternate) moult; new rectrices like those of adult in pattern but shorter.

**Second immature (non-breeding and breeding)** (Second basic [winter] and alternate [summer]). Very similar to adult non-breeding. Have non-breeding head-pattern and, probably, completely white underparts for entire plumage cycle (i.e. no seasonal variation). Some possibly have faintly darker cubital bar (one skin). Watson (1975) said they have a dark-grey cubital bar, and shorter, greyer tail, but these unlikely. Moult earlier than adults, so primaries in different state of wear. Can be identified during breeding season when adults in breeding plumage (P.M. Sagar) but probably not in non-breeding season. See Bare Parts.

**BARE PARTS** Based on photos (as in Plumages, above), museum labels (AIM, AM, MV, NMNZ), and literature as cited. **Adult breeding** Bill, bright red (108–11). Iris, dark brown to black-brown. Orbital ring, small and inconspicuous, dark. Legs, bright red (11–12), often slightly lighter than bill.

**Adult non-breeding** Bill, dark red to reddish black; probably never completely black, though in transition from breeding, show distinct red and black areas; on Snares Is, some darken from tip, but most darken from base (PM. Sagar); on Antarctic Pen., usually darken from tip (Parmelee 1987). Bill said to be black at Heard I. (Downes 1952). Iris and orbital ring, as breeding. Legs, dark red; mottled black in some (Falla 1937; Bailey & Sorensen 1962). **Downy young** At hatching: bill, black, with faint purplish tinge and small white egg-tooth. Iris, dark brown. Legs, pale flesh (Watson 1975) or flesh with smoky tinge (Hagen 1952). Bill and feet, brown (Falla 1937). **Juvenile** Bill, black or brownish black, often with hint of red-brown towards base; gape, orange. Iris, dark brown; also reported as hazel (Falla 1937). Legs, from orange-red to dull brownish-red; become mottled with black in transition to first immature. **First immature non-breeding** Bill, black. Iris, dark brown. Legs, black, with slight dark-red tinge. **First immature breeding** No information. **Second immature non-breeding** Bill, black, perhaps with slightly reddish tinge (photos; museum labels; Hagen 1952). Legs, probably dark red to blackish red.

**MOULTS** Based on skins (AIM, AM, CM, MV, NMNZ); 91 skins of subspecies *bethunei* and 30 of nominate *vittata* examined, with no differences detected between these. **Adult post-breeding** (Third and subsequent pre-basic). Complete; mostly symmetrical. Begins after breeding finished; moult of individuals spans an average 6 months between Feb. and Aug. Most begin Mar. or Apr. (failed breeders sometimes start Jan. or Dec.); timing varies by up to 2.5 months between individuals. Primaries sequentially outwards; usually two, sometimes one or, rarely, three active at a time; outer primaries apparently moult at much slower rate than inner primaries. Greater primary coverts moult with respective primaries. Secondaries moult inwards, sequentially; exact timing unknown. Details of tertials, not known. Tail, centrifugal (outwards), sometimes with irregularities (t6 sometimes before t3-t5); usually symmetrical; begins about when p3 or p4 moulted, finishes about time p10 finished. Moult of head and body begins with first primaries (cap sometimes begins before p1) and finishes when PMS 35-40. Individuals with completely different timing rather common (>5% of skins; Downes *et al.* 1959); Terns in both breeding and non-breeding plumages present all months at Campbell I. (Sadleir *et al.* 1986). Resident Antarctic subspecies *gaini* has more staggered schedule of moult, apparently as a result of asynchronous breeding; moult of body begins as early as late Jan. and moult of flight-feathers as early as late Feb., but always after breeding finished (Parmelee 1992). Migratory subspecies *tristanensis* said to begin moult after arrival in wintering areas in South Africa in Apr.-May (Parmelee 1987), though at Tristan da Cunha, Richardson (1984) said that moult (possibly body-moult) to non-breeding plumage completed by half the adults by 20 Apr. **Adult pre-breeding** (Third and subsequent pre-alternate). Partial; moult all head and body. Begins about May or June, soon after or possibly just before post-breeding moult of head and body finishes, and when post-breeding moult of primaries still under way; finishes shortly after post-breeding moult of primaries, Sept.-Oct. Primaries not moulted and no evidence that tail moulted. **Post-natal** Not evident for at least several days after hatching. Starts with scapulars, mantle, back and belly; then wing-coverts and flanks; then remiges, tail and tail-coverts; head last. **Post-juvenile** (First pre-basic). Partial; moult head and body (skins; Kinsky 1969); reference to *portlandica* plumage

(Downes *et al.* 1959) in error (see Sterninae). Begins soon after fledging, usually in Mar. or Apr., and finishes by June. Sometimes retain a few scattered juvenile scapulars; no evidence of replacement of any feathers of wing or tail. Starting dates well spread because fledging dates vary. Probably rapid. **First pre-breeding** (First pre-alternate). If birds undergo this moult it is a limited partial moult of head and body (probably only part of body). One skin in first post-breeding moult had already replaced t6 in a previous moult. **First post-breeding** (Second pre-basic). First complete moult. Sequence probably similar to that of adult post-breeding. Begins towards end of first year, starting as early as Sept. and finishing Dec. or Jan. Full variation in timing unknown. **Second pre-breeding** (Second pre-alternate). Partial; similar to adult pre-breeding, though earlier.

**MEASUREMENTS** (1-6, 8-11) Skins; T1 = length of t1; T6 = length of t6 (= Tail) (AIM, AM, CM, MV, NMNZ). Differences between subspecies, locations and age-groups tested with sexes combined.

(1-2) Subspecies *bethunei*: Snares, Auckland, Campbell and Macquarie Is: (1) Adults and second-year birds; (2) First-year birds.

	MALES	FEMALES	
WING	(1) 262.1 (6.75; 250-273; 25) (2) 243.4 (5.13; 238-259; 5)	263.5 (5.51; 251-272; 27) —	ns
T1	(1) 70.6 (4.39; 62-81; 26) (2) 64, 73	73.2 (3.82; 65-82; 30) —	ns
T6	(1) 137.9 (6.82; 122-153; 25) (2) 104.6 (2.30; 102-107; 5)	138.4 (6.96; 124-152; 32) —	ns
BILL	(1) 35.7 (1.75; 31.5-39.1; 31) (2) 30.4 (2.85; 26.5-34.0; 5)	34.1 (1.16; 31.7-36.0; 32) —	**
TARSUS	(1) 18.7 (0.75; 17.0-20.5; 36) (2) 18.8 (0.61; 18.2-19.7; 6)	18.2 (0.73; 17.0-20.2; 37) —	*
TOE	(1) 18.3 (0.81; 16.3-19.9; 34) (2) 16.7, 17.8	18.0 (0.70; 16.2-19.1; 36) —	ns

First-year birds have significantly shorter Wing, T6 and Bill ( $P<0.01$ ).

(3-6) Subspecies *bethunei*: Adults and second-year birds (as sample 1): (3) Snares Is; (4) Auckland Is; (5) Campbell I.; (6) Macquarie I.

	MALES	FEMALES	
WING	(3) 263 (4) 258.6 (7.40; 251-269; 5) (5) 263.0 (6.94; 250-273; 14) (6) 262.6 (6.54; 258-272; 5)	265.0 (2.45; 262-268; 5) 266.3 (1.51; 264-268; 6) 263.7 (6.02; 257-271; 7) 260.5 (7.60; 251-272; 8)	ns
BILL	(3) 33.7, 36.5 (4) 35.6 (2.31; 33.5-38.8; 4) (5) 36.1 (1.84; 31.5-39.1; 16) (6) 35.4 (1.33; 33.1-37.2; 8)	34.4 (1.15; 32.2-35.6; 7) 34.6 (1.00; 33.7-36.0; 6) 34.6 (0.70; 33.5-35.4; 6) 33.3 (1.14; 31.7-35.3; 12)	ns
TARSUS	(3) 19.0, 19.2 (4) 18.5 (1.18; 17.5-19.9; 5) (5) 18.7 (0.69; 17.9-20.5; 16) (6) 18.4 (0.86; 17.0-19.4; 12)	17.7 (0.59; 17.0-18.6; 8) 18.5 (0.58; 17.9-19.2; 6) 18.5 (0.65; 17.3-19.3; 7) 18.1 (0.62; 17.2-19.2; 9)	ns

Within NZ subantarctic islands, Campbell I. birds have longer Toe than Snares Is birds ( $P<0.01$ ); no other significant differences. Macquarie I. birds differ from combined birds from NZ islands by shorter Bill and longer Tarsus and Toe ( $P<0.01$ ); see Geographical Variation.

(7) Subspecies *bethunei*: Snares Is, adults, live (P.M. Sagar).

## UNSEXED

WING	(7) 265 (5.1; 256–275; 23)
T6	(7) 135 (8.1; 123–160; 23)
BILL	(7) 36.3 (1.7; 32.9–38.7; 38)
TARSUS	(7) 19.2 (1.2; 16.5–21.6; 38)
TOE C	(7) 27.6 (1.3; 24.6–29.8; 22)

(8) Nominate *vittata*: Heard I. and Iles Kerguelen, adults.

## MALES

## FEMALES

WING	(8) 275.6 (6.53; 269–287; 11)	274.3 (5.82; 265–285; 8)	ns
T1	(8) 73.9 (4.04; 67–80; 9)	72.6 (4.37; 68–78; 8)	ns
T6	(8) 146.3 (6.60; 137–156; 10)	139.8 (6.54; 131–149; 8)	ns
BILL	(8) 33.7 (1.01; 32.1–35.4; 11)	32.5 (1.05; 31.3–34.3; 7)	*
TARSUS	(8) 17.6 (0.71; 16.6–18.8; 11)	17.5 (0.59; 16.8–18.4; 8)	ns
TOE	(8) 17.6 (0.47; 16.9–18.5; 12)	17.4 (0.90; 16.5–18.7; 8)	ns

Nominate *vittata* has significantly longer Wing and smaller Bill, Tarsus and Toe ( $P<0.01$ ) than subspecies *bethunei*.

(9–10) Nominate *vittata*: Adults (as sample 8); (9) Heard I.; (10) Iles Kerguelen.

## MALES

## FEMALES

WING	(9) 276.0 (6.96; 269–287; 5)	272.7 (5.68; 265–277; 4)	ns
	(10) 275.3 (6.80; 270–285; 6)	275.7 (6.40; 271–285; 4)	ns
BILL	(9) 34.0 (1.29; 32.1–35.0; 4)	32.2 (0.97; 31.3–33.6; 4)	ns
	(10) 33.6 (0.89; 32.5–35.4; 7)	32.1, 32.3, 34.3	
TARSUS	(9) 17.1 (0.62; 16.6–18.0; 5)	17.2 (0.53; 16.8–18.0; 4)	ns
	(10) 17.9 (0.62; 17.3–18.8; 7)	17.8 (0.56; 17.1–18.4; 4)	ns

Tarsus of Kerguelen birds slightly but significantly longer ( $P<0.01$ ) than on Heard I.

(11–12) Subspecies *georgiae*: S. Georgia, adults: (11) Skins; (12) From Murphy (1938).

## MALES

## FEMALES

WING	(11) 260, 265	263
	(12) 257.6 (246–270; 18)	262.3 (255–266; 8)
T1	(11) 74, 76	—
T6	(11) 129, 138	—
	(12) 129.2 (123.4–137.5; 18)	131.2 (121.2–134.7; 8)
BILL	(11) 29.7, 31.1, 32.0	—
	(12) 31.2 (30.0–32.8; 18)	29.4 (28.5–30.5; 8)
TARSUS	(11) 16.0, 16.3, 17.8	15.5
	(12) 16.7 (16.0–17.8; 18)	16.5 (15.9–17.5; 8)
TOE	(11) 15.5, 15.6, 16.6	15.5
TOE C	(12) 21.6 (20.1–22.5; 18)	21.9 (21.2–23.9; 8)

Birds from S. Georgia (sample 11) have significantly smaller Bill, Tarsus and Toe ( $P<0.01$ ) than subspecies *bethunei* and *vittata*.

(13) Subspecies *gaimardi*: Deception I. (Murphy 1938).

## MALES

WING	(13) 281.5 (277–284; 4)
T6	(13) 150 (146–157; 4)
BILL	(13) 36.2 (34.7–37.1; 4)

TARSUS (13) 18.6 (18.3–18.8; 4)

TOE C (13) 24.0 (23.2–24.6; 4)

(14) Subspecies *tristanensis*: Tristan da Cunha and Gough Is, and Iles St Paul and Amsterdam; combined data from Murphy (1938), Hagen (1952), Gill (1967) and Segonzac (1972).

## UNSEXED

WING	(14) 257.3 (236–274; 46)
T6	(14) 171.5 (150–188; 19)
BILL	(14) 36.8 (33.0–40.0; 53)
TARSUS	(14) 19.9 (18.5–21.4; 53)

Elliot (1957) reported specimen from Inaccessible I. with tail-streamers (t6) of 198 mm.

Little difference between sexes in all subspecies except males have longer Bill.

**WEIGHTS** (1–4) Adults, museum labels (AM, MV, NMNZ); (1–2) Subspecies *bethunei*: (1) Snares, Auckland and Campbell Is; (2) Macquarie I. (3–4) Subspecies *vittata*: (3) Heard I.; (4) Iles Kerguelen. (5) Subspecies *tristanensis*: Tristan da Cunha and Ile Amsterdam (Hagen 1952; Gill 1967).

	MALES	FEMALES	
(1)	150 (12.7; 140–168; 4)	159 (15.3; 135–187; 14)	ns
(2)	160 (7.20; 150–168; 6)	154 (6.80; 144–163; 9)	ns
(3)	146 (26.7; 115–188; 5)	155 (4.08; 150–160; 4)	ns
(4)	115, 135, 188	142, 142	
(5)	140 (13.0; 120–159; 10)	139 (10.8; 125–160; 11)	ns

Subspecies *bethunei*: Snares Is, adults, live: 144 (10.9; 127–168; 37) (P.M. Sagar). Nominate *vittata*, Iles Kerguelen, juveniles, skins, collected just before fledging: 133 (21.2; 113–170; 8) (MV).

(6–8) Seasonal changes in weight, sexes combined: (6–7) Subspecies *gaimardi*, Anvers I., Antarctic Pen. (Parmelee 1988); (6) Adults; (7) 'Subadults'. (8) Nominate *vittata* and subspecies *bethunei* combined, adults; data from museum labels from subantarctic islands (as samples 1–4 above).

	OCT.–MAR. (SUMMER)	APR.–SEPT. (WINTER)	
(6)	168 (10; 25)	202 (14; 19)	**
(7)	160 (15; 9)	190 (12; 8)	**
(8)	149 (17.2; 115–188; 27)	159 (7.96; 144–175; 20)	*

Suggested that resident birds on Antarctic Pen. accumulate fat reserves for energy, and perhaps insulation, as an adaptation to extreme winter conditions (Parmelee 1988). Trend to increased weights in winter appears not to be so marked in subantarctic populations.

**STRUCTURE** Wing, long, narrow and pointed; proportionately slightly broader and shorter than that of Arctic Tern. Eleven primaries: p10 longest, p9 10–20 mm shorter, p8 30–42, p7 52–65, p6 73–89, p5 93–107, p4 102–130, p3 128–149, p2 142–164, p1 158–175; p11 minute. Seventeen to 18 secondaries, including 3–4 tertials; tips of longest tertials fall between p3 and p5 on folded wing. Tail, long and deeply

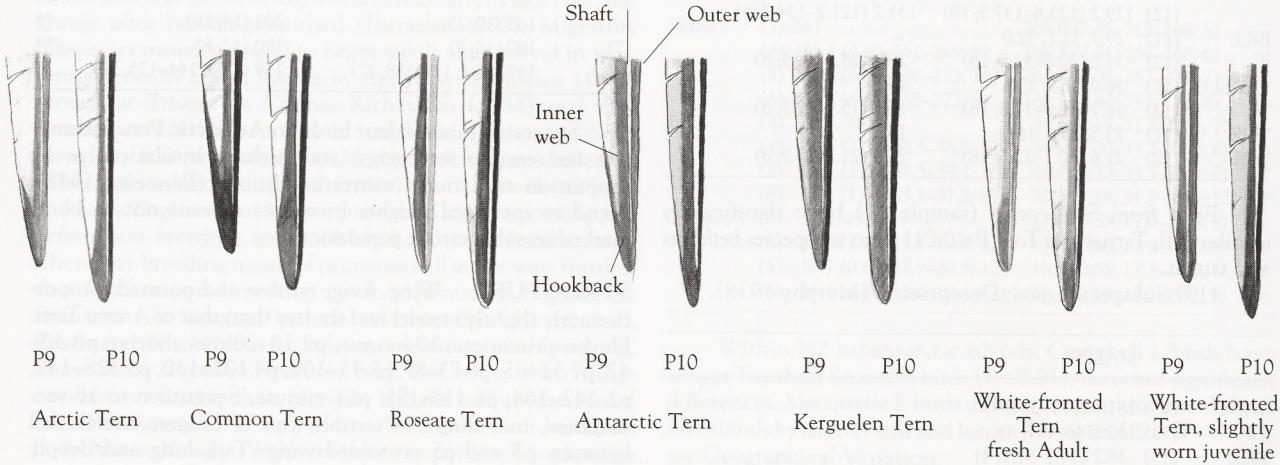
forked; shorter than tail of Arctic and White-fronted Terns and longer than tail of Common and Kerguelen Terns; 12 rectrices; in adults, t6 elongated to form tail-streamer, length varying geographically (see Measurements); at rest, tail-streamers fall close to wing-tips in most subspecies, but well beyond wing-tips in subspecies *tristanensis*. Juveniles have shorter outer rectrices and shallower tail-fork than adults. Bill, fine and straight except for gently decurved ridge to culmen and prominent gonydeal angle about half-way along lower mandible; longer and heavier than bill of Arctic and Common and much longer than that of Kerguelen Terns. Nostril, elongated slit; perforate. Tarsus, quite short, though longer than that of Arctic Tern; scutellate in single row on front of tarsus and top of toes, reticulate elsewhere. Toes, slender; front toes fully webbed; outer toe 92–97% of middle, inner 68–78%, hind 19–27%, raised.

**RECOGNITION Recognition of medium-sized *Sterna* terns** (Prepared by D.I. Rogers.) The following summary concentrates on features diagnostic in the hand in all plumages for Common, Arctic, Antarctic, Kerguelen, Black-fronted, White-fronted and Roseate *S. dougallii* Terns. Figure 8 shows the upper surface of p9 and p10 for all but Black-fronted Tern. For further distinctions, see the relevant Field Identification and Plumages accounts and colour plates (Plates 37–40); also see Baker (1993) for Common and Arctic Terns.

**Arctic Tern** Tarsus, short (14.5–17.0 mm); always shorter than tarsus of White-fronted, Roseate or Common Terns, but tarsus of largest Arctic overlaps with that of smallest Antarctic and Kerguelen Terns, and with many Black-fronted. All remiges translucent. Pattern of outer primaries diagnostic: (1) p6–p9 always have hookbacks (unlike all Roseate and White-fronted Terns); (2) dark-grey strip on inner web of p10 (next to shaft), narrow, 2.0–3.0 mm wide at level of p6 on folded wing (4.2–5.5 mm in Common Tern; wider still in other terns with hookbacks).

**Kerguelen Tern** In most plumages, underwing-coverts and subhumerals, pale grey (resembling Black-fronted Tern, but unlike white underwing-coverts in all plumages of other *Sterna* considered here). Juveniles have white underwing-coverts but pattern of underparts differs markedly from other *Sterna*. Underparts, not clean white in any plumage; remiges not translucent. Outer primaries, light grey (darker when worn) with only narrow grey-white inner edge (broader in other *Sterna*); hookbacks rather small and diffuse.

Figure 8



**Black-fronted Tern** Pattern of remiges and, in most plumages, grey-tinged underwing-coverts and subhumerals, similar only to Kerguelen Tern, with which unlikely to overlap. Kerguelen generally greyer, e.g. rump and inner edges of primaries usually have pale-grey tinge (cleaner white in Black-fronted). Legs of Black-fronted, orange at all ages (red or black in all other terns treated here). Bill of Black-fronted has less pronounced gonydeal angle, and more strongly decurved culmen than Kerguelen; also usually differs in colour.

**Common and Antarctic Terns** Have similar pattern of outer primaries and are difficult to distinguish in non-breeding plumages. Translucence of remiges differs: in Common, only inner four primaries and (sometimes) outer one or two secondaries strongly translucent; in Antarctic, most remiges (including all secondaries) strongly translucent (but translucence of outer primaries not so marked as in Arctic). Hookbacks of Antarctic slightly narrower and shorter than those of Common, and dark trailing-edge of outer primaries generally crisper, narrower and longer. On inner web of p10, dark strip bordering shaft broader on average in Antarctic, especially at base of feather, and inner boundary of strip is more diffuse than in Common; this especially obvious when worn, when boundary still clear-cut in Common, but, in Antarctic, boundary faded so there may be a distinctly paler-grey zone between the white inner edge and the mid-grey strip bordering shaft. In other plumages, many additional characters allow identification: e.g. adult Antarctic has predominantly red bill, most Common Terns in HANZAB region have mainly or all-black bill; in breeding plumages, Antarctic lacks moult-contrast in primaries, which Common has; juvenile Antarctic has buff-and-brown brindling on breast, juvenile Common has white underparts.

**White-fronted and Roseate Terns** Differ from other terns above in lacking distinct hookbacks. White inner edges of outer primaries extend to tips of feathers, and are visible on folded wing as broad white line along top of folded primaries (except in a few exceptionally worn birds). Roseate is markedly smaller than White-fronted, e.g. wing of Roseate always <230 mm in HANZAB region, at least 260 mm in White-fronted.

**GEOGRAPHICAL VARIATION** Complex and information not complete; last revised by Murphy (1938). Five subspecies recognized here, following Murphy (1938) and data below. Many insular populations.

**Subspecies bethunei** (Based on examination of 91 skins, including 29 from Macquarie I.) Little geographical variation in plumage in NZ region. Population on Macquarie I. described as separate subspecies *macquariensis* by Falla (1937) but validity of subspecies questioned by Murphy (1938); synonomized with *bethunei*, by Falla, in NZCL 1953. However, Macquarie I. birds intermediate between NZ and subantarctic Indian Ocean populations. Birds from Macquarie I. differ from those of NZ region by: (1) slightly darker grey upperparts and underparts in adults (identical to birds from Iles Kerguelen), though difference slight; (2) outer three rectrices of adults have more extensive pale-grey (86) wash or dusting on outer webs, similar to Kerguelen birds; (3) shorter bill and longer tarsus and toe (see Measurements). Birds from Macquarie I. differ from nominate *vittata* from Heard I. and Iles Kerguelen by: (1) paler, more buff underparts in juvenile plumage (similar to NZ juveniles); (2) much shorter wing and longer bill and tarsus. Macquarie I. population probably does not warrant subspecific status and best classified under subspecies *bethunei*, though it differs from the type-population of *bethunei*.

**Nominate vittata** (Based on examination of 30 skins from Heard I. and Iles Kerguelen.) Heard and Kerguelen populations differ only in possibly slighter longer tarsus on Kerguelen (see Measurements). Differ from subspecies *bethunei* by: (1) in adult breeding plumage, very slightly darker grey above and slightly darker grey below, thus having less contrast between upperparts and underparts; (2) in adult breeding plumage, chin and throat concolorous with breast (usually paler in *bethunei*), highlighting cheek-stripe a little more; (3) in adult plumage, outer webs of outer three rectrices washed pale grey (c86); (4) in adult plumage, possibly a slightly broader dark trailing-edge to outer primaries; (5) in juvenile plumage, slightly darker and browner (less buff) ground-colour to breast, recalling colour (but not distribution of pattern) in Kerguelen Tern; (6) longer wing and smaller bill, tarsus and toe. No data on taxonomy of populations on Iles Crozet, Prince Edward Is and Bouvetøya.

**Subspecies georgiae** (Based on examination of five skins from S. Georgia.) Differs from subspecies *bethunei* by: (1) in adult breeding plumage, chin and throat concolorous with breast; (2) in adult plumage, t4 and t5 pale grey on outer webs, and t6 light grey (85) basally grading to dark grey (83) distally on outer web; (3) in adult plumage, shorter tail-streamers (Murphy 1938); (4) in fresh juvenile plumage, tips of scapulars and primaries, cream (54), not buff (124) (one skin); (5) much shorter bill, tarsus and toe (the smallest subspecies [Murphy 1938]; see Measurements). Breeding on S. Sandwich Is needs confirmation. No data on taxonomy of populations on S. Orkney Is (Murphy 1938); tentatively included under *georgiae* on geographic grounds.

**Subspecies gaini** (No specimens examined). Described by Murphy (1938) on basis of large size of four male skins from Deception I., S. Shetland Is, compared with ten males of subspecies *georgiae* from S. Georgia (see Measurements); otherwise, not known to differ from subspecies *georgiae* (Murphy 1938). No data on taxonomy of populations from Antarctic Pen.; tentatively included with *gainsi* on geographical grounds.

**Subspecies tristanensis** (No specimens examined). According to Murphy (1938), differs from nominate *vittata* by: (1) larger size (longest tail and tarsus; second longest wing after subspecies *gainsi*); (2) plumage slightly paler grey; and (3) grey band next to shaft on inner web of primaries narrower. Appears to be another example of biogeographical affinities of Iles Amsterdam and St Paul in the Indian Ocean with Tristan

da Cunha and Gough Is in the Atlantic Ocean (all near 40°S), rather than with islands at higher latitude in the Indian Ocean (Prince Edward Is, Iles Crozet and Kerguelen, and Heard I.) (see, for example, Rockhopper Penguin *Eudyptes chrysocome* and Great [Subantarctic] Skua *Catharacta skua*) (Segonzac 1972; HANZAB). Nonetheless, more systematic comparison of Atlantic and Indian Oceans populations needed. A chick banded on Stag I., Cape Province, South Africa, Aug. 1940, was recovered at sea, Jan. 1941, and identified as a 'subadult' of subspecies *tristanensis* by R.C. Murphy (Courtenay-Latimer 1957). This appears to be the only breeding record to date from South Africa. However, Antarctic Tern was not mentioned in a review of species there (Brooke et al. 1988) and Cooper (1976) and Maclean (1985) considered record equivocal.

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Arctic Tern *Sterna paradisaea* (page 668)

1 Adult breeding, fresh plumage, boreal summer; 2 Adult non-breeding, austral summer; 3 Juvenile, moderately worn plumage, first austral spring

Kerguelen Tern *Sterna virgata* (page 692)

4 Adult breeding; 5 First immature non-breeding

Antarctic Tern *Sterna vittata* (page 677)

6 Adult breeding; 7 Adult non-breeding; 8 First immature non-breeding

Black-fronted Tern *Sterna albostriata* (page 699)

9 Adult breeding; 10 First immature non-breeding



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Volume 3, Plate 40

Kerguelan Tern *Sterna virgata* (page 692)

1 Adult breeding; 2 Adult non-breeding; 3 Juvenile; 4 First immature non-breeding

Antarctic Tern *Sterna vittata* (page 677)

5 Adult breeding; 6 Adult non-breeding; 7 Downy young; 8 Juvenile; 9 First immature non-breeding

Arctic Tern *Sterna paradisaea* (page 668)

10 Adult breeding, fresh plumage, boreal summer; 11 Adult non-breeding, austral summer; 12 Adult, in early stages of moult from breeding to non-breeding plumage, austral spring; 13 Juvenile, moderately worn plumage, first austral spring; 14 Second immature breeding, boreal summer

Black-fronted Tern *Sterna albostriata* (page 699)

15 Adult breeding; 16 Adult non-breeding; 17 Downy chick; 18 Juvenile; 19 First immature non-breeding