

Text and images extracted from

Higgins, P.J. & Davies, S.J.J.F. (editors) 1996. Handbook of Australian, New Zealand & Antarctic Birds. Volume 3, Snipe to pigeons. Melbourne, Oxford University Press. [Vol. 2, pages 648-649] Vol. 3, pages 384-387, 438-447; plates 24, 26 & 27.

Reproduced with the permission of BirdLife Australia, Frank Knight & Brett Jarrett.

648 Charadriiformes

## 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.

## REFERENCES

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

## Family LARIDAE skuas, jaegers, gulls and terns

A large assemblage of small to very large charadriiform seabirds. We recognize four subfamilies within the Laridae following Mayr & Amadon (1951), AOU (1983).<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) moults complete or partial, varying within and between families; moults of subadults complicated and vary between subfamilies (see subfamily accounts). Generally slow to mature, attaining adult plumage when 2–4 years old and first breeding at 2–4 years (smaller gulls and terns) to 4–9 years (many skuas and larger gulls and terns); some may breed in first year (e.g. *Sterna albifrons*).

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

See subfamily accounts for summaries of social organization and breeding.

## REFERENCES

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

## Subfamily STERCORARIINAE skuas and jaegers

Medium to large (50–65 cm) predatory and scavenging seabirds. About six species in two genera: (1) *Catharacta* (skuas) comprises three or four species (but their taxonomy complex, see below), mostly of Subantarctic and Antarctic; two species occur HANZAB region; (2) *Stercorarius* (jaegers) comprise three species that breed in n. hemisphere and migrate to s. hemisphere for boreal winter; all three are non-breeding migrants to HANZAB region. Morphological and behavioural studies often agree in finding these genera to be distinct (Devillers 1978; Furness 1987; Christidis & Boles 1994), but Olson (1985) found no osteological basis for recognizing two genera, and recent preliminary study of mitochondrial DNA (Peter et al. 1994) found unexpected similarity between *S. pomarinus* and *C. skua*; further biochemical research needed. Relationship between skuas and other Laridae unclear; morphological studies generally suggest closest to Larinae (e.g. Strauch 1978; Furness 1987; Chu 1995) while studies of behaviour (Moynihan 1959) and DNA–DNA hybridization (Sibley & Ahlquist 1990) suggest they are equally related (sister-group) to all other Laridae. Major review of biology, morphology and taxonomy in Furness (1987).

The genus *Catharacta* comprises six closely related forms (all but one of which breeds in s. hemisphere), and boundaries between species and subspecies difficult to define: *skua* breeds North Atlantic; *lonnbergi*, circumpolar, breeding subantarctic islands and Antarctic Pen.; *hamiltoni* breeds Tristan Grp and Gough I., South Atlantic Ocean, and it is probably this form that occurs Iles Amsterdam and St Paul, Indian Ocean; *antarctica* breeds Falkland Is and Patagonia; *chilensis* breeds coastal Chile and Patagonia; and *maccormicki* is circumpolar on Antarctic Continent, continental islands and South Shetland Is. Both *maccormicki* and *chilensis* usually treated as separate monotypic species. Other four usually treated as one or two species, but treatment complicated by nomenclatural priorities: the three s. circumpolar taxa *antarctica*, *lonnbergi*, and *hamiltoni* almost always treated as subspecies of a single species, and North Atlantic *skua* treated as separate species or fourth subspecies with s. taxa. If all four treated as one species, *skua* has nomenclatural priority (thus *C. skua* with four subspecies); if treated as two species, *C. skua* monotypic, and *C. antarctica* has three subspecies. (The specific name used for s. hemisphere

## Plate 24

- |  |  |
|--|--|
| Great Skua <i>Catharacta skua</i><br>(page 388)  | Pomarine Jaeger<br><i>Stercorarius pomarinus</i> (page 438)                |
| 1 Adult on breeding grounds,<br>austral summer; 2 Downy<br>young; 3 Juvenile   | 8 Adult female breeding, light<br>morph; 9 Juvenile, intermediate<br>phase |
| South Polar Skua<br><i>Catharacta maccormicki</i><br>(page 412)  | Arctic Jaeger<br><i>Stercorarius parasiticus</i> (page 448)                |
| 4 Adult pale morph, in worn<br>plumage at breeding grounds,<br>austral summer; 5 Adult<br>dark morph, in fresh plumage<br>at breeding grounds, austral<br>summer; 6 Downy<br>young; 7 Juvenile | 10 Adult breeding, light morph;<br>11 Juvenile, intermediate phase         |
|  | Long-tailed Jaeger <i>Stercorarius</i><br><i>longicaudus</i> (page 459)    |
|  | 12 Adult breeding, light morph;<br>13 Juvenile, intermediate phase         |

forms has little biological implication beyond whether *skua* has differentiated sufficiently to be considered a species; *Catharacta* clearly radiated in s. hemisphere and *skua* is a recent offshoot from a s. ancestor [Furness 1987; cf. Brooke 1978].) Here we treat *skua*, *antarctica*, *lonnbergi* and *hamiltoni* as subspecies of *C. skua* and recognize *maccormicki* and *chilensis* as separate species (following Devillers 1977, 1978; Furness 1987; Christidis & Boles 1994; BWP; NZCL). Forms of *Catharacta* mostly allopatric; some hybridization occurs in all areas of contact between breeding forms. For fuller discussion of hybridization, variation and taxonomy in *Catharacta*, see Great (Subantarctic) Skua: Geographical Variation.

Body, robust and thickset, especially in *Catharacta*. Females larger than males: females 11–17% heavier during breeding season, and wings 1–4% longer, but differences slight or absent in other linear measurements. Wings, long; narrow and pointed, with angled carpal joint in *Stercorarius*; broader, straighter and blunter in *Catharacta*; 11 primaries; p11 minute; 17–20 secondaries. Tail, short, slightly wedge-shaped to rounded in *Catharacta*; 12 rectrices; central pair (t1) project slightly in *Catharacta* and most plumages of *Stercorarius*; greatly elongated in adult breeding plumages of *Stercorarius*, forming long tail-streamers (the shapes of which are diagnostic of species); tail-streamers often broken off (or intentionally bitten off) during breeding season. Bill, short, heavy and powerful, with strongly hooked tip to upper mandible and prominent gonydeal angle; superficially gull-like, but rhamphotheca complex, with four distinct sheaths on upper mandible: (1) sheath of lateral edge; (2) strongly curved distal sheath (unguis), smoother and more rounded than tip of bill of gulls; and (3) pair of separate, soft, thin dorsal plates covering nostrils, forming distinct cere (absent in all other Laridae). Head, rounded; neck, thick and strong. Coracoids do not overlap. Sternum has one notch on each side. Legs, short, superficially gull-like, but with very short bare part on tibia. Tarsi, short; scutellate in *Stercorarius*; with single row of scutes at front and reticulate scaling elsewhere in *Catharacta*; scales hard (soft and fleshy in other Laridae). Four toes; hindtoe, short, raised; front toes, fully webbed. Claws, moderately long, strong, laterally compressed, strongly hooked and sharp; combination of strongly hooked claws and fully webbed toes unique among birds. Oil-gland feathered. Caeca present, large, much longer than in Larinae. Supra-orbital salt-glands, well developed. Down occurs on both pteryiae and apteria.

Sexes similar in plumage. Bare parts not brightly coloured, unlike Rynchopinae and many Larinae and Sterninae. Iris, black-brown. Bill, dull brown to black. Legs, blue-grey to black. In most *Catharacta*, plumages dark brown, with varying red and yellow tints; great individual variation in plumages within populations (though variation associated with wear, age and season poorly understood). South Polar Skua *C. maccormicki* and all *Stercorarius* polymorphic, with dark morphs (very rare in Long-tailed Jaeger *S. longicaudus*) and varying light morphs (including so-called intermediate morph, which often recognized for convenience); ratios of morphs vary geographically in some species. White bases of primaries form conspicuous patches in wing of all species, but less conspicuous in *Stercorarius*. Light morph *Stercorarius* have white in underbody of adults and subadults. Similarity of plumages between species and great individual variation complicates field identification. Adults moult twice annually: a complete post-breeding (pre-basic) moult and a partial pre-breeding (pre-alternate) moult; both occur mainly while migrating or in non-breeding areas. Young hatch with long soft woolly down, mostly uniform greyish-brown but slightly paler on belly, tips of wing-pads and around and in front of eyes; chicks of *C. maccormicki* very pale all over. Although precocial, chicks dependent on parents for some time. Bill, legs and feet of juveniles paler than in adult and area of black increases with age in *Stercorarius*. Juveniles strongly barred below in *Stercorarius* (unique among Laridae) but not *Catharacta*, one of main reasons for generic separation (Brooke 1978; Furness 1987). Juvenile plumages of *Stercorarius* polyphasic; coloration of juvenile plumage not necessarily related to colour of immature or adult plumage (hence use of phase in accounts, q.v.). Immatures of *Stercorarius* recognized by barred underwing-coverts; gradually attain adult plumage through a series of immature plumages; length of central rectrices increases with age until adult plumage attained. Transition to adult plumage also gradual in *Catharacta*, but immatures difficult to age and subadult moults poorly known. Minimum age of first breeding probably 4–8 years old in *Catharacta* (Furness 1987); c. 4 years old in *Stercorarius*; in Arctic Jaeger *S. parasiticus*, average age of first breeding appears to vary with morph (see Arctic Jaeger: Plumages).

*Catharacta* breeds s. hemisphere, except for outlying population (*C.s. skua*) breeding in North Atlantic. *Stercorarius* circumpolar breeders in high latitudes of n. hemisphere. Migratory, but non-breeding range of all species poorly known. Marine in non-breeding season, in pelagic or (less often) coastal waters. *Stercorarius* migrate S in boreal winter to poorly known wintering areas in Pacific, Indian and Atlantic Oceans. Migrations of *Catharacta* more varied and poorly known, but at least South Polar Skua long-distance trans-equatorial migrants, and almost all leave breeding colonies in non-breeding periods; some Great (Subantarctic) Skua stay near breeding islands in non-breeding periods.

Opportunistic predators, scavengers and, notably, kleptoparasites, though importance of kleptoparasitism varies greatly between species. Feed on land and at sea, taking a variety of carrion, small mammals, eggs and young of seabirds, burrowing petrels, land birds and fish, crustaceans, molluscs, offal and garbage. At times, approach or follow boats, feeding on offals or scraps thrown overboard or stealing food from other seabirds. Pomarine Jaeger and some populations of Long-tailed Jaeger depend almost exclusively on lemmings during breeding season. At sea, food

taken mostly by dipping, surface-diving, pattering and aerial pursuit; also piracy. On land, use a variety of methods, including direct attacks, stealing and scavenging. Feeding behaviour of South Polar Skua influenced by presence of Great (Subantarctic) Skua in areas where both species breed (see South Polar Skua: Food). Some individuals defend feeding territories or type-A territories.

Behaviour well studied. Established pairs normally monogamous, with pairs re-forming at start of each breeding season on traditional territories. However, Pomarine Jaegers do not retain same mates or territories but roam nomadically and breed opportunistically and Great (Subantarctic) Skuas in some locations, including HANZAB region, breed in trios as well as pairs (e.g. Bonner 1964; Burton 1968a,b; Young 1978; Hemmings 1989). Trios usually consist of two males and a female (Hemmings 1989). Trios not recorded for South Polar Skua. Nests well-spaced and territories vigorously defended. Clubs a feature of large colonies, generally where non-breeding birds gather to rest together or to practice displays and behaviours. Most jaegers and skuas have same patterns of displays, though only jaegers use a distraction display as well as diving at intruders near nest. During most activities, *Catharacta* typically display white patches in wings by stretching wings vertically. Jaegers and skuas have fewer displays than gulls, and displays generally aggressive, with fewer appeasing postures than gulls. Fight often. Main types of aggressive behaviours involve Upright (equivalent to Upright of gulls), Oblique, Bent, and Long Call Complex. Most conspicuous display, Long Call Complex, combines Oblique and Bent displays with Wing-raising and Long Call; involved in territorial advertisement and in agonistic and sexual encounters. Long Call Complex differs between taxa of skua. Tail-raising important display between prospective mates; performed on ground within territory and displays central rectrices (which are diagnostic of age and species in jaegers). In established pairs, Scoop-making or Scraping may begin only a couple of days after a pair reforms. Young precocial and, if undisturbed, semi-nidifugous; fed by both parents, food being given in bill or regurgitated onto ground. Dependent on food from parents for long period. When food short, usually only one chick fledged by each successful pair; second-hatched chick, younger by 1–2 days, often killed by sibling. Chicks of all species show cryptic behaviour when predators present. Adults show alarm by calling or attacking, sometimes swooping and striking intruder. Only Arctic Jaeger has full distraction-lure display, though Pomarine and Long-tailed Jaegers less often use an incomplete distraction-lure type display. No such displays by *Catharacta* species. Often bathe in fresh water, though will bathe communally in seawater where no freshwater sites. Interspecific hybridization occurs between *Catharacta* species (see above, accounts, and Great Skua: Geographical Variation).

Breed seasonally. *Stercorarius* in high latitudes of n. hemisphere in boreal summer; *Catharacta* in austral summer (except outlying population *C. skua skua* breeding North Atlantic in boreal summer). In *Catharacta*, season broadly Sept.–Feb. but onset of laying varies with latitude, Sept.–Nov. in mid-latitudes, later in Antarctic (Young 1977). S. hemisphere *Catharacta* nest in or round penguin colonies; in sheltered snow-free areas on flat or sloping ground, in valleys, on small hills, moraines, cliff edges; *Stercorarius* on tundra and, in Arctic Jaeger, in moorland. Nest, a scrape or scoop in gravel, soil or vegetation, sometimes with rim; lined or unlined; nests sometimes more substantial. Colour of eggs vary from light grey, pale green or greenish blue to olive-brown or dark stone, with irregular blotches of light or dark brown, yellow-brown or purple. Usually two eggs per clutch, occasionally only one. Eggs laid at intervals of 2–8 days in *Catharacta*. Both sexes incubate, either beginning with first egg (e.g. South Polar Skua) or when clutch complete (Great Skua). Incubation period, 24–34 days, mostly 28–30 days. Hatching asynchronous. Young, semi-precocial. Both sexes feed and brood young. Chicks may leave nest within 24 h but chicks of South Polar Skua may stay in nest for up to 27 days. Parent regurgitates food onto ground then picks up pieces, which chick takes; older chicks catch food as it is being regurgitated or take food from ground. Age of first flight, 49–65 days. Young fed by parents after fledging though start feeding themselves at c. 7 weeks. May remain in parents' territory for 3–4 weeks after fledging.

## REFERENCES

- Bonner, W.N. 1964. Br. Antarct. Surv. Bull. 3: 41–7.
- Burton, R.W. 1968a. Br. Antarct. Surv. Bull. 15: 9–28.
- 1968b. Br. Antarct. Surv. Bull. 16: 15–39.
- Brooke, R.K. 1978. Durban Mus. Nov. 11: 295–308.
- Christidis, L., & W.E. Boles. 1994. RAOU Monogr. 2.
- Chu, P.C. 1995. Condor 97: 174–96.
- Devillers, P. 1977. Auk 94: 417–29.
- 1978. Gerfaut 68: 374–417.
- Farner, D.S., et al. (Eds) 1985. Avian Biology. 8. Academic Press, Lond.
- Furness, R.W. 1987. The Skuas. Poyser, Calton, England.
- Hemmings, A.D. 1989. J. Zool., Lond. 218: 393–405.
- Moynihan, M. 1959. Am. Mus. Novit. 1928.
- Olson, S.L. 1985. Pp 79–238 In: Farner et al. 1985.
- Peter, H.U., et al. 1994. J. Orn., Lpz. 135: 320.
- Pietz, P.J. 1985. Condor 87: 316–26.
- Sibley, C.G., & J.E. Ahlquist. 1990. Phylogeny and Classification of Birds. Yale University Press, New Haven.
- Strauch, J.G. Jr. 1978. Trans. zool. Soc. Lond. 34: 263–345.
- Tinbergen, N. 1959. Behaviour 15: 1–70.
- Young, E.C. 1977. Ibis 119: 191–5.
- 1978. NZ J. Zool. 5: 401–16.

*Lestris pomarinus* Temminck, 1815, *Man. d'Orn.* 1815: 514 — Arctic Europe.

The generic name is directly from the Latin *stercorarius*, belonging to dung (from *stercus*, dung) with reference to the skuas' parasitic pursuit of other seabirds till they disgorge their food; the disgorged food was once thought to be excrement. The specific name refers to the corneous sheath or operculum that covers the nostrils during the breeding season (Greek πῶμα lid or cover, and ρύς, ρύνος nose).

OTHER ENGLISH NAMES Pomarine, Pomatarine or Twist-tailed Skua.

MONOTYPIC

**FIELD IDENTIFICATION** Length 65–78 cm (including tail-streamers of breeding adult that project up to 10.5 cm); wingspan 110–127 cm; weight: male 660 g, female 740 g. Largest jaeger; thickset, with heavy bill, thick neck, deep chest, barrel-shaped body, broadly based wings and rather full tail. Smaller and slimmer than Great *Catharacta skua* or South Polar *C. maccormicki* Skuas, but larger and bulkier than Arctic Jaeger *Stercorarius parasiticus*. Adults dimorphic: light and dark morphs, with occasional intermediates. Adult in breeding plumage has diagnostic long twisted central tail-streamers; non-breeding adults and immatures have much shorter and less twisted tail-streamers and those of juveniles are rounded at

tips and project only slightly. Juveniles distinguished from other juvenile jaegers by diagnostic double pale patch on underwing. Sexes similar, though female of breeding pair slightly larger and often separable in breeding plumage. Slight seasonal variation. Juveniles and immatures separable.

**Description** **Adult breeding LIGHT MORPH:** Forehead, crown, nape and area round eye, black, forming dark cap that extends to base of bill and well down sides of face. Rest of head and neck, white, with varying straw-yellow wash on hindneck and sides of neck, occasionally extending over throat. Upperparts, blackish brown, contrasting only slightly with blacker primary coverts, remiges and tail; off-white shafts of

outermost 3–8 primaries form triangular patch on closed outerwing or semicircular patch when wing spread. Underbody, white, with blackish-brown flanks, vent and undertail-coverts and, sometimes, a dark patch extending onto centre of lower belly from vent; most have prominent mottled or barred black-brown breast-band. In females and younger adults, breast-band and flanks typically messily barred; in older birds more uniform; many males have neat dark flanks and breast-band reduced to small dark wedge on sides of breast. Underwing: axillaries and most coverts, blackish brown, contrasting slightly with glossy grey-black greater coverts, outer secondary coverts and remiges; up to basal half of primaries, white, forming striking white wing-patches. Central rectrices, long, broad and rounded, projecting well beyond rest of tail, twisted distally and appearing blob-tipped in profile; ends of tail-streamers often broken off, though characteristically broad projections can usually still be seen in close view. Many, especially females, retain traces of non-breeding plumage during breeding season, such as dark-barred breast-band, dark spots on hindneck and flanks, and white feathers on dark vent and tail-coverts. Bill, bi-coloured: tip, black; basal two-thirds paler brown. Iris, dark brown. Legs and feet, black. **DARK MORPH:** As light morph except body and innerwing-coverts, uniform dark grey-brown to black-brown, often with slightly darker glossy black cap; nape, hindneck, sides of neck and head usually washed slightly paler, yellowish brown. **Adult non-breeding LIGHT MORPH:** Differ from adult breeding by: dark cap appears paler, dark brown or grey-brown, sometimes extending to chin and throat, forming dusky hood. Rest of head and neck usually white (with, at most, only trace of yellow wash) or faintly mottled brown, separating hood from dark breast-band; on some, hindneck and sides of neck spotted and barred brown and hood appears to merge with dark breast-band. On upperparts, feathers of mantle and scapulars have narrow creamy tips, and uppertail-coverts are barred black and white, forming prominent pale area above dark tail. Underbody, white, with prominent breast-band densely spotted darker; heavy and messy dark barring along flanks; some dark smudging on lower belly and vent; and, usually, bold black-and-white barring on undertail-coverts; some have fine dark mottling or barring over belly. Tail-streamers, shorter, narrower and less twisted, though still obviously broad and rounded at tips; often missing. **DARK MORPH:** Like breeding, but no yellowish-brown on head and neck and may have some indistinct buff barring on uppertail- and undertail-coverts; when close, underbody may appear faintly barred or grizzled white in some; tail-streamers, as light morph. **Juvenile** Much variation in colour of plumage: most generally uniform dark grey-brown (so-called intermediate or barred phase); some have paler head and underbody (light phase) or are almost all dark (dark morph). **INTERMEDIATE PHASE:** Combination of pale patch on uppertail-coverts and uniformly dark head and neck characteristic of this plumage. Darker birds: Head and neck, dark grey-brown, typically with darker area on lores and round base of bill (contrasting markedly with pale base of bill); nape and neck sometimes faintly paler and greyer but never forming pale collar; nape, neck, chin and throat indistinctly spotted or barred darker. Underbody, dark grey-brown or dark buff-brown, with dense, diffuse, narrow dark barring grading to bolder, even cream and dark barring on undertail-coverts; often have dark-barred breast-band, contrasting slightly with paler head and belly. Upperparts, blackish brown, narrowly barred buff on saddle and rump and with thin buff tramlines along innerwing. On standing birds, blackish wing contrasts with paler breast.

Uppertail-coverts, boldly barred black and buff, typically showing at distance as obvious pale patch. Pale shafts of outermost 3–8 primaries form pale flash on outer upperwing as on adult; primaries normally lack pale tips. Underwing: axillaries and underwing-coverts, boldly barred black and white, conspicuous even at some distance and contrasting with dark body; remiges, dark, with white patch covering up to basal half of primaries (as on adult); bases of greater primary coverts also white, and, with pale bases of primaries, form distinctive double patches (often visible at distance in good light). Tail, black, grading to paler off-white at base on underside; tail-streamers, short and blunt, often hard to see in flight, and tail appears variously rather square-ended or gently wedged at tip. **LIGHT PHASE:** Pattern of plumage similar to that of intermediate phase. Differ mainly by paler greyish-buff ground-colour of head, neck and underbody (latter matching underwing-coverts). Palest birds have rather uniform grey-brown head and neck, and prominent faintly barred grey-brown breast-band, grading to fine grey-brown barring over off-white lower breast to vent; undertail-coverts boldly barred black and white as intermediates. Pale head and neck contrast with blackish upperparts but concolorous with pale-and-dark barred uppertail-coverts. Pale barring and tramlines on upperparts slightly broader and more prominent. **DARK PHASE:** Similar to intermediate phase but darker and rather uniform sooty black throughout (though with double pale patches on underwing); most show faintly paler hindneck and trace of paler rufous-brown tips to feathers of upperparts and pale barring on uppertail-coverts and underwing-coverts; usually show distinct pale barring on undertail-coverts. Bare parts similar in all phases. Bill: tip, black, with paler bluish-grey to brownish-grey basal two-thirds; pale base contrasts with tip and dark face and is visible at long range if light good. Iris, dark brown. Legs, pale blue-grey; distal three-quarters of (and often whole of) foot, black. **First immature (non-breeding and breeding) LIGHT AND INTERMEDIATE MORPHS:** Similar to corresponding juveniles, differing by: saddle, tertials and innerwing-coverts, blackish brown, without pale tips or barring (except a few on coverts, which may be lost with wear); head, neck and underbody, rather grey-brown (lose warmer buff or brown tones of many juveniles) and pale areas begin to show on head and body, with many developing paler hindneck-collar and pale belly; rounded tail-streamers, longer; dark areas on bill larger, especially along cutting edges of mandibles, and pale base more grey or yellow; more black on legs. **DARK MORPH:** As juvenile except for slightly longer tail-streamers and slight changes in colour of bare parts (as light morph). All morphs best aged during first austral summer–autumn by combination of essentially juvenile appearance with active moult of remiges, Feb.–July. **Second immature non-breeding LIGHT MORPH:** Similar to adult non-breeding but underbody and underwing heavily barred, similar to juvenile. Tail-streamers short, similar to first immature non-breeding. Bare parts like first immatures. **DARK MORPH:** Similar to first immatures except whole plumage (including underwing-coverts) said to be uniformly dark, with crown slightly darker than rest of upperparts; tail-streamers and bare parts as light morph. **Second immature breeding LIGHT MORPH:** General appearance is of adult-like head, neck and underbody, with heavily barred juvenile-like underwing. Upperparts as first immature. Dark hood, dark-spotted and barred breast-band and dark-barred flanks and undertail-coverts contrast with white rest of underbody, though hood less sharply demarcated from paler neck, chin and throat because these areas and underbody generally more dark-spotted than on adult; pale

areas of underbody heavily barred in some. Hindneck and sides of neck, tinged yellow, though less strongly than on adult. Tail-streamers, similar to first immature. Bill, similar to adult or slightly paler on base of upper mandible; legs slightly darker and with more black on tarsi than first immatures. **DARK MORPH:** As second immature non-breeding and barely distinguishable from other dark-morph immatures; tail projections and bare parts as light morph. **Third immature non-breeding** **LIGHT MORPH:** Similar to second immature non-breeding but even more like adult, with whiter belly. Best aged by adult-like non-breeding plumage pattern, but with much less coarse and extensive barring on axillaries and underwing-coverts than second immature non-breeding; barring varies but greater coverts tend to be uniformly dark and axillaries plainer, with only fine pale barring or mixture of plain and barred feathers; barring tends to be concentrated in pale band on central coverts and subhumerals, surrounded by much plainer dark coverts, with some pale mottling also along leading innerwing-coverts; effect of double pale patches on underwing generally lessened. Bare parts similar to adult, except legs and feet, black, with some pale patches on tarsi. **DARK MORPH:** As second immature non-breeding. **Third immature breeding** **LIGHT MORPH:** Very similar to adult breeding, but pale areas of head and neck sometimes streaked or spotted darker and with duller yellow wash; tail-coverts (especially undertail-coverts) uniform or barred black-and-white; and barring of vent and rear flanks partly mixed with plain dark feathering. Best distinguished by adult-like appearance coupled with mostly uniform dark underwing-coverts (with less pale mottling or barring than third immature non-breeding). Compared with second immature breeding, belly whiter (with only a little barring) and tail-streamers longer (but shorter than adult breeding, and not or only slightly twisted). Bare parts as third immature non-breeding but legs and feet, black, with only traces of pale blue-grey on tarsi. **DARK MORPH:** Similar to adult breeding but tail-streamers shorter and not or hardly twisted; often still some blue-grey patches on tarsi. **Fourth immature (non-breeding and breeding)** Both morphs very similar to adult and not generally separable, though may retain traces of pale barring on some smaller underwing-coverts and pale areas on tarsi; in breeding plumage, tail-streamers shorter and less twisted (see also Plumages).

**Similar species Arctic Jaeger** (q.v.). See also comments under **Great** and **South Polar Skuas**. Prominent white wing-flashes and piratical behaviour should suffice to separate from immature large gulls.

Generally in pairs or small groups in Arctic breeding areas. At other times, and in A'asian wintering areas, singly, in pairs or small groups, occasionally in larger groups at sources of food, such as trawlers. In HANZAB region, in pelagic waters mainly during migration. Prefer more offshore waters than Arctic Jaeger, commonly wintering in shelf-break and outer shelf-waters, though often venture closer inshore along open coasts; only occasionally enter bays and harbours. Rarely seen ashore in HANZAB region, though occasionally blown inland during gales. Appear to have large head and full body, with centre of gravity between breast and belly, giving characteristic barrel-chested jizz or even impression of hanging belly on heavier individuals; barrel-chested appearance often emphasized by prominent dark breast-band. Wings appear broad, both at base and for full length of innerwing, though outerwing rather slender. Tail appears rather short, broad and full for a jaeger; length of body behind wings (measured from trailing-edge of wing at base to tip of tail) slightly narrower to slightly

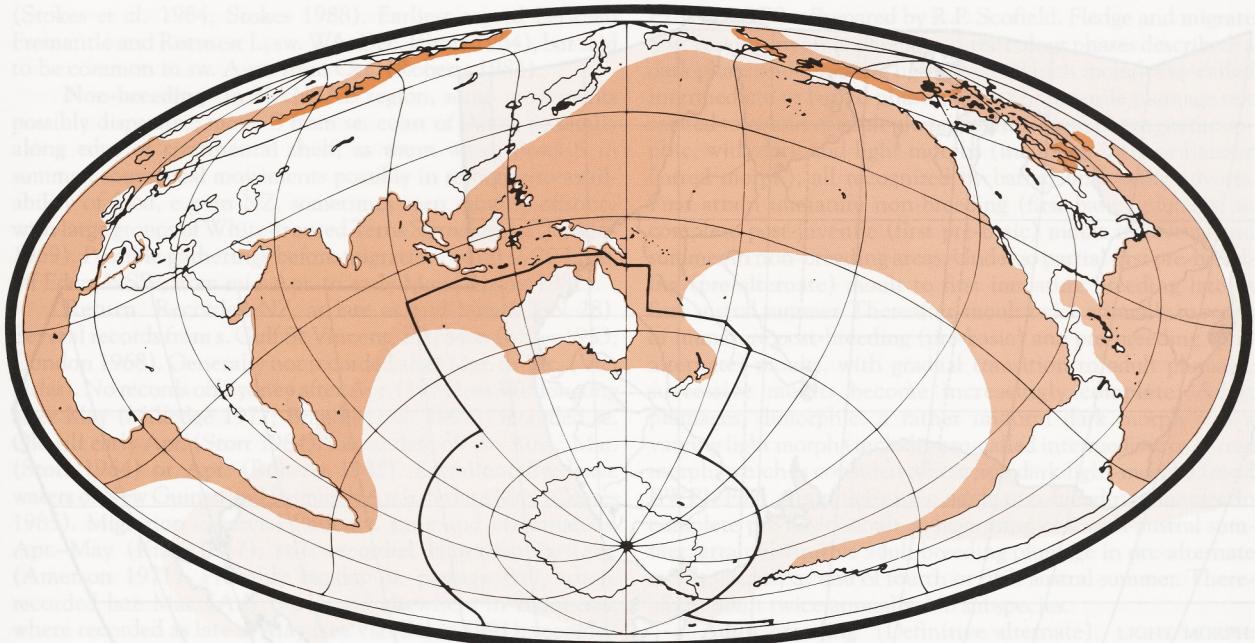
broader than width of innerwing (measured at its narrowest point half-way to carpal) and this often helpful in identification of lone and distant birds flying past. In flight, generally appear more thickset, menacing and powerful than Arctic Jaeger; normal flight appears more laboured than that of Arctic, with deep regular wing-beats like those of Great Skua or large gull; in higher winds, banking, gliding and careening slower and more ponderous than in Arctic Jaeger. Hunting flight combines great speed and agility, including somersaults, dives and tight turns, though typically, piratical bouts shorter than in Arctic Jaeger. Attack other seabirds more directly than other jaegers and such pursuits often include direct assault on victim; will pursue larger seabirds up to size of gannet or smaller albatross. On migration, fly with almost mechanical wing-beats in light to moderate winds, only resorting to shearwater-like progression in strong winds; at least in n. hemisphere, also soar and sail over sea and land when migrating. Gait heavier than Arctic Jaeger, with more rolling walk; carriage heavier, with broad tail-streamers adding weight to appearance of rear-end. Look bulky on sea, with large tail held well up. Normally silent at sea.

**HABITAT** During non-breeding period, occur in tropical and subtropical seas (Aust. Seabird Atlas). Occurrence off e. Aust. coincides with rise in water temperature and strongest flow of E. Aust. Current (Barton 1979, 1982); in e. Cook Str. region, associated with warm D'Urville Current rather than cooler Southland Current (Bartle 1974). Off se. Aust., recorded in seas with surface temperatures of 15.6–23.9 °C (Fisher 1963; Barton 1978, 1980, 1982). In A'asia, most common in offshore waters along edge of continental slope; uncommon inshore (Barton 1982; Wood 1989; Aust. Atlas). Of 30 birds off se. Aust., 27 over continental slope, and three over continental shelf (Aust. Seabird Atlas). Off Wollongong, most abundant offshore, with lower numbers inshore and beyond shelf-break; ratio of neritic to pelagic observations 3:2 (Wood 1989). Sometimes recorded on coast, entering sheltered harbours or bays (Roberts 1982; Morris 1986) and off major estuaries (Morris 1975; Dell & Fleming 1956).

Off Sydney, feed from surface of water more than by stealing from other birds (Milledge 1977). Commonly feed while sitting on surface of water; if food sinks, may dive to retrieve it. When feeding aerially by stealing from other birds, usually fly 10–15 m above water (Barton 1982). Readily feed at trawl-spills or on refuse thrown overboard from ships (Fisher 1963; Milledge 1977). Near Sydney, frequent sewage outfall (Hindwood 1955).

May alight on sea to rest (Storr 1964; Milledge 1973; Barton 1982; Wood 1989), including during strong winds, when birds duck their heads as waves hit (Barton 1982). Rarely, observed resting on beaches or floating driftwood (Gibson 1977).

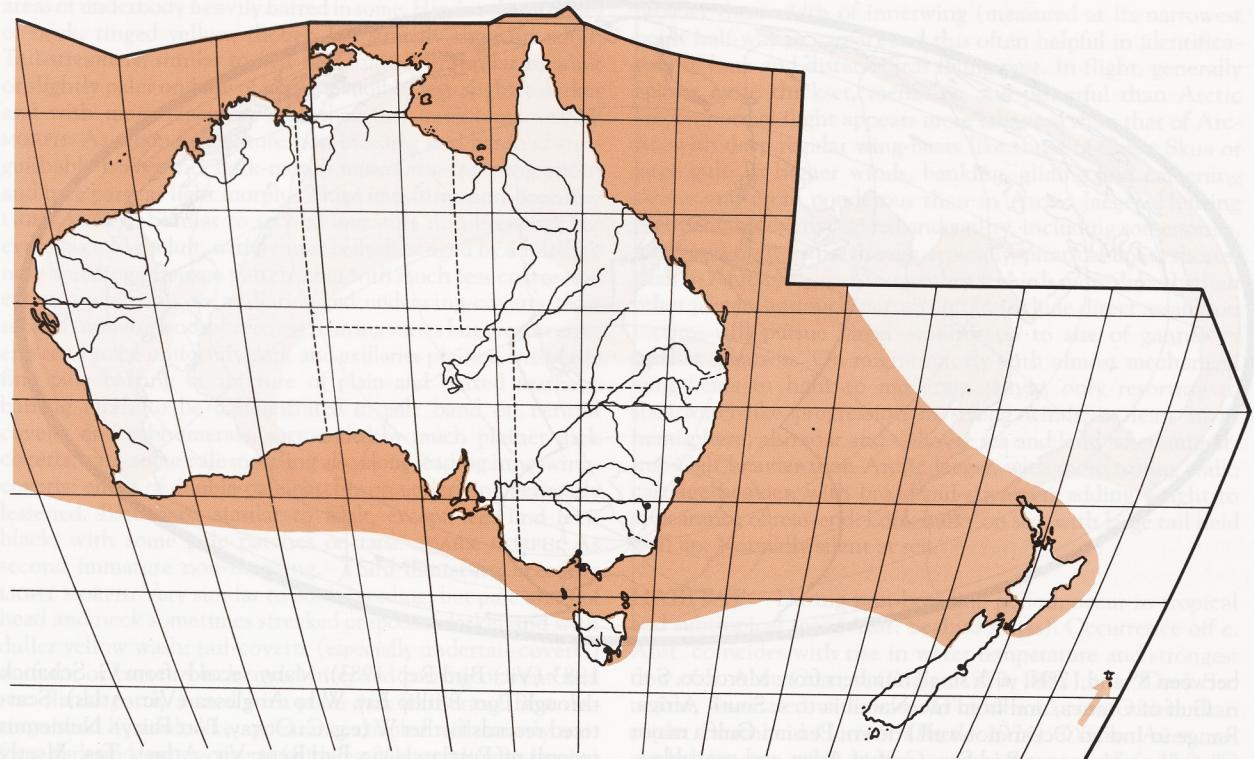
**DISTRIBUTION** Breed N of Arctic Circle in North America and Russia. In North America, breed Alaska, round Hooper Bay, w. Seward Pen. and from Pt Hope, E to Coronation Gulf in Canada, and N through Canadian Arctic islands, to s. Melville and Bathurst Is; also e. Devon, Bylat and e. Baffin Is; S to Southampton I. and nw. Quebec. In Russia, from Kanin Pen. and n. Novaya Zemlya, E to Chukotskii Pen. (Dement'ev & Gladkov 1951; AOU 1983; Furness 1987). In non-breeding periods: In Atlantic, mainly N of Equator; S from North Carolina through Caribbean islands S to Guyana; accidental to Brazil; in cool upwellings off w. Africa, especially



between 8° and 17°N, with small numbers from Morocco, S to n. Gulf of Guinea, and from nw. Namibia to s. South Africa. Range in Indian Ocean not well known; Persian Gulf a major wintering area; occur Red Sea, Gulf of Aden and probably s. Arabia, with largest numbers in Gulf of Oman; rare elsewhere in e. Africa; occur off India, Pakistan and Sri Lanka. Occasional in se. Asia. In Pacific Ocean, recorded in low numbers off coasts of America, from California S to Peru, and winter round Hawaii (in small numbers) and in SW, in Kiribati, Fiji, Vanuatu, Tonga, Bismarck Arch. and elsewhere in PNG and A'sia (Bailey 1966; Ali & Ripley 1969; Blake 1977; Clunie et al. 1978; Lovegrove 1978; Jenkins 1980; AOU 1983; Coates 1985; de Silva 1986; Furness 1987; Pratt et al. 1987; Urban et al. 1987; Roberts 1991; van den Berg et al. 1991; BWP; Qld Bird Rep. 1987).

**Aust.** Mostly off SE. **Qld** Few published records. In tropical areas: single, Booby I., 1 Feb. 1987 (Qld. Bird Rep. 1987); two records E of Torres Str., 10°30'S, 145°30'E and 11°30'S, 145°30'E (Aust. Atlas). Unverified record at Cooktown, 12–13 Mar. 1991 (McLean 1991). Probably most common Skua on se. coasts, but generally replaced by Arctic Jaeger in Moreton Bay (C. Corben); said to be rare visitor to SE, N to 26°20'S (Storr 1984). Published records include: single, Fraser I., 24 Jan. 1982 (Sutton 1990), and unknown numbers Mooloolaba, Redcliffe Pen. and Stradbroke I. (Aust. Atlas). **NSW** Most abundant skua (Milledge 1977; Wood 1989). Widespread off most of coast, mainly from Coffs Harbour in N to Green C. in S (NSW Bird Reps; Aust. Atlas). Also in sw. Tasman Sea, between Eden and Gascoyne Seamount (Barton 1980). Off Sydney Heads, several records of 50–100+ birds (NSW Bird Reps 1973, 1974, 1976, 1983, 1985); other records of large numbers: 50–80 off Wollongong, 26 Jan. 1986 (NSW Bird Rep. 1986); 60 off Eden, 16 Jan. 1976 (NSW Bird Rep. 1976); 44 off Coffs Harbour, 3 Apr. 1977 (NSW Bird Rep. 1977). **Vic.** Many records in e. Bass Str. (Vic. Bird Rep. 1985; Aust. Seabird Atlas; Aust. Atlas). Amiet (1964) found most between Gabo I. and Wilsons Prom.; only Aust. Atlas records for that region are Marlo and Darby Beach, Wilsons Prom. Elsewhere in Gippsland: single, Walkerville, 27 June

1983 (Vic. Bird Rep. 1983). Many records from C. Schanck through Port Phillip Bay, W to Anglesea (Vic. Atlas). Scattered records farther W (e.g. C. Otway, Port Fairy). Numerous records off Portland (Vic. Bird Reps; Vic. Atlas). **Tas.** Mostly in Bass Str.: numbers unknown, Nov. 1948, Dec. 1948 and Mar. 1949 (Wall 1977). Recorded N of King I. and ne. King I. (Aust. Seabird Atlas). Several records round Devonport: two, 6 Jan. 1973 (Milledge 1973); three, 22 Mar. 1979 (Tas. Bird Rep. 9); 1–3, 29 Jan. 1980 (Tas. Bird Rep. 10); unknown number, 5 Dec. 1981 (Tas. Bird Rep. 11); ten, 23 Feb. 1988 (Tas. Bird Rep. 18); single, 18 Jan. 1990 (Tas. Bird Rep. 20). Few records farther S: single, off Bellerive, Hobart, 8 Apr. 1974 (Tas. Bird Rep. 4); 24, D'Entrecasteaux Channel, 12 Feb. 1949 (Wall 1977); unknown number, SW of Tas., 45°S, 144°E (Aust. Seabird Atlas). **SA** Few published records. Two, 16 km SSE of Port Macdonnell, 19 Oct. 1980 (SA Bird Reps 1977–81; Aust. Atlas); two, 32–48 km off C. Jaffa, 17 Feb. 1963 (Fisher 1963); recorded S of Fleurieu Pen. (Aust. Seabird Atlas). Most records from s. Gulf St Vincent, and often seen between Port Adelaide and Kingscote, Kangaroo I. (Miles 1953; SA Bird Reps); single recorded NE of Kangaroo I. (Aust. Seabird Atlas). Unknown number, 5 km NE of Greenly I., 24 Jan. 1979 (Aust. Atlas). **WA** Few published records. Isolated record on s. coast: three, Pt Anne, Fitzgerald R. NP, 15 Jan. 1991 (Vervest 1991). In SW, recorded round C. Naturaliste, 15 Mar. 1988 (Vervest & Jaensch 1988), but most records at sea between Fremantle and Rottnest I. or Carnac I. (Serventy 1948; Storr 1964; Serventy & Whittell 1976; Roberts 1982; Aust. Atlas). Once recorded at L. Cooloongup (details unknown) (Storr & Johnstone 1988). Several records NW and N of Kimberley Div. (Aust. Atlas): N of C. Leveque at 14°15', 122°5' and 15°30', 122°30', and N of C. Londonderry at 12°25', 126°25', 12°25', 126°45' and 12°25', 127°25'. **NT** Several reports, including NW of Nhulunbuy at 9°30'S, 135°30'E, 20 Nov. 1980; two inshore records: single, near Peron Is, May 1982; two, between Buffalo Pt and Lee Pt, Oct. 1982 (Aust. Atlas; H.A.F. Thompson & D.K. Goodfellow). **NZ** Regular visitor in small numbers. First recorded Dec. 1933 at Bay of Islands (Oliver). **NI** Most widespread round



Auckland Isthmus, with records from Parengarenga Harbour, S to Manukau Harbour and Miranda, Firth of Thames, especially in Hauraki Gulf. Also recorded off C. Colville and at Whitianga on Coromandel Pen. and scattered in Bay of Plenty between Little Waihi and Ohope-Ohiwa; a few scattered records between C. Runaway and Aramoana. In SW, recorded between Turakina and Waikanae R. Estuaries, with many records from Foxton and Manawatu R. Estuary (CSN). Cook Str. (Sibson 1962; Bartle 1974). In Feb. 1984, 38, c. 103 km W of mouth of Waikato R. (NZCL; J.A.F. Jenkins). SI Multiple records from Farewell Spit and Motueka, Nelson Bay; also recorded Tory Channel, Marlborough Sounds. Widespread between Kaikoura Pen. and Rakaia R. Estuary; also recorded in s. Canterbury Bight at St Andrews. Isolated Southland record at Waituna Lagoon; on w. coast, recorded at Charleston and off Punakaiki (CSN).

**Chatham Is.** Single, at roosts with Great (Subantarctic) Skuas, Nov.–Dec. 1993 (Nilsson et al. 1991).

**Antarctic Pen.** Vagrant: Single, Léonie Is (67°36'S, 68°22'W), Marguerite Bay, w. Graham Land, 22 Feb. 1937 (Sladen 1954); single, Neny I. (68°12'S, 67°02'W), Marguerite Bay, 24 Dec. 1946, 12 Jan. 1947 (Beck 1968); single, Argentine Is (65°15'S, 64°16'W), 9 Feb. 1953 (Sladen 1954).

**MOVEMENTS** Migratory but poorly known. Breed in Arctic, moving S to pelagic and offshore non-breeding areas in low latitudes of Pacific, Indian and Atlantic Oceans during boreal winter (BWP). Migration mainly at sea, though some passage inland (Dement'ev & Gladkov 1951; Aust. Atlas). Injured bird recorded landing on ship (D.W. Eades; T. Montague).

**Departure** Immatures and unsuccessful breeders move S, July and Aug.; departure apparently complete, Oct. or early Nov. (see Furness 1987). For details of migration in Atlantic Ocean, see BWP. In Pacific Ocean, said to migrate down e.

and w. Pacific (Tuck & Heinzel 1980), though also said to be common in central Pacific from Dec. (King 1967). In e. Pacific, migrate along coast of North America (AOU 1983). In w. Pacific, regular offshore passage migrant, Japan (Orn. Soc. Japan 1974); accidental to inland and coastal China (de Schauensee 1984); recorded Philippines (White 1976); regular to waters of New Guinea (particularly in N) and Bismarck Arch., from late Oct. (Coates 1985). On islands of Pacific Ocean: occur Hawaii, from Oct. (Amerson 1971); Tonga, from Oct. (Jenkins 1980); near Fiji, from early Sept. (Clunie et al. 1978); visit Society Is (du Pont 1976). In e. Aust., rare visitor to se. Qld waters from early Aug. (Storr 1984); arrive Sydney, NSW, Oct. or Nov.; recorded off Wollongong, Oct., but mostly from Nov.; arrive farther S, off Eden, mid-Oct.; highest numbers off NSW coast, Jan.–Mar. (Hindwood 1955; Milledge 1977; Barton 1982; Wood 1989; Brandis et al. 1992). Regular to Vic., where recorded all months from Oct. (Vic. Atlas). Probably regular in small numbers to n. NZ, where earliest record, Aug. (Falla et al. 1981; CSN 32, 35); earliest record, SI, Nov. (CSN). Vagrants in Antarctica, Jan.–Feb., probably from Pacific Ocean (see BWP).

Birds reaching w. Indian Ocean apparently move overland across Russia from breeding grounds; birds visiting e. Indian Ocean may move W from w. Pacific across se. Asia, where dated records mainly from periods of passage (see Tuck & Heinzel 1980; Harrison 1983). Probably regular passage migrant through Bali, where recorded on s. migration in Sept. (Ash 1984); recorded elsewhere in Indonesian waters from Oct. (see van Balen 1991); sighted Borneo, late Oct. (see Smythies 1981); uncommon visitor to Thailand in boreal winter (Lekagul & Round 1991); recorded Peninsular Malaysia (Medway & Wells 1976), Burma (Smythies 1986) and Wallacea (White & Bruce 1986). Occur off n. and w. Aust. (Aust. Atlas), though not Christmas or Cocos-Keeling Is.

(Stokes *et al.* 1984; Stokes 1988). Earliest record between Fremantle and Rottnest I., sw. WA, Dec. (Storr 1964), but said to be common in sw. Aust. from Oct. (Roberts 1982).

**Non-breeding** In HANZAB region, some movements possibly dispersive; move S from se. coast of Aust., generally along edge of continental shelf, as warm water flows S in summer; some local movements possibly in response to availability of food, e.g. in NZ, sometimes seen moving offshore with large groups of White-fronted Terns *Sterna striata* (Jenkins 1969). Possible gatherings before migration, of up to 20 birds, off Eden, NSW, from mid-Apr. to early May (Barton 1982).

**Return** Recorded NZ, as late as mid-May (CSN 28). Several records from s. Gulf St Vincent, SA, Mar. (Miles 1953; Condon 1968). Generally not recorded after Mar. in Vic. (Vic. Atlas). No records off Sydney after Apr. (1974), or Wollongong after May (Milledge 1977; Brandis *et al.* 1992); recorded se. Qld till early Apr. (Storr 1984). Latest date off sw. Aust., Mar. (Storr 1964) or Apr. (Roberts 1982). Extraliminally, leave waters of New Guinea and Bismarck Arch. by late May (Coates 1985). Migration observed Phoenix, Line and Hawaiian Is., Apr.–May (King 1967); still recorded Hawaiian Is., June (Amerson 1971). Probably regular on passage Bali, where recorded late Mar. (Ash 1984) and elsewhere in Indonesia, where recorded as late as May (see van Balen 1991); recorded Borneo, mid-Apr. (see Smythies 1981). Most records from Philippines, May (Dickinson *et al.* 1991). Vagrant to Hong Kong, where recorded once Feb. (Chalmers 1986). Move through Japanese waters from Mar. (Orn. Soc. Japan 1974). Apparently arrive breeding grounds, May and June, though timing affected by ice-cover and availability of food (see Dement'ev & Gladkov 1951).

**Breeding** Recorded between non-breeding areas and n. Pacific and Atlantic Oceans and central Canada (AOU 1983; Furness 1987). Winter records in HANZAB region are at start and end of winter, apparently birds arriving early or leaving late (see Aust. Atlas).

**FOOD** Opportunistic predator and scavenger; steal food from other birds. On non-breeding grounds, mainly fish. Extralimitally (on breeding grounds) invertebrates, insects, fish, birds (eggs and young), and small mammals, especially rodents (BWP). **Behaviour** More predatory than Arctic Jaeger. Reported chasing White-fronted Terns (Crockett 1962), Crested Terns *Sterna bergii* (Milledge 1977), Caspian Terns *Sterna caspia* (Dell & Fleming 1956; Crockett 1962), Silver Gulls *Larus novaehollandiae* and Arctic Jaegers (Milledge 1973), attempting to force them to drop food. Attempt to steal offal from birds such as Wedge-tailed *Puffinus pacificus* and Flesh-footed *P. carneipes* Shearwaters, by crashing into them with outstretched wings, but rarely successful (Barton 1982). Take offal from surface of water while in flight (Wood 1989), but may dive below surface if food sinks (Barton 1982). Take small gulls and passerines by chasing them and forcing them into sea (BWP).

**Adult** Poorly studied in A'sia. Molluscs: pteropods (HASB); fish spilt from trawler (Milledge 1977); offal (Milledge 1977; Barton 1982; Wood 1989); refuse (Fisher 1963).

**VOICE** Only information for HANZAB region from Barton (1982): sharp *which-yew*, *which-yew*, followed by a continuous *week, week, week*, given when pursuing trawlers; birds called only when feeding or when catch was hauled. Also call loudly when swooping on, and crashing into, other birds with food. Calls at breeding grounds said to be lower in pitch than those of Long-tailed Jaeger; for a brief account, see BWP.

**PLUMAGES** Prepared by R.P. Scofield. Fledge and migrate S in varying juvenile plumage; three colour phases described: a dark phase and a varying light phase (which includes so-called intermediate or barred phase); colour of juvenile plumage not related to colour of adult plumages. Immature plumages dimorphic, with dark and light morphs (including intermediate or barred morph); all recognized by barred underwing-coverts. First attain immature non-breeding (first basic) plumage in complete post-juvenile (first pre-basic) moult in first austral summer in non-breeding areas. Undergo partial first pre-breeding (pre-alternate) moult to first immature breeding late in first austral summer. Thereafter, moult twice annually in series of immature post-breeding (pre-basic) and pre-breeding (pre-alternate) moults, with gradual transition to adult plumage; successive moults become increasingly complete. Adult plumages, dimorphic: a rather uniform dark morph and a varying light morph (including so-called intermediate or barred morph, which is considered here as a dark light-morph) (*apud* BWP). First attain definitive adult non-breeding plumage in complete pre-basic moult at beginning of fourth austral summer; attain definitive adult breeding plumage in pre-alternate moult, usually at end of fourth or fifth austral summer. Thereafter, moult twice annually. No subspecies.

**Adult breeding** (Definitive alternate). **LIGHT MORPH:** Based on specimens (MV B3542, MV 19601), photos in Pringle (1987) and BWP. **Head and neck** Forehead, crown to just below eye, centre of upper nape, lores, malar area and feathering at base of lower mandible, glossy black (89), becoming black-brown (119) with wear. Chin, white. Rest of head, and neck, white; feathers have elongated yellow (55) tips (which fade to buff [124]) and many have dark-brown (119B) shaft-streaks. **Upperparts** Dark brown (219). **Tail** Dark brown (119A), grading to black brown at tip; bases of rectrices, white, increasing from basal sixth of inner web of t6 to basal fifth of t1. Shaft of t6, white basally, with black-brown (119) distal half; area of white on shafts increases inwards, with t1, off-white. T1, elongated and twisted (see Structure) but often missing by end of boreal summer. Undertail, dark brown (219A) with slight silvery-rufous (c36) wash near tip. **Underparts** Mostly white; usually have dark-brown (119A) band across upper breast, marked with buff (124) tips to feathers when fresh. Lower breast, upper belly, flanks and patch on thigh varyingly barred and streaked brown (119B) and white, with buff tips to feathers. Rear of belly, vent and undertail-coverts, dark brown (119A) with dark subterminal bars and buff (124) tips to some feathers; some scattered feathers, white. **Upperwing** Coverts, dark brown (219). Remiges, black-brown (119). Shafts of primaries, light grey-brown (119D) grading to off-white on p8–p10. Bases of primaries, white extending beyond coverts and, with white shafts, form white patch at bases of primaries. **Underwing** Mostly brown (119B) with silvery tinge to remiges and white bases to primaries extending beyond coverts to form large white triangular patch on bases of outer primaries. Males differ from females by having: few, if any, dark shaft-streaks to white feathers of head and neck; less barring on underparts (generally only a little on sides of breast, flanks and rear of belly); and vent and undertail-coverts, generally uniform dark brown (119A). **DARK MORPH:** Forehead, crown to just below eye, centre of upper nape, lores, malar area and feathering at base of lower mandible, glossy black (89) becoming black-brown (119) with wear. Rest of head, neck and body, black-brown (119) with light grey-brown (119C) fringes to most feathers of upperparts; with wear, fringes are lost and plumage fades to dark brown (119B).

Most have yellow (c55) wash to tips of ear-coverts and feathers of nape, at least when fresh, giving glossy appearance. Remiges and rectrices as light morph, though extent of pale bases usually reduced.

**Adult non-breeding** (Definitive basic). Central rectrices missing, growing, or projecting only slightly, and hardly twisted. **LIGHT MORPH:** Rather uniform. Based on photos (Harrison 1987: p. 112, no. 432; Pringle 1987: p. 470; Olsen 1989: p. 149, no. 95; Olsen 1992: pp. 87–8, nos 21–23). **Head and neck** Forehead, crown to just below eye, centre of upper nape, lores, malar area, and feathering at base of lower mandible, black-brown (119) with broad pink-brown (219D) edges to feathers, which quickly fade to white and lost with wear. Throat, off-white with dark-brown (119A) rosethorns at tips. Nape and sides of neck, light grey-brown (119C) and off-white, with pink-brown (219D) or yellow (c55) tips. **Upperparts** Dark brown (219); feathers of mantle and smaller scapulars have broad pink-brown (219D) edges, and uppertail-coverts generally have 3–4 complete or incomplete buff (124) or off-white bars. **Underparts** Mostly white with: dark mottled band across breast, formed by black-brown (119) subterminal bars and tips to feathers of breast and upper flanks; and some scattered barring on belly, lower flanks and vent formed by black-brown (119) subterminal bars to some feathers. Undertail-coverts usually have 3–4 complete or incomplete buff (124) or off-white bars. **Wing, Tail** As adult breeding (except length of t1). **DARK MORPH:** Based on photos (Pringle 1987: p. 472, lower; Olsen 1992: p. 88, no. 25; unpubl.: D.W. Eades). As adult breeding but without contrast between head and body; and no yellow (c55) tips to ear-coverts and feathers of nape. Fringes possibly broader than those of adult breeding, and often washed pinkish-brown (219D).

**Juvenile** **LIGHT PHASE:** Varies (e.g. photos in Harrison 1987; Olsen 1989, 1992). **Head and neck** Dark brown (119B) with pinkish-brown (219D) tips to feathers, widest on nape, sides of head and throat; often have dark-brown (119A) patch in front of eye. Exceptionally pale birds may have light grey-brown (119D) nape and ear-coverts, with broad pinkish-brown (219D) tips to feathers. **Upperparts** Dark brown (119A) with narrow buff (5) edges to feathers of mantle and rump and broad buff edges to scapulars and feathers of back. Uppertail-coverts broadly barred off-white and brown (119B) with buff (5) wash to two outermost white bars. **Underparts** Brown (119B) with buff (5) bars, which are narrow anteriorly grading to broad on vent, undertail-coverts and axillaries. Some may have very broad pale bars, belly sometimes appearing mostly white. **Tail** Black-brown (119) with varying white bases that grade from one-eighth of t1 to one-eighth of inner web of t6. Shafts, light grey-brown (119D) grading to off-white at bases. Undertail, brown (119B) with silvery tinge; shafts, off-white. **Upperwing** Coverts, dark brown, with broad buff (5) fringes to inner and median coverts, and narrow buff (5) tips to outer coverts. Remiges, black-brown (119) without pale tips to primaries (though tips may appear paler with wear) and often with buff (124) spots at tips of secondaries and a few buff spots along edge of tertials. Shafts and pale areas of primaries, as adults. **Underwing** Marginal coverts, dark brown (119A) with broad pink-brown (219D) tips. Lesser and median coverts, dark brown (119A) with narrow complete or incomplete pink-brown (219D) bars. Outer coverts typically buff (124) with incomplete brown (119B) bars and subterminal marks and spots; less often, light grey-brown (119C) with buff (124) edges. Greater primary coverts, off-white with dark-brown (119) tips, exposed bases forming prominent whitish crescent

on outerwing. Remiges as adult breeding. **DARK PHASE:** Dark brown (219) with off-white bases to primaries and off-white shafts to outer primaries (as in adult breeding) and usually with dark rufous-brown (240) fringes to all underwing-coverts, undertail-coverts and feathers of vent.

**Immature** Immature stages of light morph presented in sequence, followed by immatures of dark morph.

**LIGHT MORPH First immature (non-breeding and breeding)** (First basic, First alternate). Based on BWP. Like light-phase juvenile but: scapulars and upperwing-coverts, uniform dark brown (219) with pink-brown (219D) fringes on only a few innermost coverts. Breeding usually superficially similar to non-breeding, with varying mix of new and old feathers above.

**Second immature non-breeding** (Second basic). Based on photos (Olsen 1992: p. 86, nos 13–14); and one specimen (ANWC 19805). Intermediate between light-phase juvenile and adult non-breeding. Nape, ear-coverts and throat, dark brown (119B) with yellow (153) tips and shaft-streaks. Upperparts, mostly dark brown (119A) with many pink-brown (219D) fringes, especially on feathers of mantle and longer scapulars; uppertail-coverts, white, with pink-brown (219D) wash and three broad brown (119B) bars. Feathers of belly, white, with faint pink-brown (219D) wash and 1–2 brown (119B) subterminal bars, which are lost by late in austral summer, leaving belly pale. Underwing darker than in juvenile with narrower, off-white (not pink-brown) bars on coverts.

**Second immature breeding** (Second alternate). Based on photos (Olsen 1992: pp. 85–6, nos 10, 15) and BWP. **Head and neck** Forehead, crown to just below eye, centre of upper nape, lores, malar area and feathering at base of lower mandible, black-brown (119), forming dark cap bordered below by whitish ear-coverts and nape (feathers white, tinged with yellow [c55], especially on tips of pointed shafts). Feathers of chin and throat, white with 1–2 dark-brown (219) subterminal bars. **Upperparts** Mostly black-brown (119); feathers of mantle and uppertail-coverts have narrow off-white tips and 2–3 white bars, which are washed pink-brown (219D) when fresh. **Tail** Like light-morph adult breeding but: central rectrices shorter, extending only 3–7 cm; rarely twisted, though often missing or heavily worn. **Underparts** Heavily barred black-brown (119) and white. Breast and upper flanks often almost uniform black-brown (119) with only scattered feathers that have white barring. Feathers of centre of belly generally have only single narrow black-brown (119) subterminal bar, which, with pale tips, quickly lost with wear, leaving belly white. **Upperwing** Mostly black-brown (119) and rather uniform. Remiges as light-morph adult breeding. **Underwing** Marginal, lesser and median coverts, dark brown (119A) with 1–3 narrow off-white bars; subhumerals and axillaries, black-brown (119) with 3–4 bold white bars; greater coverts, light grey-brown (119C) with narrow off-white fringes or subterminal streaks. Remiges as light-morph adult breeding.

**Third immature non-breeding** (Third basic). Based on photos (Pringle 1987: p. 473, upper; Olsen 1992: p. 85, no. 11) and two specimens (ANWC 20239; B12714). Differs from second immature non-breeding by: throat, ear-coverts and lower nape mostly off-white, with some dark-brown (119A) fringes and yellow (c55) wash to feathers; underparts, especially belly, whiter, with only feathers on sides of belly having indistinct dark-brown (119A) subterminal bars; pale bars on breast and chin often have extensive pinkish-buff (219D) wash; underwing mostly dark brown (119A) with only narrow off-white fringes to most coverts (119A); greater coverts, light

grey-brown (119C) with off-white tips, especially on innermost coverts. Subhumerals and longer axillaries, dark-brown (119A) with 3–4 narrow white bars.

**Third immature breeding** (Third alternate). Based on photos (Olsen 1992: p. 86, nos 16–17) and BWP. Differs from light-morph adult breeding by: some narrow off-white fringes to feathers of mantle and some barring on lateral uppertail-coverts. Breast-band and upper flanks, black-brown (119) barred with pink-buff (219D); feathers of vent and rear flanks, uniform dark brown (219) mixed with some feathers with off-white and light grey-brown (119C) tips; belly, mostly white, with very few feathers with dark-brown (119A) subterminal bar; undertail-coverts, barred black and white with a pink-brown (219D) wash. Upperwing like adult breeding. Underwing like second immature non-breeding.

**Fourth immature non-breeding** (Fourth basic). Based on two specimens (ANWC 19807; B18793). Like adult non-breeding but some (if not most) inner marginal coverts, subhumeral coverts and axillaries may have off-white fringes.

**Fourth immature breeding** (Fourth alternate). Last plumage usually separable from adult. May retain some pale barring on uppertail- and undertail-coverts. Feathers of head may be less pointed and less suffused with yellow (c55). Some may retain some pale fringes to inner marginal coverts, subhumeral coverts and axillaries. Males that in subsequent years have mostly white breast may still have large amount of black-brown barring across breast, flanks and vent. Females may also have more barring on breast and flanks but less dark brown (219) on vent than in subsequent years.

**DARK MORPH** Immature plumages poorly understood and literature contradictory. **First immature (breeding and non-breeding)** Like dark-phase juvenile (BWP). **Second immature non-breeding and subsequent immature plumages** Forehead, crown to just below eye, centre of upper nape, lores, malar area and feathering at base of lower mandible, glossy black (89). Rest of body, black-brown (119). Patterning of underwing appears to vary; one photo (Olsen 1992: p. 85, no. 12) of probable second or third immature breeding shows strongly spotted lesser and median coverts (i.e. similar to juvenile) but light grey-brown (119C) greater coverts. Often have two or more generations of feathers in wing-coverts.

**BARE PARTS** Based on BWP; photos (Pringle 1987; Br. Birds *passim*) and museum labels (six skins: ANWC, AM, QM). **Adult** Bill: tip, black (89); rest, grey-brown (91) or dark grey (83), sometimes with orange-red (15) wash. Iris, dark brown (219). Tarsus and foot, black (89). **Juvenile** Bill, olive-grey (42) or grey-brown (91) with black-brown (119) tip. Iris, dark-brown (219); off-white in some light-phase birds. Tibia and tarsus, light blue-grey (88); foot, light blue-grey (88), distal three-quarters of toes and webs, black (89). **Immatures** Bill and iris, like adult. Area of black (89) on tarsus and foot increases with age, spreading from outer toe inwards and from tibia downwards (asymmetrically); covers foot and tibia in second calendar year when some may have dark spotting on central tarsus (especially on back of tarsus); in third calendar year, 0–50% of tarsus black (89); in fourth, 20–90%; in fifth, 80–100%; from sixth on, 100%.

**MOULTS** Based on BWP, c. 30 skins (AM, AIM, ANWC, MV, SAM, QM, WAM), Stresemann & Stresemann (1966) and photos (Harrison 1987; Pringle 1987; Olsen 1992; unpubl.: M.J. Carter; D.W. Eades; A. Palliser). **Adult post-breeding** (Pre-basic). Complete; primaries outwards. Moult of body nor-

mally begins with underdown and some feathers of head on breeding grounds in late Aug. or Sept.; finished rapidly in non-breeding areas by late Nov. or early Dec.; in failed and non-breeders, moult of body may begin July and be completed before s. migration in Aug. Sequence normally: crown, neck, mantle, breast, flanks, tail-coverts, rest of head, belly, vent, scapulars, back and rump; moult rapid. Remiges and wing-coverts moulted early Nov. to early Apr. Tail, Oct.–Feb.; in all A'asian specimens, sequence: t1–t2–t3–t4–t6–t5. **Adult pre-breeding** (Pre-alternate). Partial; moult t1 and all of body, except possibly scapulars; do not moult remiges or wing-coverts. Many, especially females, said to retain some feathers of mantle, breast, flanks and undertail-coverts because there is little time for moult (BWP). However, the few A'asian specimens examined indicate that these tracts are moulted but retain dark barring or have pale tips. Moult begins as adult post-breeding moult of primaries finishing, between late Feb. and Apr. Sequence: head, neck, mantle, flanks, tail-coverts and breast. T1 moulted early Mar. to late Apr., taking c. 40 days to reach full length; some may also moult t2. Only a little moult occurs on n. migration. **Post-juvenile** (First pre-basic). Complete; in non-breeding areas. Moult body and tail, early Nov. to Apr. or even later (Broome 1987); t1 generally missing in Nov. and beginning to project in Jan. Wing moulted Feb.–July. **First immature pre-breeding** (First pre-alternate). Partial. Some may replace a few feathers on back and scapulars late in first austral winter of second calendar year. **First immature post-breeding** (Second pre-basic). Partial; generally moult all of body; may replace a few scattered wing-coverts from July of first austral winter. Moult of wing starts 1 month earlier than in adult, generally by Oct., and finished earlier. **Second, third and fourth immature pre-breeding** (Second, third and fourth pre-alternate). Partial; replace some feathers of upperparts, scapulars and tail-coverts. **Second, third and fourth immature post-breeding** (Third, fourth and fifth pre-basic). Partial; moult of body may start in late June and often completed by Aug., do not replace all wing-coverts and tail-coverts in second immature post-breeding moult; moult of wing-coverts and tail-coverts becomes increasingly complete with age; fourth immature post-breeding mostly complete. Timing of moult of wing as adult. T1 often retained in second and third immature breeding plumages.

**MEASUREMENTS** For data from w. Palaearctic, see BWP. (1–2) A'asia, skins; T6 = length of t6 from point of insertion in skin; T1–T6 = difference between length of t1 and t6 (distance t1 projects beyond rest of tail); M–U = length of maxillary unguis (distance from tip of bill to point where maxillary unguis meets supra-nasary saddle); Gonys = distance between tip of lower mandible and point where rami join to form gonys; SNS = length of supra-nasary saddle (distance from base of bill where feathering meets mandible to the distal edge of the soft sheath covering the proximal two-thirds of the upper mandible) (AM, ANWC, MV, QM, SAM, WAM): (1) Adults; (2) Subadults. (3) South America, adult, skins (Murphy [AMNH]).

	MALES	FEMALES	
WING	(1) 359 (6.4; 352–370; 6) (2) 348, 353, 364 (3) 362 (349–374; 10)	362 (11.4; 340–379; 8) 351 (6.7; 335–359; 9) 360 (351–370; 9)	ns
TAIL	(1) 202 (14.8; 174–217; 5) (2) 137	179 (25.4; 132–222; 7) 140 (10.3; 120–156; 9)	ns

T6	(3) 208 (172–243; 10) (1) 116 (11.2; 103–130; 5) (2) –	181 (128–206; 9) 127 (6.65; 114–135; 7) 134 (9.94; 120–150; 6)	ns
T1-T6	(1) 75 (27.1; 43–114; 7) (2) 7, 63	56 (20.5; 34–93; 7) 19 (6.6; 11–31; 5)	ns
BILL	(1) 38.5 (1.66; 36.6–41.7; 6) (2) 38.4 (1.79; 35.9–40.2; 9) (3) 40.4 (38.0–43.5; 10)	38.5 (1.72; 36.3–41.9; 8) 37.6 (1.68; 35.4–40.2; 9)	ns
M-U	(1) 19.0, 21.0	40.2 (38.0–44.0; 9)	
GONY'S	(1) 9.5, 10.0, 12.6 (2) –	20.6 9.0 8.3, 8.8	
SNS	(1) 18.6, 21.2 (2) 19.4, 19.3, 19.8	22.7 –	
TARSUS	(1) 52.1 (1.23; 49.8–53.6; 7) (2) 52.2, 54.6, 57.0 (3) 52.0 (48.0–54.0; 10)	54.2 (2.10; 51.1–58.8; 8) 54.9 (2.50; 50.5–58.0; 9) 52.1 (50.0–55.0; 9)	*
TOE	(1) 51.3 (1.59; 49.6–53.7; 5) (2) 52.0, 56.1 (3) 44.6 (42.0–47.0; 10)	51.9 (1.94; 48.9–54.8; 5) 52.6 (3.12; 48.6–56.3; 7) 46.1 (42.0–48.0; 9)	ns

(3–7) Asia and Europe, skins; sexes combined (ANWC, AM, MV, QM, SAM, WAM); (3) Adults in breeding plumage; (4) Adults in non-breeding plumage; (5) Adults combined; (6) Immatures; (7) Juveniles.

## UNSEXED

WING	(3) 364 (8.4; 353–379; 7) (4) 357 (8.3; 340–371; 11) (6) 354 (4.4; 346–360; 8) (7) 349 (7.9; 335–364; 8)		
TAIL	(3) 203 (13.9; 181–222; 7) (4) 167 (17.5; 132–191; 9) (6) 142 (11.0; 120–156; 7) (7) 134 (4.7; 125–140; 7)		
T6	(3) 117 (9.8; 103–130; 7) (4) 130 (4.72; 118–135; 8) (6) 134 (9.3; 120–150; 7) (7) 120 (5.1; 112–130; 7)		
T1-T6	(3) 87 (18.2; 59–114; 7) (4) 42 (11.9; 13–60; 11) (6) 20, 31, 63 (7) 14 (3.6; 7–18; 7)		
BILL	(3) 38.1 (1.77; 36.3–41.9; 7) (4) 38.7 (1.54; 36.4–41.7; 11) (6) 38.9 (1.62; 36.4–41.7; 8) (7) 36.6 (1.37; 35.4–40.0; 8)		
M-U	(3) 19.0, 20.6, 21.0 (7) 17.7, 17.7, 18.3		
GONY'S	(3) 10.3 (1.39; 9.0–12.6; 4) (4) 8.9, 10.0 (5) 9.42 (8.3–10.8; 29) (6) 9.13 (8.1–10.3; 46) (7) 8.9 (0.65; 8.2–10.0; 5)		
SNS	(3) 20.6 (1.51; 18.6–22.7; 4) (4) 19.2, 19.4 (7) 19.9 (0.5; 19.4–20.8; 6)		
TARSUS	(3) 52.6 (2.71; 49.8–58.8; 7) (4) 53.8 (0.79; 51.8–54.8; 12) (6) 55.5 (1.73; 52.2–58.0; 8) (7) 52.9 (2.51; 50.1–57.0; 8)		
TOE	(3) 51.4 (2.11; 48.9–54.8; 6) (4) 51.6 (2.02; 47.5–54.1; 7) (6) 55.3 (1.13; 53.3–56.3; 5) (7) 49.5 (1.07; 48.6–52.0; 7)		

breeding; (C) Second immature breeding; (D) Third immature non-breeding; (E) Fourth immature breeding; (F) Adult non-breeding.

		MALE	FEMALE
T1-T6	A	15 (3.9; 9–22; 17)	13 (3.9; 7–18; 13)
	B	30 (10.7; 16–41; 5)	21 (8.3; 10–30; 4)
	C	50, 54, 70	44 (16.1; 25–63; 5)
	D	67, 71, 72	46 (8.5; 36–54; 4)
	E	78 (12.7; 57–98; 10)	72 (15.5; 53–89; 7)
	F	46 (9.7; 32–57; 6)	42 (9.0; 34–60; 9)

Wing of juveniles and immatures significantly shorter ( $P<0.01$ ) than wing of adults. Tail of subadult significantly shorter than that of adult, but length varies with age. Ratio of length of supra-nasal saddle to length of maxillary unguis: in adults, 1.06 (0.95–1.10; 3); in juveniles, 1.13 (1.11–1.15; 3). For extralimital data, see BWP.

**WEIGHTS** (1–2) Asia, skins, Dec.–Feb. (ANWC, AM, MV, QM, SAM, WAM); (1) Adults; (2) Subadults. (3–4) Adults, live: (3) N. Alaska, breeding season (Maher 1974); (4) Yakutia, Russia, June (Uspenski *et al.* 1962).

	MALES	FEMALES
(1)	530, 690	666 (58.6; 595–750; 5)
(2)	600, 615	731 (34.2; 680–780; 6)
(3)	648 (53.4; 542–797; 73)	740 (84.4; 576–917; 52)
(4)	660 (620–800; 9)	740 (680–830; 6)

Immature female weighing 600 g collected off e. Aust. in June (BWP).

**STRUCTURE** Wing, long and pointed, rather narrow; width of wing between carpal joint and longest tertial about two-fifths length of wing. Eleven primaries; extralimitally: in adult, p10 longest, p9 6–22 mm shorter, p8 25–40, p7 47–60, p1 175–205; in juvenile, p10 longest, p9 8–21 mm shorter, p8 20–46, p7 41.2–71, p6 65–98, p5 88.2–122; p4 109–145; p11 minute, covered by primary coverts (Olsen 1992; BWP; lengths of other primaries not given); no Aust. data because specimens in moult. Eighteen secondaries, including five tertials. Tail, slightly rounded; 12 rectrices; t1 projects beyond rest of tail at all ages (see Measurements). In adult and older immature breeding plumages, t1 twisted through 90°, with inner web forming upper edge; protruding portion of t1 slightly spatulate (widening to 26–45 mm in breeding plumage) with rounded tip and obtuse point at shaft; in adult non-breeding, t1 shorter, narrower, hardly twisted, and with slight point; in juvenile, t1 barely projects, with tips of all feathers only slightly rounded or almost square; in immatures, t1 intermediate in shape and length. T2 sometimes projects beyond t3 by 20–30 mm. Bill, heavy, wide at base, somewhat stubby; maxillary unguis c. 50% total bill-length in adults; slightly smaller and narrower in juvenile (see Measurements; Arctic Jaeger: Recognition, Table 1). Tarsus and toes, short but strong, scutellate; front toes, fully webbed; nails, sharp, strongly decurved; outer toe c. 86% of middle, inner c. 76%, hind c. 27%.

**AGEING** Complex. JUVENILES: Differ from immatures and adults by: short, rounded central rectrices that hardly project

beyond rest of tail (9–22 mm); pale base to bill; pale tarsi, tibii and most of foot; strong rufous tinge to sides of head; broad rufous brown (139) fringes to feathers of upperparts; and much buff (124) barring on underwing-coverts on all but darkest birds. IMMATURES: All immatures differ from adults by: (1) pale barring at tips of some feathers of upperparts; (2) central rectrices (t1) do not normally project as far beyond rest of tail (in immature breeding plumages, 25–98 mm; in adult breeding, 65–111 mm), though length of projection increases with age (see Measurements); (3) pale patches on tarsus, size of which decrease with age (see Bare Parts); (4) barring on underwings, extent of which decreases with age; (5) a mixture of two or more ages of feathers on upperparts and wing-coverts because immature post-breeding moults incomplete; (6) timing of moult of primaries; (7) timing and completeness of moult of rectrices.

#### RECOGNITION See Arctic Jaeger.

**GEOGRAPHICAL VARIATION** No subspecies. Frequency of occurrence of dark morph varies slightly between populations (see Southern 1944 and references therein; Furness 1987).

#### REFERENCES

- Ali, S., & S.D. Ripley. 1969. *Handbook of the Birds of India and Pakistan*. 3. OUP, Bombay.
- Amerson, A.B. 1971. *Atoll Res. Bull.* 150: 1–383.
- Amiet, L. 1964. *Aust. Bird Watcher* 2: 118–19.
- AOU. 1983. *Check-list of North American Birds*. Am. Orn. Union, Lawrence, Kansas.
- Ash, J.S. 1984. *Bull. Br. Orn. Club* 104: 24–35.
- Bailey, R. 1966. *Ibis* 108: 224–64.
- Bartle, J.A. 1974. *Notornis* 21: 135–66.
- Barton, D. 1978. *A'sian Seabird Grp News*l. 10: 14–19.
- 1979. *Emu* 79: 31–5.
- 1980. *A'sian Seabird Grp News*l. 14: 9–13.
- 1982. *Emu* 82: 56–9.
- Beck, J.R. 1968. *Br. Antarct. Surv. Bull.* 18: 81–2.
- Blake, E.R. 1977. *Manual of Neotropical Birds*. 1. Univ. Chicago Press, Chicago.
- Brandis, C.C.P., et al. 1992. *Aust. Bird Watcher* 14: 165–79.
- Broome, A. 1987. *Br. Birds* 80: 426–7.
- Chalmers, M.L. 1986. *The Birds of Hong Kong*. Hong Kong Bird Watching Soc., Hong Kong.
- Clunie, F., et al. 1978. *Notornis* 25: 118–27.
- Coates, B.J. 1985. *The Birds of Papua New Guinea*. 1. Dove Pubs, Alderley, Qld.
- Condon, H.T. 1968. *Handlist of the Birds of South Australia*. S. Aust. Orn. Assoc., Adelaide.
- Crockett, D.E. 1962. *Notornis* 10: 93–4.
- de Schauensee, R.M. 1984. *The Birds of China*. OUP, Oxford.
- De Silva, R.I. 1986. *Loris* 17.
- Dean, F.C., et al. 1976. *Condor* 78: 271–3.
- Dell, R.K., & C.A. Fleming. 1956. *Notornis* 7: 62–3.
- Dement'ev, G.P., & N.A. Gladkov (Eds) 1951. *Birds of the Soviet Union*. 3. Israel Prog. Scient. Transl., Jerusalem (1969).
- Dickinson, E.C., et al. 1991. BOU Checklist 12.
- du Pont, J.E. 1976. *South Pacific Birds*. Delaware Mus. Nat. Hist. Monogr. Ser. 3.
- Falla, R.A., et al. 1981. *The New Guide to the Birds of New Zealand*. Collins, Auckland.
- Fisher, C.D. 1963. *Aust. Bird Watcher* 2: 36–43.
- Furness, R.W. 1987. *The Skuas*. Poyser, Calton, England.
- Gibson, J.D. 1977. *Aust. Birds* 11: 41–74.
- Greensmith, A. 1975. *Sunbird* 6: 77–89.
- Hario, M. 1985. *Lintumies* 20: 2–20.
- Harrison, P. 1983. *Seabirds: An Identification Guide*. Croom Helm, Sydney.
- 1987. *Seabirds of the World: A Photographic Guide*. Christopher Helm, Lond.
- Hindwood, K.A. 1955. *Emu* 55: 212–16.
- Jenkins, J.A.F. 1969. *Notornis* 16: 205.
- 1980. *Notornis* 27: 205–34.
- King, W.B. 1967. *Seabirds of the Tropical Pacific Ocean*. Smithson. Inst., Washington, D.C.
- Lekagul, B., & P.D. Round. 1991. *Birds of Thailand*. Saha Karn Bhaet, Bangkok.
- Lovegrove, T.G. 1978. *Notornis* 25: 291–8.
- Maher, W.J. 1974. *Pacific Coast Avifauna* 37: 1–148.
- McLean, J. 1991. *Qld orn. Soc. News*l. 22(3): 4–5.
- Medway, Lord, & D.R. Wells. 1976. *The Birds of the Malay Peninsula*. 5. Withery, Lond.
- Miles, J.A.R. 1953. *S. Aust. Orn.* 21: 12.
- Milledge, D.R. 1973. *Tasm. Nat.* 35: 5.
- 1977. *Corella* 1: 1–12.
- Morris, A.K. 1975. *Aust. Birds* 9: 37–76.
- 1986. *Aust. Birds* 20: 65–81.
- Nilsson, R.J., et al. 1994. *Notornis* 41 Suppl.: 109–25.
- Olsen, K.M. 1989. *Br. Birds* 82: 143–76.
- 1992. *Jagers*. GMB Uitgeverij, Haarlem.
- Orn. Soc. Japan. 1974. *Check-list of Japanese Birds*. Gakken, Tokyo.
- Pratt, H.D., et al. 1987. *A Field Guide to the Birds of Hawaii and the Tropical Pacific*. Princeton Univ. Press, Princeton.
- Pringle, J.D. 1987. *The Shorebirds of Australia*. Angus & Robertson, Sydney.
- Roberts, G. 1982. *A'sian Seabird Grp News*l. 17: 3–5.
- Roberts, T.J. 1991. *The Birds of Pakistan*. 1. OUP, Karachi.
- Serventy, D.L. 1948. *Emu* 47: 241–86.
- , & H.M. Whittell. 1976. *Birds of Western Australia*. Univ. West. Aust. Press, Perth.
- Sibson, R.B. 1962. *Notornis* 10: 94.
- Sladen, W.J.L. 1954. *Ibis* 96: 315–16.
- Smythies, B.E. 1981. *The Birds of Borneo*. Sabah Soc. & Malayan Nat. Soc., Sabah & Kuala Lumpur.
- 1986. *The Birds of Burma*. Nimrod, Liss, England.
- Southern, H.N. 1944. *Ibis* 86: 1–16.
- Stokes, T. 1988. *Aust. Natn. Parks Wildl. Serv. Occ. Pap.* 16.
- , et al. 1984. *Emu* 84: 23–8.
- Storr, G.M. 1964. *Emu* 63: 297–303.
- 1984. *Rec. West. Aust. Mus. Suppl.* 19.
- , & R.E. Johnstone. 1988. *Rec. West. Aust. Mus. Suppl.* 28.
- Stresemann, E., & V. Stresemann. 1966. *J. Orn. Lpz.* 107 (Sonderheft): 1–439.
- Sutton, P. 1990. *Sunbird* 20: 41–58.
- Tuck, G., & H. Heinzel. 1980. *Seabirds*. Collins, Sydney.
- Urban, E.K., et al. 1987. *The Birds of Africa*. 2. Academic Press, Lond.
- Uspenski, S.M., et al. 1962. *Ornitologiya* 4: 64–86.
- van Balen, S. 1991. *Kukila* 5: 117–24.
- van den Berg, A.B., et al. 1991. *Ardea* 79: 1–14.
- Vervest, R. 1991. *West. Aust. Bird Notes* 57: 1–2.
- , & R.P. Jaensch. 1988. *West. Aust. Bird Notes* 46: 2–3.
- Wall, L.E. 1977. *Aust. Birds* 12: 1–7.
- White, C.M.N. 1976. *Emu* 76: 79–82.
- , & M.D. Bruce. 1986. BOU Checklist 7.
- Wood, K.A. 1989. *Corella* 13: 97–104.



Volume 3, Plate 24

Great Skua *Catharacta skua* (page 388)

1 Adult on breeding grounds, austral summer; 2 Downy young; 3 Juvenile

South Polar Skua *Catharacta maccormicki* (page 412)

4 Adult pale morph, in worn plumage at breeding grounds, austral summer; 5 Adult dark morph, in fresh plumage at breeding grounds, austral summer; 6 Downy young; 7 Juvenile

Pomarine Jaeger *Stercorarius pomarinus* (page 438)

8 Adult female breeding, light morph; 9 Juvenile, intermediate phase

Arctic Jaeger *Stercorarius parasiticus* (page 448)

10 Adult breeding, light morph; 11 Juvenile, intermediate phase

Long-tailed Jaeger *Stercorarius longicaudus* (page 459)

12 Adult breeding, light morph; 13 Juvenile, intermediate phase



Brett Jarrett

Volume 3, Plate 26

Pomarine Jaeger *Stercorarius pomarinus* (page 438)

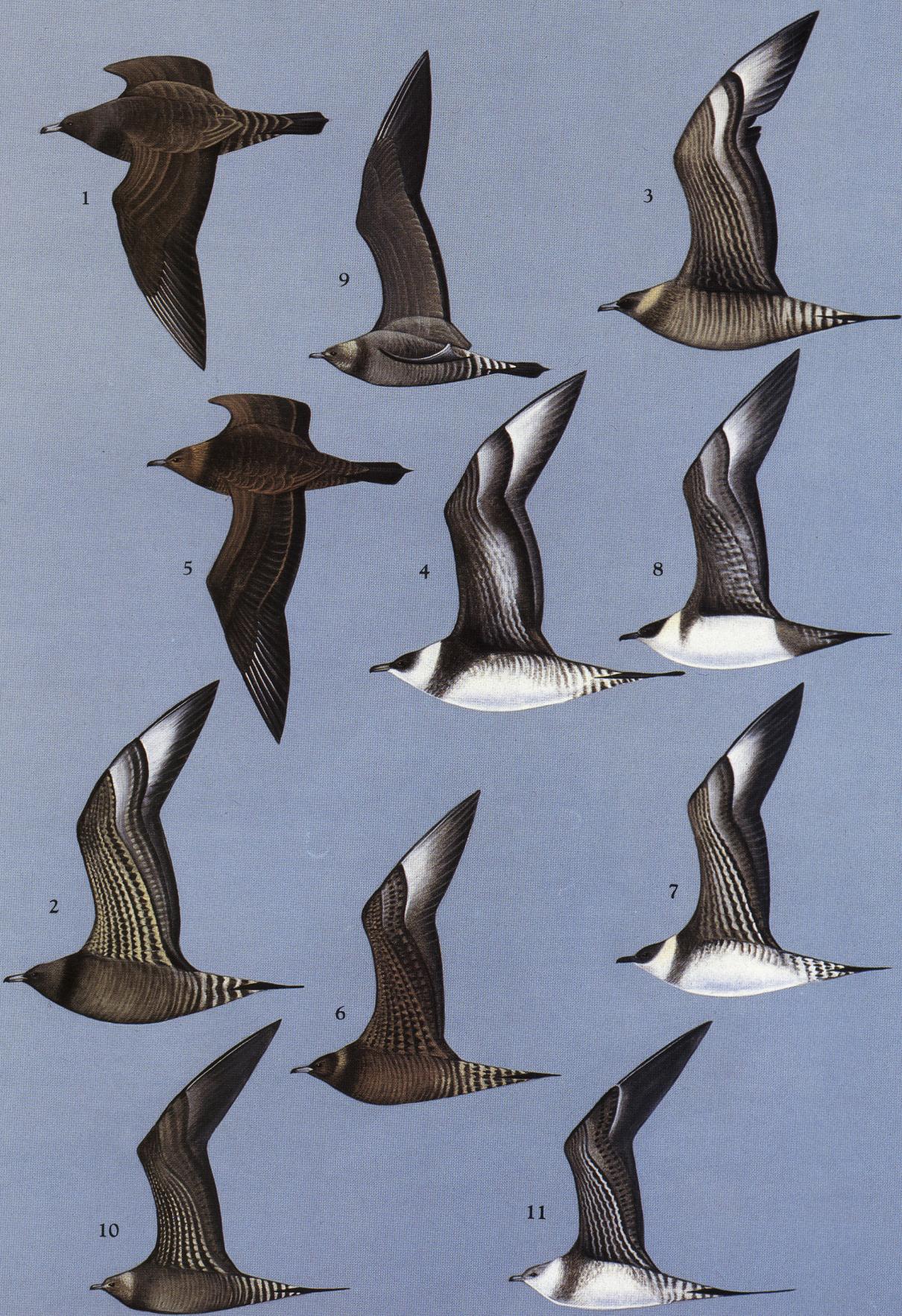
1, 2 Adult male breeding, light morph; 3, 4 Adult non-breeding, light morph; 5, 6 Adult breeding, dark morph

Arctic Jaeger *Stercorarius parasiticus* (page 448)

7, 8 Adult breeding, light morph; 9, 10 Adult non-breeding, light morph; 11, 12 Adult breeding, dark morph

Long-tailed Jaeger *Stercorarius longicaudus* (page 459)

13, 14 Adult breeding, light morph; 15, 16 Adult non-breeding, light morph



Brett Jarrett

Volume 3, Plate 27

Pomarine Jaeger *Stercorarius pomarinus* (page 438)

1, 2 Juvenile, intermediate phase; 3, 4 Juvenile, light phase, in early stage of moult to first immature non-breeding, first austral summer-autumn;  
4 Third immature non-breeding, light morph

Arctic Jaeger *Stercorarius parasiticus* (page 448)

5, 6 Juvenile, intermediate phase; 7 Second immature breeding, light morph; 8 Third immature breeding, light morph

Long-tailed Jaeger *Stercorarius longicaudus* (page 459)

9, 10 Juvenile, intermediate phase; 11 Second immature non-breeding, light morph