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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.
Ibidiorhynchidae	Ibisbill; monotypic, central Asia.
Charadriidae	plovers and lapwings; *c.* 60 species, cosmopolitan.
Pluvianellidae	Magellanic Plover; monotypic, S. America.
Dromadidae	Crab Plover; monotypic, Arabian region.
Glareolidae	pratincoles, coursers, and Egyptian Plover; *c.* 15 species, widespread in Old World.
Stercorariidae	skuas and jaegers; about seven species, mostly in Arctic and Antarctic regions.
Rhynchopidae	skimmers; three species, pantropical.
Laridae	gulls; *c.* 47 species, cosmopolitan.
Sternidae	terns; *c.* 42 species, cosmopolitan.
Alcidae	auks; *c.* 20 species, Arctic and temperate regions of n. hemisphere.

Apparently monophyletic. Pteroclididae (sandgrouse) probably sister-group of Charadriiformes (e.g. Fjeldså 1976, 1977; Sibley & Ahlquist 1990; BWP), though whether best placed within Charadriiformes or in separate order is debated. Flamingoes (Phoenicopteridae) and divers (Gaviidae) have also been treated as Charadriiformes (Olson & Feduccia 1981; Fjeldså 1976, 1977) but DNA–DNA hybridization studies (Sibley & Ahlquist 1990) inconsistent with these theories. Affinities to other orders still controversial; DNA–DNA hybridization has suggested closest links are to large waterbirds, such as storks, herons and allies, Pelicaniformes, Procellariformes, 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, Ibidorhyncidae, Charadriidae, Pluvianellidae, Dromadidae, Glareolidae, Stercorcariidae, Rhynchopidae, Laridae, Sternidae, Alcidae); Strauch (1978) treated Alcidae as separate lineage, but skeletons may be so highly modified for foot-propelled diving that they do not reflect relations well (Sibley & Ahlquist 1990); gulls and allies have also been regarded as a separate lineage (Christian *et al.* 1992) or as allied to 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 schizorhinal nostrils, schizognathous palates, well-developed vomer, lachrymals fused with ectethemoid and pre-frontal bones, well-developed supra-orbital grooves; see Olson & Steadman (1981) for more information on osteological characters. Wings usually have 11 primaries, with p10 longest and p11 minute; 15–24 secondaries; diastataxic except in *Scolopax minor*, as far as is known. Usually 12 tail-feathers. Necks usually rather long with 15–16 cervical vertebrae. Oil-gland bilobed and tufted. Syrinx, tracheo-bronchial; two carotids (type A-1 of Glenny 1955); caeca present. Legs usually rather long; hind toe small or lacking in most but all toes greatly elongated in 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, Stercorcariidae, Laridae and Sternidae will be dealt with in Volume 3 of HANZAB.

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Family **LARIDAE** skuas, jaegers, gulls and terns

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

Stercorariinae Skuas and jaegers; about six species; cosmopolitan.
Larinae Gulls; *c.* 47 species; cosmopolitan.
Sterninae Terns; *c.* 42 species; cosmopolitan.
Rynchopinae Skimmers; three extralimital species, pan-tropical.

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

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

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

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

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

Small to large charadriiform seabirds, ranging in size from Little Gull *Larus minutus* (27 cm) to Great Black-backed Gull *Larus marinus* (76 cm). Cosmopolitan, with greatest number of species in n. hemisphere; diversity lowest in Tropics and no breeding species in central Pacific. About 48 species in five genera, with most species in one genus (*Larus*) and other genera extralimital, with one or two species.

GENUS	NUMBER OF SPECIES
Larus	41–45 species; cosmopolitan
Pagophila	Monotypic; Ivory Gull *P. eburnea*, extralimital in Arctic
Rhodostethia	Monotypic; Ross's Gull *R. rosea*, extralimital in Arctic
Creagrus	Monotypic; Swallow-tailed Gull *C. furcatus*, extralimital in e. tropical Pacific Ocean
Rissa	Two species; kittiwakes, extralimital in n. hemisphere

Taxonomy of subfamily unsettled; number of genera recognized varies from twelve (Wolters 1975) to nine (Dwight 1925), seven (Peters) or one (Moynihan 1959). Our arrangement follows Christidis & Boles (1994) and BWP; Sibley & Monroe (1990) recognize a sixth genus, *Xema* (for Sabine's Gull *L. sabini*). *Larus*, as recognized here, is a large and varied genus and there is little consensus on how it would be best subdivided; species-groups recognized in major reviews by Dwight (1925), Moynihan (1959) and Campbell & Lack (1985) differ substantially. Taxonomy also complex at species level, especially in n. hemisphere, where distributions of some taxa overlap widely (often secondary contact in formerly isolated populations) and they behave as separate species in some areas but hybridize freely in others (Barth 1968; Devillers 1977, 1982; Grant 1986; Mierauskus *et al.* 1991; Nicolau-Guillaumet 1977; Smith 1966; Snell 1989; BWP). Only *Larus* represented in HANZAB region. Four species breed. Pacific Gull *L. pacificus* endemic to s. Aust. and rather distinctive; formerly placed in genus *Gabianus*, sometimes with Dolphin Gull *L. scoresbii*, but shows affinities to typical *Larus*. Black-billed *L. bulleri* endemic to NZ, distinctive member of s. hemisphere *cirrocephalus* species-group, with *L. cirrocephalus*, *L. novaehollandiae* and *L. hartlaubii* (Johnstone 1982). Silver Gull widespread in HANZAB region, and occurs extralimitally only in New Caledonia; Hartlaub's Gull *L. hartlaubii* of Southern Africa, sometimes considered conspecific (e.g. White 1965). Kelp Gull *L. dominicanus* wide-ranging in s. hemisphere, and has affinities with typical large gulls of n. hemisphere, such as Herring *L. argentatus* and Lesser Black-backed *L. fuscus* Gulls (see Kinsky 1963). Another five species have been recorded as vagrants to Aust.; and four species have been doubtfully recorded or recorded as vagrants in subantarctic.

Body-form varies: some slender and compact, others large and robust. Females generally slightly smaller than males (Ingolfsson 1969), useful for sexing birds; sexual dimorphism greater in larger species. Heads rounded; necks slender to thick. Wings, long, moderately broad, pointed; at rest, wings extend beyond tail; 11 primaries (p11 minute); *c.* 20 secondaries (18–23). Tail, moderately short, with 12 rectrices; square to slightly rounded in most species; slightly forked in a few (*Rissa*, *Creagrus* and *L. sabini*) and wedge-shaped in *Rhodostethia*. Expansor secondarium present. Coracoids in contact; sternum with two notches at each side; pectoral girdle differs from Stercorariinae. Bill, rather short (usually shorter than head) and sturdy, massive in some. Upper mandible hooked at tip, overhanging lower mandible; rhamphotheca simple; no cere; gonydeal angle prominent, highly so in some. Nostrils schizorhinal and perforate, with no median septum; usually narrow slit (narrowest in *L. bulleri*), but round in *L. pacificus*. Legs, moderately long, slender; tarsi scutellate in front, reticulate elsewhere; scales soft and fleshy; claws not hooked. Three front toes fully webbed; hindtoe, small or vestigial, often lacking claw in *Rissa*. Caeca present, small. Oil-gland and supra-orbital salt-glands well-developed, former feathered and with at least three openings on each side.

Sexes alike in plumage. Typically, adults mostly grey above and white below, with distinctive pattern of black and white on wing-tip; a few extralimital species mostly dark. Mantle, back, scapulars and upperwing-coverts, evenly coloured: light to dark grey in most species, black in several, white in *Pagophila*. Tips of outer primaries usually black, with complex white markings of much value in identification and ageing (see General Introduction for definitions of plumages terms specific to gulls). Underparts and tail usually white, with some exceptions: e.g. pink tinge to underparts of several species, black subterminal bands or tips to tails of some. In breeding plumage, head and neck either white or with large dark hood; in non-breeding plumages, hoods much reduced and many species develop brown streaking, especially on neck. Bare parts, brightly coloured. Iris, white to black-brown, surrounded by fleshy orbital ring. Bill, usually red, yellow or black, often with contrasting subterminal markings or tips; many large species have yellow bill with red spot on gonys which is tapped by chicks to elicit feeding from parent. Legs, usually pink, red, yellow or black. Adults moult twice annually: (1) a complete post-breeding (pre-basic) moult, generally beginning during or just after breeding (but before in *Pagophila*); and (2) a partial pre-breeding (pre-alternate)

moult, usually involving feathers of head and body, and, in smaller species, often some inner upperwing-coverts and, rarely, some tertials and central rectrices. *Larus pipixcan* (q.v.) remarkable in usually having two complete moults per cycle. *Larus sabini* (q.v.) apparently aberrant in performing complete pre-breeding and partial post-breeding moults.

Young, precocial, semi-nidifugous. Hatch with soft, loose down; generally buff to light grey, with partly exposed dark-grey bases to down, and with dark cryptic mottling above. Ground-colour varies (though less markedly than in Sterninae) and some species polymorphic; markings of back generally fainter in large marine species of *Larus*; *Rissa*, *Pagophila* and *L. marinus* nearly uniform pale (see Fjeldså 1977 for more information on patterns of downy young). Plumages of juveniles, browner and more cryptic than in adults; mantle, scapulars and upperwing-coverts usually strongly patterned brown and buff, and remiges and rectrices more extensively black than adults; larger species usually have mottled brown upperparts. Post-juvenile (first pre-basic) moult always partial, involving head and body, and occurring soon after fledging. Thereafter, undergo partial pre-breeding (pre-alternate) and complete post-breeding (pre-basic) moults each cycle (annually) (except *L. pipixcan* and *L. sabini*, as noted above). Moults of immatures and failed breeders occur slightly earlier in year than corresponding moults of adults; moults of immatures occur slightly later each year until breeding, when timing as adult. Plumages become progressively less brown, more like adults, with age: largest species take 4 or more years to attain definitive plumage, smaller species 1–3 years. Ageing by plumage can be rather accurate; approach to ageing discussed in Kelp Gull (Ageing). For further information on plumages and moults, especially of subadults, see species texts and reviews in Dwight (1925), Stresemann & Stresemann (1966), Grant (1986) and BWP.

Flight strong and buoyant, with regular, leisurely and often shallow wing-beats; often soar and glide. Swim and walk well. Usually coastal and inshore; some species pelagic when not breeding (notably vagrant Sabine's Gull); some occur in inland waters (sometimes including Silver Gull and vagrant Franklin's Gull); some occasionally frequent riverbeds in mountain regions (notably Black-billed and Kelp Gulls in NZ). Often associate with people and populations increasing locally in response to changes in availability of food, such as refuse and fish offal.

Omnivorous predators, scavengers and kleptoparasites, though steal food less than skuas and jaegers. Take almost anything available of suitable size and texture, including offal and human waste. Over water, feed by surface-plunging, surface-seizing, surface-diving, pattering and aerial pursuit; also steal food. On land, feed by hovering and hawking for insects; sometimes take small birds in flight; also feed by walking slowly and gleaning along coasts, riverbeds and lake shores. Almost completely diurnal; some migrate at night (Campbell & Lack 1985) and some species certainly forage in artificially lit areas at night (e.g. Silver Gull *L. novaehollandiae*, q.v.).

Typically noisy and gregarious, especially when nesting. Roost in large mixed-species roosts, and feed socially. Normally monogamous, defending nesting territory within colony. Colonies often large and densely packed. At breeding colonies, mass-flights or silent dreads recorded for some species (also see comments in Sterninae). Fidelity to colony, nest-site and partner can be high in established breeders. Most first breed when adult plumage attained, when 1–5 years old. Pair-formation may occur at nest-site or in Clubs of non-breeders, which are characteristic of some species. Behaviour of many species well studied, and partial summaries in Tinbergen (1959) and Moynihan (1962). Displays and calls well developed. Based on ritualized displays, breeding species can be split into two types: (1) large white-headed gulls (e.g. Pacific Gull *L. pacificus*, Kelp Gull *L. dominicanus*) and (2) masked gulls (e.g. Silver Gull *L. novaehollandiae*, Black-billed Gull *L. bulleri*). The following are some of the displays of Silver Gull and representative of both types. (References to figures are to those of Silver Gull, which see for full details of displays.) (1) UPRIGHT POSTURES: In aggressive form (Fig. 1) performed with neck swollen, carpals raised and bill depressed. In anxiety form, neck thin, carpals not usually raised, and bill horizontal or raised (usually facing away from opponent). (2) ALARM CALL POSTURES (Fig. 9): Similar to Upright Postures but always accompanied by call. (3) OBLIQUE DISPLAY (Fig. 2): A challenging display, often performed at the end of other displays and not without long loud call. In white-headed gulls, the call is termed Long Call and the display more intense and followed by head being jerked back into THROWBACK position, where head and bill point upwards, often beyond vertical. (4) FORWARD DISPLAY (Fig. 3): Associated with Oblique Display, head and foreparts lowered, neck under-arched and bill pointed anywhere between horizontal and vertical; call with bill almost closed. (5) HEAD TOSS (Fig. 4): After Oblique or Forward Displays, bird may fling foreparts up until bill and head point vertically; silent or with soft call. Moynihan (1962) noted that Head-tossing appeared to be restricted to gulls and was associated with sexual, hostile and food-begging displays, and seemingly related to escape and appeasement. (6) HUNCHED AGGRESSIVE (Fig. 5): Horizontal posture similar in form to forward and hunched positions of begging young. In this posture will chase other adults, often for long periods. (7) CHOKING (Figs 6, 7, 8): Bird calls with body tilted and head and bill facing downwards. Performed during territorial disputes, or as part of nesting ceremonies; can be lengthy and irregular. FACING-AWAY (including HEAD-FLAGGING) only seen in masked gulls but not in Silver Gull; display exaggerates contrast between dark head and pale nape, and is conspicuous during pair-formation, mutual displays at nest and immediately after copulation. Conspicuous PECKING-INTO-GROUND, often with GRASS-PULLING, used to settle territorial disputes (Tinbergen 1953). Young precocial and, if undisturbed, semi-nidifugous. Fed by regurgitation. Dependent on parents for long period (BWP).

Noisy, with large range of loud calls; alarm calls one of most familiar and distinctive features of group (Moynihan 1962).

Breed in loose or dense colonies, occasionally as isolated pairs (HASB). Season annual, usually from late Aug. or Sept. to Jan. in HANZAB region; Kelp Gulls subantarctic usually Nov.–Feb.; Silver Gulls have longer season, from June or July to Mar. in s. Aust., earlier in n. Qld. Nest on offshore islands, islands in estuaries or lakes, on headlands, cliffs, terraced coastal promontories, coastal dunes, edges of lagoons, under or on top of bushes; Silver Gulls will also nest in tree hollows; some species on man-made structures such as jetties, roofs of buildings and moored boats (Fjeldså 1977; HASB; Aust. NRS). Build untidy nests out of plant material or any other material available; usually more substantial than those of Sterninae and Stercorariinae (Fjeldså 1977). Both sexes build. Eggs strongly coloured and marked; in HANZAB region, ground-colour varies from brownish olive to stone-grey or greenish stone, blotched with black or brown or both (HASB). Clutch usually 2–3 eggs, but from one to four recorded; larger clutches usually from dump-nesting or stealing of eggs (Fjeldså 1977; Campbell & Lack 1985; North; Aust. NRS). Usually single brooded; repeat clutches generally only laid after failure (Fjeldså 1977); Silver Gulls can raise more than one brood per season (Nicholls 1974). Both sexes incubate; incubation period, 21–29 days (Campbell & Lack 1985; HASB). Hatching more or less asynchronous (Fjeldså 1977). Young, precocial and, if undisturbed, semi-nidifugous (BWP). Both parents care for young. Young stay in nest for first 2–3 days then begin to wander about; siblings tend to keep together. Parents can recognize young within 4–6 days of hatching. Young beg by pecking at parent's bill; food regurgitated in front of chick (Fjeldså 1977). Fed in or near nest for 2–3 weeks, usually till fledging at 4–6 weeks, and in some species, up to 3 months thereafter (Campbell & Lack 1985; Oliver; HASB). When disturbed by people, young run to shelter and crouch under vegetation or in crevices; adults of large species soar over intruders, some birds swooping down and even striking; small species swoop more regularly and often defecate at intruder; Sabine's Gulls feign injury (Fjeldså 1977). Most breed upon attaining adult plumage, at 1–5 years (Campbell & Lack 1985).

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Larus pacificus Pacific Gull

COLOUR PLATE FACING PAGES 449 & 480

Larus pacificus Latham, 1801, *Ind. Orn.*, *Suppl.*: lxviii — New Holland = New South Wales (*ex Gen. Syn.*, *Suppl.* 2: 332).

Specifically named for the Pacific Ocean (Latin *pacificus*, peaceful).

OTHER ENGLISH NAMES Large-billed Gull, Jack Gull, Larger Gull.

POLYTYPIC Nominate *pacificus*, se. Aust.; subspecies *georgii* Vigors, 1827 (=1826), SA and WA.

FIELD IDENTIFICATION Length 50–67 cm; wingspan 131–169 cm; weight: male 1.6 kg, female 1.1 kg. Largest gull in HANZAB region; powerful, deep-chested and thickset black-backed gull, with attenuated rear-end and long wings extending well beyond tip of tail at rest. At all times easily identified by deep massive bill, with prominent gonys and rounded nostrils. Bigger and bulkier than Kelp Gull *Larus dominicanus*, with much bigger bill, bigger head with more rounded crown, and slightly broader wings. Sexes similar, but male larger, with heavier bill. Slight seasonal variation in colour and pattern of bare parts of adults (and with wear of plumage). Juvenile separable. Immatures separable up to third or fourth year, but ageing complicated by individual variation in plumage and bare parts and, especially, by variation in rate at which adult plumage and bare parts acquired; in particular, much overlap between third- and fourth-year birds and fourth-year birds and adults (see Plumages). Two subspecies, differing in colour and pattern of bare parts and shape of loral point and extent of tail-band (see Geographical Variation, Plumages).

Description Adult breeding Head, neck, rump and underbody, white. Saddle and upperwing, black, with narrow white leading-edge and broad white trailing-edge to secondaries and inner primaries (and no white markings on outer primaries). At rest, show narrow white tertial crescent and inconspicuous scapular crescent (latter often not visible). Tail, white, with diagnostic narrow black subterminal band (tail-band sometimes not visible during moult). Underwing: remiges, black, forming dark subterminal band tapering towards body, contrasting with white coverts, and with translucent white trailing-edge. Bill, bright orange with bright-red tip. Iris, silvery white; dark-brown in at least some w. populations. Orbital ring, orange. Legs and feet, orange-yellow to orange. **Adult non-breeding** As breeding except: Bill slightly duller, orange-yellow, with orange-red to bright-red tip. Orbital ring duller, yellow to orange. Legs and feet, yellow to orange-yellow. **Juvenile** Head and neck, rich dark-brown, grading to slightly paler and greyer on face. Saddle, dark brown, neatly scaled with white; tertials similar but with darker centres. Pattern of upperwing, diagnostic: secondary coverts as saddle, but with generally broader dirty-cream fringes to greater coverts; remiges and outer primary coverts, brown-black, slightly paler and browner on inner primaries and with thin off-white trailing-edge to secondaries and inner primaries. In flight, have slightly paler window between blackish outerwing and secondary bar, all contrasting with paler, browner secondary coverts; often, have slightly paler band between coverts and secondary bar. At rest, greater coverts form pale panel along lower edge of folded wing. Rump and uppertail-coverts, off-white, with brown mottling and streaks; in some, as dark as rest of upperparts but paler at sides. Tail, brown-black, with narrow off-white tip. Underbody, dark brown, with fine, paler fringing and mottling, heaviest on lower breast and belly; typically show contrast between paler mottled belly and more uniform dark-brown foreneck and upper breast. Vent and undertail-coverts, cream, with diagnostic broad dark-brown streaks and spots on sides and faint brown mottling on central coverts; in flight, show as pale area squarely cut off from rest of underbody. Underwing: lesser and median coverts, dark brown, faintly streaked paler; contrast with glossy dark grey-brown remiges and greater coverts; remiges show translucent thin pale trailing-edge. Bill, black, with dirty-pink patches at base and orange-brown spot at tip of upper mandible. Iris, dark brown. Orbital ring, dark grey. Legs and feet, dirty pink. **First immature non-breeding** Similar to juvenile, differing by: Forehead, lores, cheeks, chin and throat, off-white or white, heavily mottled brown, giving paler-faced appearance. Saddle, brown to dark brown, with much broader and more diffuse buff fringes, appearing less scaly than juvenile, and contrasting with narrowly scaled wing-coverts. Rump and uppertail-coverts usually contrastingly pale. Underbody generally slightly paler

brown and more mottled. Basal two-thirds of bill, paler, dull pink to pink, with varying dusky mottling; contrasts strongly with black tip, which extends back along cutting edges; small dull-pink spot on tip of upper mandible. **First immature breeding** Similar to first immature non-breeding, differing by: Forehead, whiter; and with more white mottling over rest of face, cheeks and crown, often extending in narrow half-collar to behind mostly dark ear-coverts. Eye-ring, off-white, broken in front of eye. Tertials and secondary coverts, worn and faded, with pale fringes much reduced or bleached to white; bleached greater coverts typically form broad pale panel on folded wing between browner rest of coverts and blackish-centred tertials. Remiges and tail, browner through wear and fading. In flight, upperwing shows strong contrast between dark remiges and worn, faded and paler-brown secondary coverts; bleached greater coverts show as paler band of varying prominence in front of secondary bar. Underbody remains mostly brown but generally more extensively mottled with white, especially on centre of foreneck and breast. Base of bill paler pink, without dark mottling; less black along cutting edges. Iris, brown to paler grey-brown. **Second immature non-breeding** Plumage still mostly brown. Differ from first immature breeding by: Head, neck and underbody may have more white mottling; vent and undertail-coverts, off-white, with fainter or no dark streaking. Saddle, dark brown, with more diffuse scaling, appearing much more uniform. Tertials similar to saddle but with darker black-brown centres and conspicuous creamy fringes. Secondary coverts have broader and much less distinct fringes than first-year birds; in some, lesser and median coverts appear scaly, contrasting with uniform dark band of greater coverts on folded wing. In flight, from above, little contrast between paler and brownish median and lesser secondary coverts and blackish rest of wing; greater coverts uniformly dark (when fresh) and, unlike first-year birds, do not form paler band. Rump and uppertail-coverts, white. Tail, blacker, with narrow white tip. Underwing, as first-year birds or with more pale mottling to coverts. Bill, similar, but pale-pink base usually unmarked and black tip more sharply demarcated. Iris, pale; light brown to grey or grey-yellow. Legs and feet, slightly paler, dirty pink. **Second immature breeding** Has diagnostic combination of slate-black saddle, contrasting with worn and faded brown tertials and secondary coverts (with bleached fringes); and all-dark tail retained from second immature non-breeding. Some have scattered slate-black lesser secondary coverts; or median coverts, slate-black, forming contrasting band through centre of coverts. Rump and uppertail-coverts, white. Head and underparts vary considerably and less reliable for ageing: face usually white, with dark speckling; top of head, neck and breast usually brown or grey-brown, mottled with white, and grading to mainly white vent and undertail-coverts. Bill, pale yellow, with sharp black tip and pale spot at tip of upper mandible. Iris, paler, yellow, grey-yellow or silvery white. Orbital ring, yellow-brown to dull orange. Legs and feet, dirty pink, with varying yellow tinge. **Third immature non-breeding** Has diagnostic combination of adult-like pattern of wing and tail, with head and underbody of second immature breeding. Head, neck and underbody vary, from heavily to sparsely mottled brown (much overlap in appearance with second immature breeding); often have dark mottled hood contrasting with mostly white underbody (sparsely mottled brown on flanks and belly). Saddle, secondary coverts and tertials, slate-black with faint brown tinge; at rest, tertial crescent as adult; rest of upperwing, black, with narrow white leading-edge and broad white trailing-edge. Underwing, as adult, except lining suffused and lightly mottled grey-brown. Bill varies from pale to bright yellow or orange-yellow, with black reduced to narrow subterminal band and with some red on tips of mandibles. Iris, pale yellow to silvery white. Legs and feet as second immature breeding, or pale yellow. **Third immature breeding** Similar to third immature non-breeding except: Head, neck and underbody more sparsely mottled brown, appearing whiter. May show contrast in wear between fresh saddle and retained wing. Bill, brighter yellow to orange-yellow, with mostly red tip; black restricted to narrow subterminal band or smaller marks. **Fourth immatures** Some with adult plumage except for sparse brown mottling on head and neck may be this age (see Ageing).

Similar species If seen well, all ages of Pacific Gull easily distinguished by massive bill (with unique rounded nostrils). Can be confused with **Kelp Gull**, which differs by: AT ALL AGES: (1) much smaller bill, with more parallel edges in profile, and less prominent gonys (and narrow slit-shaped nostrils); (2) smaller and less bulky, with slightly narrower more angular and shapely wings that tend to appear more rounded at tips; (3) smaller and more wedge-shaped head, with more sloping forehead and peak of crown behind eye; (4) slightly quicker, shallower wing-beats giving less lumbering flight; and (5) different calls: loud strident *ki-och*, *ki-och*, *ki-och* and yelping or laughing *yo-yo-yo-yo-yo* with sobbing intonation. ADULTS differ by: (1) yellower bill, with red confined to spot at tip of lower mandible; (2) at rest, broader and more prominent white crescents on scapulars and tertials; (3) white mirrors on outer primaries conspicuous in flight; (4) white apical spots conspicuous on folded wing and visible in flight (though tips can be reduced or lost through wear); (5) white leading-edge broader and more conspicuous and clearly visible from above as well as head-on and, with broad white trailing-edge, gives distinctive effect of black upperwing outlined in white; (6) tail, white without black band (though tail of Pacific can appear wholly white when moulting). JUVENILES: At rest, differ by: (1) head, neck and underbody more streaked and mottled, with usually obvious pale collar; (2) saddle, secondary coverts and tips of tertials have more coarsely chequered and notched pattern; (3) diagnostic dark bar along bottom of folded wing, broadening outwards and contrasting with chequered coverts above; (4) vent and undertail-coverts, spotted and barred brown; (5) bill, all black. In flight: (6) have second dark bar across innerwing in front of dark secondary bar; (7) rump and uppertail-coverts, whiter (with narrow dark barring) contrasting more with dark upperparts; (8) tail, dark, with paler base and some dark markings on outer feathers; (9) barred vent and undertail-coverts appear similar to rest of underbody. OLDER FIRST IMMATURES: separable by same characters as juvenile (except saddle) and streaked, not speckled, facial pattern. OLDER IMMATURES: best separated by differences in structure and flight; also by: (1) from second immature non-breeding plumage on, bill mostly pale yellow, with varying diffuse blackish subterminal band; never has red or orange on tip of upper mandible; (2) prominent broad white scapular and tertial crescents from second immature non-breeding on; (3) second and third immatures have white tail, with varying broad to narrow or incomplete dark tail-band, always appearing messy and less clear-cut than on Pacific.

Large gull of coastal s. Aust. Prefer rocky and sandy beaches, estuaries, bays, harbours and offshore islands; usually avoid human habitation but occasionally seen on farmland and rubbish tips near coast and, rarely, inland. Gregarious; seen singly, in pairs or small groups; sometimes in large flocks;

much less sociable and less aggressive than Kelp Gull. Typically seen patrolling tidelines in search of natural prey; often soar vertically to drop molluscs on rocks or plunge into water to seize prey. Follow fishing boats and larger vessels but usually stay inshore in sheltered waters except round offshore islands. Gait similar to that of Kelp Gull but at times slightly heavier and more waddling. In flight, appear slow and lumbering; flight similar to Kelp Gull but wing-beats slightly slower, deeper and more measured, giving more lumbering action between long glides. Much less vocal and noisy than Kelp Gull; commonest call low gruff, barking *ow ow* or more muffled *auk auk auk*.

HABITAT Sandy or, less often, rocky coasts (Merilees 1970; Simpson 1972; HASB; Vic. Atlas). In e. Aust., prefer areas protected from ocean swells, such as bays, inlets, estuaries and lagoons; in WA, occasionally in harbours, but mostly on exposed coasts (Tarr 1961; Serventy & Whittell 1976; Farr 1978; Bedggood 1980; Smith 1987). Sometimes on mudflats (Matheson 1976; Wakefield 1983b; Peter 1990; Schokman 1990; Chafer 1991; Vic. Atlas). Often on offshore islands. Sometimes occur up to 10 km inland, usually at rubbish tips and wetlands; also on farmland and, once, heathland; occasionally well inland, moving along major rivers (Tarr 1961; Liddy 1969; Sonter *et al.* 1984; Fleming 1987; Tas. Bird Reps). Usually close inshore and rarely far offshore; two immatures *c.* 6 km offshore, beyond Lawrence Rocks, Vic. (Vic. Bird Rep. 1987); historical record of one following steamer to *c.* 350 km NE of Sydney (North). May frequent artificial wetlands, such as saltworks and stormwater overflow ponds (Storr 1985; J.M. Peter); sometimes in towns. One adult, apparently displaced by floods, took up residence in suburban garden where food was supplied (Dove 1930).

Breed offshore on rocky islets and rock stacks, usually on raised areas, such as ridges, cliffs, headlands and hillocks. Also on rocky outcrops and, sometimes, rocky beaches or rockfalls at base of cliffs (Tarr 1961; Liddy 1969; Simpson 1972; Harris & Bode 1981; *Corella Seabird Is Ser.*; HASB; Aust. NRS). Less often, on sandy islets, sandflats or at edges of lagoons (Simpson 1972; Baxter 1989; HASB; Aust. NRS). Occasionally on cliffs and headlands of mainland (Reilly *et al.* 1975; Aust. NRS). Usually nest among rock, or on granite boulders. Site bare, or with low tussock vegetation, small bushes, low succulents and weeds, such as thistles (Liddy 1969; Brothers 1980; North; Aust. NRS).

Usually forage along coasts, between high-water mark and shallow (<200 mm) water; on sandy beaches (Watson 1955; Tarr 1961; Cooper 1975; Chafer 1991; HASB; Tas. Bird Rep. 9); exposed mudflats and mudbanks (McGill 1955; Peter 1990). Often on exposed rocky platforms and reefs (Tarr 1961; Serventy & Whittell 1976). One bird seen foraging in shallow pools in exposed wave-cut rock platform, but took prey to nearby sandy beach (J.M. Peter). Sometimes feed in inshore waters (McGill 1955; HASB), often following ships and fishing boats (Tarr 1961; Amiet 1964; Angus 1986). Also feed at rubbish tips, wharves and beaches where fishermen clean their catch and, formerly, round whaling stations (Carter 1920; Liddy 1969; Fleming 1987; Coulson & Coulson 1993). Occasionally on wet pasture or freshly ploughed paddocks (Tarr 1961; Simpson 1972; Dann *et al.* 1994); on Flinders I., flocks regularly feed in paddocks (M.D. Murray).

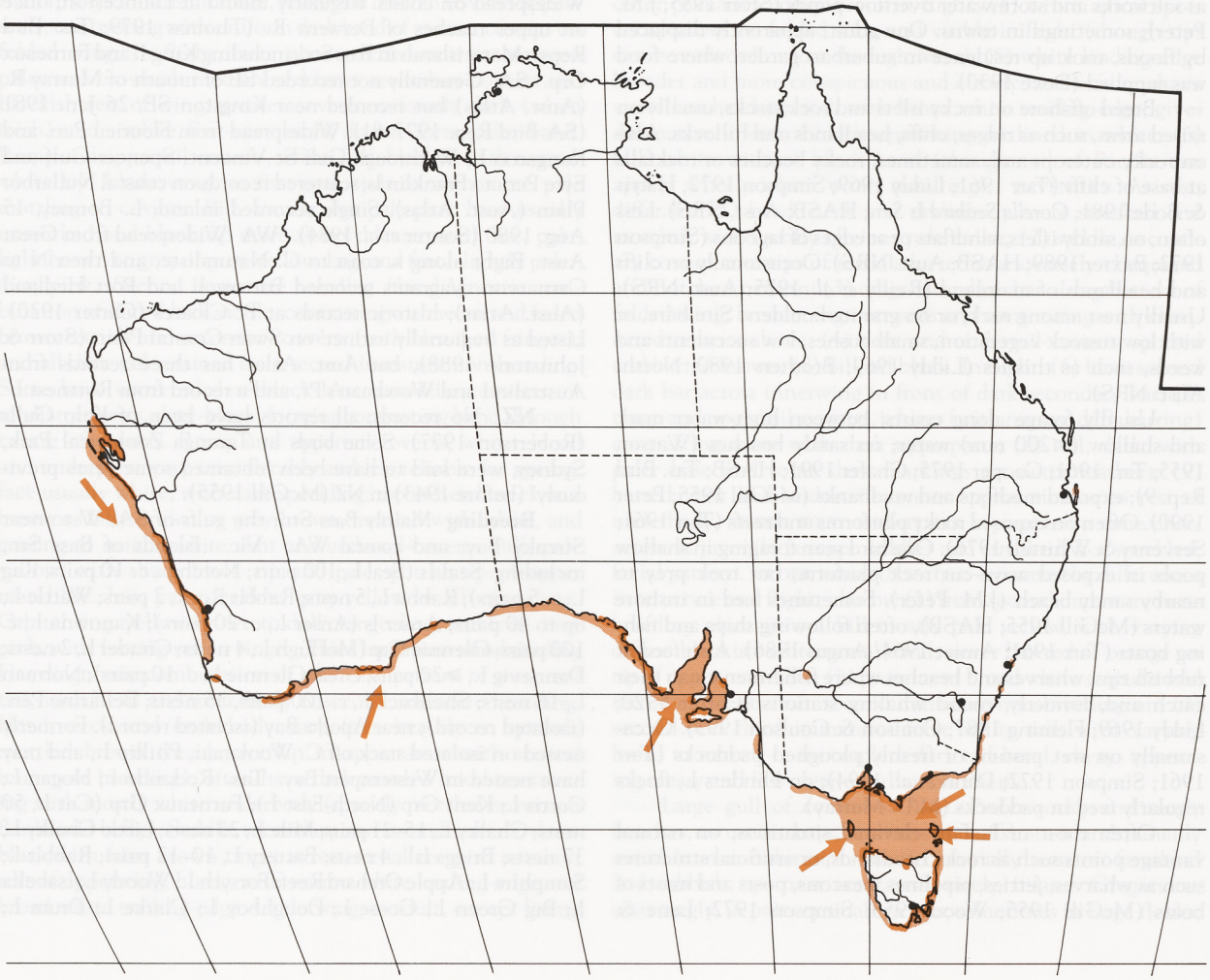
Often roost or loaf in elevated situations, on natural vantage points such as rocky headlands, or artificial structures such as wharves, jetties, pipelines, beacons, posts and masts of boats (McGill 1955; Wood 1955; Simpson 1972; Lane & Battam 1981; Baxter 1989). Also on sandy beaches (Baxter 1989), intertidal mudflats and exposed mudbanks (Peter 1990). Sometimes at edge of terrestrial wetlands, usually near coast (Fleming 1987; Tas. Bird Rep. 15; J.M. Peter).

DISTRIBUTION AND POPULATION Endemic to s. Aust.; mostly s. and w. coasts; infrequently e. coast. **Qld** Confirmed records: single, Wynnum, 14 May–Aug. 1987 (Qld Bird Rep. 1987); single, Scarborough, 6 Aug. 1989 (Qld Bird Rep. 1989). Other claims (e.g. Vernon & Filmer 1972) have not been verified (Roberts 1979). Earlier, said to be 'plentiful ... at Rockhampton' and widespread in Qld (Ramsay 1877), which may have been an exceptional n. irruption (McGill 1955); Mathews (1916) recognized a subspecies from Qld. **NSW** Recorded from Sydney, S to Vic. border (Aust. Atlas). Most n. records: Long Reef, 7 June 1941 (Hindwood 1942) and 6–12 June 1990 (NSW Bird Rep. 1990); doubtful historical record at Tweed R. (Mellor 1908). Occasionally recorded Sydney Harbour and Kurnell Pen.; increasingly reported in small numbers in Illawarra region (Gibson 1977; Morris 1986a, 1989; Chafer 1991; Hoskin 1991; NSW Bird Reps). Several unverified reports inland in Mudgee district and Blue Mts from nineteenth century (North). **Vic.** Widespread, from Gabo I. to C. Otway, mostly between Ls Entrance and w. Bellarine Pen. No Atlas records between C. Otway and Warrnambool; scattered records W from there to w. Discovery Bay (Learmonth 1954; Vic. Atlas). Vagrant recorded inland, near Mildura, Aug. 1975–Mar. 1976 (Sonter *et al.* 1984). **Tas.** Widespread on coasts. Regularly inland at Launceston; once on upper reaches of Derwent R. (Thomas 1979; Tas. Bird Reps). Many islands in Bass Str., including King I. and Furneaux Grp. **SA** Generally not recorded SE of mouth of Murray R. (Aust. Atlas) but recorded near Kingston SE, 26 Jan. 1981 (SA Bird Rep. 1977–81). Widespread from Fleurieu Pen. and Kangaroo I., W through Gulf St Vincent, Spencer Gulf and Eyre Pen. to Franklin Is; scattered records on coastal Nullarbor Plain (Aust. Atlas). Single recorded inland, L. Bonney, 15 Aug. 1980 (Sonter *et al.* 1984). **WA** Widespread from Great Aust. Bight along s. coast to C. Naturaliste, and then N to Carnarvon. Vagrants recorded Barrow I. and Port Hedland (Aust. Atlas); historic records at Pt Cloates (Carter 1920). Listed as 'regionally extinct' on Swan Coastal Plain (Storr & Johnstone 1988), but Aust. Atlas has three records from Australind and Woodman's Pt, and a record from Rottnest I.

NZ No records; all reports have been of Kelp Gulls (Robertson 1977). Some birds at Taronga Zoological Park, Sydney, were said to have been 'obtained some years previously' (before 1943) in NZ (McGill 1955).

Breeding Mainly Bass Str.; the gulfs of SA, W to near Streaky Bay; and coastal WA. **Vic.** Islands of Bass Str., including: Seal Is (Seal I., 100 pairs; Notch I., *c.* 10 pairs; Rag I., *c.* 5 pairs); Rabbit I., 5 nests; Rabbit Rock, 2 pairs; Wattle I., up to 40 pairs; Anser Is (Anser I., *c.* 20 pairs); Kanowna I., *c.* 100 pairs; Glennie Grp (McHugh I., 4 nests; Citadel I., 2 nests; Dannevig I., ≥20 pairs; Great Glennie I., *c.* 10 pairs); Norman I., 16 nests; Shellback I., *c.* 100 pairs, 35 nests; Bellarine Pen. (isolated record); near Apollo Bay (isolated record). Formerly nested on isolated stack off C. Woolamai, Phillip I., and may have nested in Westernport Bay. **Tas.** Rodondo I.; Hogan I.; Curtis I.; Kent Grp (North-East I.); Furneaux Grp (Cat I., 50 nests; Chalky I., 15–21 pairs; Mile I., 23 nests; Little Chalky I., 37 nests; Briggs Isl., 4 nests; Battery I., 10–12 pairs; Rabbit I.; Samphire I.; Apple Orchard Reef; Forsyth I.; Woody I.; Isabella I.; Big Green I.; Goose I.; Doughboy I.; Clarke I.; Drum I.;

Storehouse I.; Cragg I.; Peter Scotts Reef; S. Spences Reef; Puncheonhead Reef); Little Waterhouse I.; Baynes I.; MacLean I.; Pelican I.; Foster I.; Bird I.; Georges Rocks, 5 pairs; St Helens I., 4 pairs; Paddy's I., 60 pairs; The Nuggets No. 2, 14 pairs; Lachlan I., 60 nests; Visscher I., large colony; Green I., 27 nests; Bruny I.; Curlew I.; Seagull Rock; Southport I.; Recherche Bay; Arch I., 1 nest; Blanche Rock, 1 nest; Actaeon I., 2 pairs; Ile du Golfe, *c.* 4 pairs; Louisa I., 1 pair; Port Davey–Bathurst Harbour (Flat I., *c.* 7 pairs; Shanks I.; Kathleen I.; islands off Turnbull Head; Melaleuca Inlet; Claytons Schooner Cove); E. Pyramids, 1 pair; W. Pyramids, 1 pair; Albatross I., 2 pairs; Hunter Grp (Hunter I.; Three Hummock I.; Snob Rock; Penguin I.); Trefoil I., 40 nests; Woolnorth; Walker I.; E. Robbins I.; West Isl.; Circular Head Pen.; East I.; Howie I., 500+ birds; Crayfish Ck; Sister I.; Wright and Egg Is; Horseshoe Reef, 1 pair; Port Sorell; Trevallyn, near Launceston; Ninth or Twenty-day I.; King I. (Christmas I.; New Year I.; Councillor I.). May have nested on Sterile I., Maatsuyker I. and The Needles. **SA** Islets off Kangaroo I. (Casuarina Isl.; Beatrice Isl.; Busby Isl., 6–8 pairs; also C. du Couedic); Garden I.; Black Pt; Troubridge I., 4–5 pairs; Sir Joseph Banks Grp (Reevesby I.; Marum I.; Kirkby I.; Blyth I., 1+ nests; Sibsey I.); Boston I., 1 nest; Bicker Is; Round I.; Dangerous Reef, 7 pairs; Taylor I.; Thistle I.; S. Neptune I., 15–25 pairs; Leuth Bay; Rabbit I., 1–2 pairs; Brothers Is, *c.* 10 pairs; ABC I. (Venus Bay); W. Franklin I.; St Peter I.; Greenly Is (Anthony I.). **WA** Base of cliff, 3.2 km W of Twilight Cove, 1 nest; Arch. of the Recherche (Christmas I.; Round I.; Salisbury I.; Wickham I., 1 nest; Daw I.; Middle I., 1 nest; Goose I.; Combe I.; Cave I.; Nares I.; Lorraine I., 1 nest; Mondrain I., 2–3 pairs; Ram I., 3 pairs; MacKenzie I., 1 nest; Frederick I., 1 nest; Remark I., 1 nest; Woody I., 1–2 pairs; Thomas I.; Cull I., 2 pairs; Figure of Eight I., 1 pair; Observatory I.); Coffin I., 2 nests; Seagull I., Albany; Stanley I., 2 nests; Flat I., 1 nest; islet at mouth of Warren R.; Penguin I.; Seal I.; Rottnest I.; Edward I.; Lancelin I.; Wedge I.; Green I.; Whittell I.; Buller I.; Cervantes I.; Essex I.; Boullanger I.; Escape I.; Tern I.; Whitlock I.; Favourite I.; Sandland I.; Fisherman I.; Beagle I.; Houtman Abrolhos: 51 pairs on 39 islands: Pelsaert Grp (Stick I.; Pelsaert I., *c.* 5 pairs; Fin I.; Post Office I.; Burton I.; Diver I.; Eight I; Fairbridge [=Jackson] I.; Iris Refuge I.; Gregory I.; Gun I.; Murray I.; One I.; Seven I.; Ship Rock; Square I.; The Coral Patches; Three I.; Uncle Margie [=Mangrove I.]), Easter Grp (Wooded I., up to 8 pairs; Morley I., probably several pairs; islet off Rat I., former site; Bushby I.; Bynoe I.; Gilbert I.; Helms I.; Joe Smith I.; Keru I.; Little North I.; Suomi I.; Tapani I.; White Isl.), Wallabi Grp (Long I., E. Wallabi I., W. Wallabi I.; Dakin I.; First Sister I.; Long I.; Plover I.; Saville-Kent I.; Seal I.; Traitors I.); Jubilee I.; Passage I.; Kalbarri; Shark Bay (Three Bays I.; Salutation I., 9 nests; islet in Depuch Loop; Baudin I.; Mary Anne I.; Wilds I.; Leschenault I.; N. Guano I.; Charlie I.; Sunday I.; Slope I.; Pelican I.); Dorre I.; Bernier I. Formerly bred on islets near North Head (Green 1959; Wheeler 1960; Green & Mollison 1961; Liddy 1963, 1964, 1969; Stirling *et*



al. 1970; Milledge 1972; Davies & Chapman 1975; Reilly *et al.* 1975; Loyn 1978; Lane & Battam 1980, 1981; Harris & Bode 1981; Lane 1984, 1985; Brothers & Davis 1985; Storr 1985, 1987; Storr *et al.* 1986; Baxter 1989; Burbidge & Fuller 1989; Coulson & Coulson 1993; Fuller *et al.* 1994; Johnstone & Storr 1994; *Corella Seabird Is Ser.*; Tas. Bird Reps; SA Bird Rep. 1975; HASB; Aust. Atlas; Vic. Atlas; Aust. NRS; B.I. Robertson).

Irruptions None recently; historically, several extraordinary reports well N or inland: Rockhampton, Qld, *c.* 1877 (Ramsay 1877); in Mudgee district, NSW, Dec. 1885 and 1886 (North); Pt Cloates, WA, Sept. 1913 (Carter 1920).

Status Eastern subspecies *pacificus* considered rare; western subspecies *georgii* secure (Garnett 1993). **Populations** At least 1100 pairs in e. Aust.; non-breeding population of e. Tas. and Furneaux Grp, *c.* 1000 individuals (W.C. & M. Wakefield). Population on Houtman Abrolhos is largest in W. Populations in e. Aust. thought to have declined during twentieth century (Garnett 1993). In both e. and w. Aust., declines thought to have been caused by human disturbance on beaches and at breeding sites, and by interactions with increased populations of other species of gull (Silver *L. novaehollandiae* and Kelp Gulls) (Boehm 1961; Abbott 1977; Storr & Johnstone 1988; Garnett 1993). Near Sydney, NSW, said to be common in early 1920s but now considered rare (McGill 1958; Hoskin 1991). In Westernport Bay, Vic., numbers have declined from an average of 289 birds in 1970s to 176 in early 1980s (P. Dann). Numbers at breeding colonies and beaches in se. Tas. briefly rose from 266 to 315 between 1980 and 1983, but then fell to 146 by 1991. Numbers appear to have increased in areas where more food available through human activity (Green & Mollison 1961), e.g. at Launceston tip, numbers increased from 500 in 1984 to 850 in 1991 (Wakefield 1983a; W.C. & M. Wakefield). Rare near Perth, WA, till 1960s (e.g. Storr 1964), now considered locally extinct (Storr & Johnstone 1988).

Easily disturbed at breeding sites and roosting areas by human activity (Storr & Johnstone 1988; W.C. & M. Wakefield; Aust. NRS); birds at colony on Cat I., Tas., deliberately killed (Crowther 1938). Often scavenge on human refuse, congregating at rubbish tips, abattoirs and, formerly, whaling stations; feed on scraps left by picnickers, fishermen, round wharves and beaches, or from fishing boats (Carter 1920; Watson 1955; Liddy 1969; Merilees 1970; Simpson 1972; Wakefield 1983a; Angus 1986; Fleming 1987; Coulson & Coulson 1993). Birds occasionally become entangled in fishing lines (Liddy 1969). In Tas., after Mar. 1936, an open season held between 1 Nov. and 31 May; in Oct. 1957, partial protection was removed because Gulls were considered to be 'becoming a serious predator to other birds, particularly mutton birds ...' (Liddy 1969); fully protected after 1971 (N.P. Brothers).

MOVEMENTS Poorly known. Partly resident and partly dispersive. Movements apparently related to age (HASB). Mostly resident at breeding sites (Storr 1966; Stirling *et al.* 1970), though some disperse in non-breeding period (Aust. Atlas; Aust. Seabird Atlas); recorded throughout year in parts of non-breeding range, e.g. E of 147°E on mainland (Aust Atlas). Regular influxes recorded at some non-breeding sites, e.g. at Lakes Entrance, Vic., during winter (Bedggood 1970). Move to near-coastal wetlands or farmland in bad weather (Tarr 1961; Dann 1994) or to feed (Sedgwick 1940; Appleby 1984; Johnstone *et al.* 1990; M.D. Murray).

Adults Some regular seasonal movements recorded; in Vic., most adults recorded moving to breeding sites in spring (Vic. Atlas); at Altona, Vic., where breeding does not occur, most adults absent Sept.–Dec. (when assumed to be breeding) with numbers increasing and remaining high from Dec., possibly as birds returned from breeding sites. Decrease in numbers in late autumn may indicate dispersal to other non-breeding areas, e.g. at Cherry L., near Altona, few adults and immatures seen during winter (Watson 1955; Humphreys 1986). In Westernport Bay, Vic., numbers low in spring, when dispersed for breeding, and high in late summer to autumn (Dann *et al.* 1994); in Sydney and Illawarra areas, appears to be regular winter visitor (Morris & Chafer 1990). Straggler to coastal ne. NSW and se. Qld (see Distribution).

Subadults Disperse after fledging, some flying hundreds of kilometres from breeding grounds within months of fledging (Aust. Atlas) (see Banding). Generally remain dispersed during breeding seasons until adult, though recorded returning temporarily to natal breeding area (Wakefield 1984). **Tas.** Colour-banded young generally remained at source of food nearest natal colony in first year after fledging; some fidelity to foraging sites within seasons, though some moved >40 km between tips in se. Tas. (Wakefield 1984). **Vic.** Fledgelings disperse E and W along coast from breeding areas (see Banding), a few moving up e. coast (McGill 1955; Hoskin 1991). Recorded off coast in winter (Mitchell 1987a,b). Numbers of immatures at Altona, Vic., increase June and July, possibly indicating regular seasonal movements (Watson 1955). **NSW, Qld** Since 1941, records near Sydney mostly immatures, May–Sept. (McGill 1955; Morris 1986b; Hoskin 1991). Recorded on coast of NSW as early as Jan. and as late as Oct. (NSW Bird Reps 1987, 1988, 1989); also recorded as far N as s. Qld, May–Aug. (Qld Bird Rep. 1987).

Occurrence in some coastal areas may be related to weather conditions (e.g. Belcher 1914; Bedggood 1970). Rarely far inland or far offshore (see Distribution) but regularly use some feeding grounds away from coast, e.g. North Esk Valley, Tas. (Littler 1910), often moving along watercourses (e.g. Le Souëf 1919; Tas. Bird Rep. 1983). Pairs breeding on islands can visit adjacent mainland (Ford 1965) and move locally between roosting and feeding sites (Sedgwick & Sedgwick 1950).

Banding, Colour-marking Of birds hatched and banded Furneaux Grp, Tas., most recoveries to S on mainland Tas. (ABBBS); movements ≤165 km, with often only a few months between banding and recovery (Anon. 1979, 1980). One banded Flinders I., Bass Str., recorded mainland Tas. as second-year bird (Wakefield 1984). Of four birds banded on islands just off ne. Tas., and recovered away from natal islands, all were recovered less than 9 months after fledging and had moved between 100 and 230 km, to mainland Tas. and islands near Tas. mainland (Liddy 1969). Vic. recoveries indicate fledgelings disperse NE and NW along coast, with some moving more than 100 km (ABBBS). One banded as nestling at Coffin Bay, SA, in 1965 observed *c.* 260 km ENE in Mar. 1966 then found dead Oct. 1967, 8 km from banding site. One banded as first-year in WA, recovered 190 km N during first winter after fledging (HASB).

Fidelity to natal area unknown; one banded as runner on Mile I., Furneaux Grp, Tas., late in 1977 found dead only 8 km away in Sept. 1981 (*Corella* 6: 22) and two nestlings banded in Tas. found dead over 8 and 12 years after banding, only 21 km from banding site (*Corella* 14: 140, 16: 164). Bird banded Goose I. recovered 295 km away at Lauderdale, Tas. (Aust. Atlas).

34S135E	12	1	U	2	266	61	ABBBS
34S135E	12	J	U	2	266	61	ABBBS
34S136E	12	1	U	9	226	40	ABBBS
38S146E	12	P	U	10	194	52	ABBBS
38S146E	01	P	U	21	145	300	ABBBS
39S146E	12	P	U	33	149	301	ABBBS
39S146E	01	P	U	9	129	310	ABBBS
39S146E	01	P	U	9	123	317	ABBBS
40S147E	12	P	U	4	260	278	ABBBS
40S147E	01	P	U	13	228	188	ABBBS
40S147E	12	P	U	3	167	225	ABBBS
40S147E	11	P	U	3	162	202	ABBBS
40S147E	11	P	U	3	162	202	ABBBS
40S147E	12	P	U	8	153	169	ABBBS
40S147E	12	P	U	25	139	222	ABBBS
42S147E	12	P	U	3	107	226	ABBBS
43S147E	11	P	U	37	110	31	ABBBS
43S147E	11	P	U	37	108	36	ABBBS

FOOD Carnivorous; predator and scavenger. Molluscs, echinoids, fish, birds and other marine animals; carrion and tide-line wrack. **Behaviour** Diurnal and nocturnal. Hawk over colonies of White-faced Storm-Petrels *Pelagodroma marina* on moonlit nights, pouncing on prey (Littler 1910; Jones 1937). Will hunt co-operatively, e.g. two immatures attacked and killed Hoary-headed Grebe *Poliocephalus poliocephalus* (Smith 1985). Once seen to attack Crested Tern *Sterna bergii* in air over water, injuring it but not killing it (Stirling *et al.* 1970); seen to attack and kill seven Fairy Prions *Pachyptila turtur* but not to eat them (Robinson 1961). Take well-grown Short-tailed Shearwaters *Puffinus tenuirostris* and swallow them whole. Steal fish from Australasian Gannets *Sula serrator* at colonies (Cashion 1958). Take worms and grubs washed out of soil during floods (Littler 1910; Simpson 1972). Forage in flooded paddocks for notostracans, probing 5 cm into substrate with bills (Appleby 1984). Follow plough, with Silver Gulls (Tarr 1961). Several birds seen feeding from single beachcast corpse of Short-tailed Shearwater (J.M. Peter). Scavenge offal and waste from fishermen (Sedgwick 1940; Coulson & Coulson 1993). Swimming birds seen to dive fully under water to retrieve food such as fish scraps (B.I. Robertson). Foot-tremble to disturb prey in loose substrates (Tarr 1961). Use bill to tear molluscs from substrate and open them (Simpson 1972). Drop gastropods, echinoids and other objects from air to break them open, often using same platforms for many years (White 1916; Le Souëf 1917; Condon 1938; Serventy & White 1943; Wheeler 1943, 1946; Chisholm 1954; Watson 1955; Tarr 1961); for discussion of this behaviour see Farr (1978) and Social Behaviour.

Adult On **Green I., se. Tas.** (43 pellets; Coulson & Coulson 1993): MOLLUSCS: polyplacophorans: chitons 28.0% freq.; Mopaliidae: *Plaxiphora albida* 16.3; Chitonidae: *Chiton pelliserpentis* 16.3; gastropods: Turbiniidae *Turbo undulatus* 9.3; cephalopods: 7.0 (including unident. squid beak 4.7 and cuttle bone 2.3). CRUSTACEANS: decapods: Porcellanidae: *Petrolisthes elongatus* 7; crabs: Leucosidae: *Philyra laevis* 4.7; Portunidae: *Ovalipes australiensis* 25.6; Grapsidae: *Cyclograpsus granulosus* 4.7; *Paragrapsus gaimardii* 18.6; Cancridae: *Cancer novaezelandiae* 4.7; unident. 4.7. ECHINODERMS: sea urchin: Echinometridae: *Heliocidaris erythrogramma* 9.3. FISH (mostly *Platycephalus bassensis*, >20 cm long) 46.5. Refuse (incl. glass, string, plastic, paper, bones, and aluminium foil) 2.3.

Other records Plants Zygophyllaceae: *Nitraria schoberi* (Stirling *et al.* 1970). **Animals** ANNELIDS: oligochaetes (Littler 1910; Simpson 1972; van Tets *et al.* 1977); MOLLUSCS (Gould): polyplacophorans: Chitonidae chitons (Stirling *et al.* 1970); gastropods: limpets (Chisholm 1954); Haliotidae: *Haliotus*; Turbiniidae: *Turbo* (Le Souëf 1917; Condon 1938; Serventy & White 1943; Chisholm 1954); *T. stramineus* (White 1916); *Turbo (Ninella) torquata* (FAB); bivalves: Mytilidae (Wheeler 1943, 1946; Watson 1955; Tarr 1961); cephalopods: Octopodidae: octopus (White 1916). CRUSTACEANS: notostracans (Appleby 1984); crabs (Jones 1979; Gould): Xanthidae: *Pseudocarcinus gigas*; Portunidae: *Ovalipes australiensis* (Simpson 1972). INSECTS: Orthoptera: Tettigoniidae (FAB). ECHINODERMS: echinoids (Chisholm 1954): Echinometridae: *Heliocidaris erythrogramma* (Condon 1938). FISH (Sedgwick 1940; Cashion 1958; Tarr 1961; Gould; FAB). BIRDS: seabirds, eggs and young (Tarr 1961); Hoary-headed Grebe (Smith 1985); Australasian Gannet chicks; Little Shearwater (HASB); Short-tailed Shearwater, adults and chicks (Cashion 1958); White-faced Storm-Petrel (Littler 1910; Jones 1937). MAMMALS (Gould). Carrion (Gould): New Zealand Fur-Seal *Arctocephalus forsteri* placentae and vomit (Stirling *et al.* 1970); raw meat (van Tets *et al.* 1977). Bread; fishing offal (Watson 1955). Refuse (Tarr 1961; Simpson 1972; Wakefield 1984).

SOCIAL ORGANIZATION Poorly known; no published studies. Often solitary; adults usually seen singly or in twos, rarely in large groups (Tarr 1961; Storr 1966), though sometimes congregate to feed, breed or roost, e.g. 26 adults and 13 immatures gathered round dead shearwater chicks (Johnstone *et al.* 1990); feeding groups of 30 (Appleby 1984) and 200–300 birds (W.C. Wakefield); flocks of 50 or so in paddocks (Tas. Bird Rep 1986, 1991); up to 500 at rubbish dumps (Aust. Atlas); one record of 850 at tip in Launceston, Tas. (W.C. Wakefield); roost of 72 birds, mainly adults with some juveniles (Tas. Bird Rep. 1985). Immatures often form flocks after breeding season (Tarr 1961); more likely to move round in small groups; recorded congregating at tips in se. Tas. from about mid-May to Oct. (Wakefield 1983b).

Bonds Adults said to pair permanently (Aust. RD). **Parental care** Both sexes incubate (Aust. NRS); one member of pair may guard incubating bird (Tarr 1961). In se. Aust., young leave breeding island 8–12 weeks after hatching (Wakefield 1983b). Juveniles disperse after fledging (see Movements).

Breeding dispersion Solitary pairs (e.g. Wheeler 1960; Tarr 1961; Robertson 1981a; Fuller *et al.* 1994) or loosely colonial (e.g. Aust. NRS; W.C. Wakefield). Sometimes in mixed colonies with Kelp Gulls (e.g. Aust. Atlas; Aust. NRS); also nest with other species (see Breeding). Little published information on distance between nests: four nests at least *c.* 46 m apart, but birds did not mix (Tarr 1949, 1961); nests well spaced (Campbell). For size of colonies, see Population; usually small (e.g. Green & Mollison 1961), but up to at least 500 birds recorded (Tas. Bird Rep. 1986). **Territories** Pairs thought to hold territories (e.g. Tarr 1961; Harris & Deerson 1980; Harris *et al.* 1980), but not properly known. After eggs laid, one of pair stays at vantage point, from which it attacks intruding conspecifics (Tarr 1961). Travel up to 39 km from breeding islands to feeding areas (W.C. Wakefield).

Roosting Little known. In some areas, nocturnal communal roosting mainly by subadults (W.C. Wakefield); some birds arrive at roost after dark, apparently mainly first- and second-year birds (Wakefield 1984). Sit on ground, with head turned and bill placed on back (J.M. Peter). Sometimes shelter in pastures behind coastal dunes or cliffs (Tarr 1961). At high tide, adults generally found standing on rocks, spits, or posts;

may use these as observation points (Tarr 1961; W.C. Wakefield). At feeding areas, most time spent either loafing or, in case of adults, watching from observation points; juvenile and first-year birds mainly loafed near feeding areas (Wakefield 1984). Small numbers may roost with Kelp Gulls (Wakefield 1984).

SOCIAL BEHAVIOUR Poorly known; no published studies. Presence of people appears to cause most aggression between Pacific and Kelp Gulls in mixed colonies (Wakefield 1984). **Flock behaviour** Some co-ordination between birds as large numbers gather rapidly in response to behaviour of birds that have found food (Wakefield 1984). Will co-operate to hunt (see Food). Following displays described, though their function unknown. (1) In early Apr., two mature birds started calling, then walked parallel to each other, with bills lowered to sand as though searching for food; one bird flew at other and seized its wing; chasing followed but no further clashes; when on ground, birds let wings drop and called (Watson 1955). (2) Tame adult apparently begged to person: sidled up, pointed head and bill upwards uttering series of laughing calls, then ducked head between its legs and called again (Dove 1930). Records of flying birds deliberately dropping objects (e.g. Serventy & White 1943; Chisholm 1954) with great aerodynamic skill: with object in bill birds took off steeply into wind; stopped flapping at height of *c.* 3 m in light to moderate winds and *c.* 9 m in high winds; soared up and back until over take-off point, then dropped object; height of drops varied from 4–5 m in light to moderate conditions to 18–21 m in high winds; birds then descended almost vertically to land just behind fallen object; repeated procedure 2–8 times (Farr 1978). Sometimes birds appear to play with mussels and shells; drop then retrieve them before they reach ground (Wheeler 1943; Tarr 1961). According to Farr (1978), though no data presented, dropping more prevalent in immatures than adults; seems only to occur when at least moderate wind blowing; object dropped onto any surface, e.g. sea, sand or concrete. For discussion on whether behaviour associated with feeding or playing, see Farr (1978).

Agonistic behaviour During incubation, appears to be little aggression within colony or between colonially breeding Pacific and Kelp Gulls; interactions with nesting Kelp Gulls in colony often quite fierce, with physical clashes (B.I. Robertson). Intruder approaches occupied territory, with neck arched in a still attitude (Silver Gull has similar posture), then begins picking up pieces of grass or sticks and dropping or throwing them over its back; these actions seldom end in fight as aggressor usually leaves in response to advance of resident bird (Tarr 1961). One bird, for unknown reason, seen to attack Crested Tern, leaving it with much broken plumage and unable to fly (Stirling *et al.* 1970). **Alarm** Will bite if handled (Wakefield 1983b). Flying Gulls turn and return to soar over observers (if noticed) uttering loud cry (Legge 1930); see Parental anti-predator behaviour. Aggression by Kelp Gulls towards Pacific Gulls mainly towards newly fledged young; in areas where both breed, Kelp Gulls seen to attack and kill recently fledged Pacific Gulls; this aggression arises mainly as a result of human presence in colonies (Wakefield 1983b, 1984).

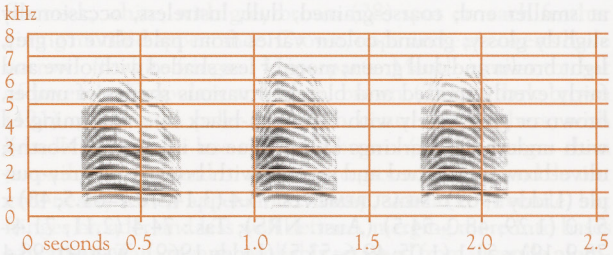
Sexual behaviour Courtship feeding Details unknown. Following observed some distance from colony: one adult lowered head and body to another Gull, which disgorged food onto ground from where it was eaten by first bird (HASB). **Copulation** Often occurs at resting place near nesting area (Tarr 1961).

Relations within family group For first week, young appear to be fed on partly digested food, mainly by one parent (Tarr 1961). **Anti-predator responses of young** Hide under tussocks (Brothers 1980); before they can fly, may take to water (HASB); well-feathered chicks may fly or run into sea (Warham 1956). If suddenly disturbed, sometimes disgorge food (Tarr 1961). **Parental anti-predator strategies** Where field of view round nest restricted, non-brooding parent may keep guard from lookout-posts (W.C. Wakefield). When disturbed, often fly over nests or young, calling (Tarr 1949; Campbell; North; HASB). Bird once flew after White-bellied Sea-Eagles *Haliaeetus leucogaster* near colony (Warham 1956).

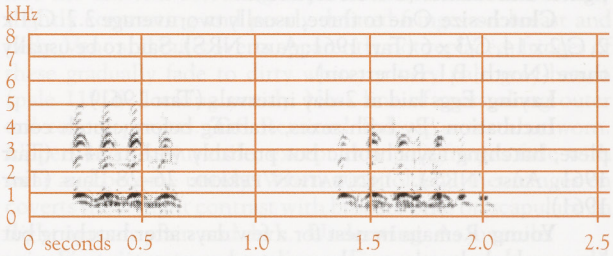
VOICE Poorly known. No detailed studies. Calls quite different from those of Kelp Gull.

Adult ALARM CALL: rather long *ow-ow* (sonagram A) or *oh-oh; ow-ow* uttered when people enter colony; notes becoming shorter and sharper if nests approached (HASB); persistent deep barking *oh-oh* when flying over intruder near nest (Tarr 1961; Campbell; North). **Other calls** Deep throaty *cark-cark* given by each of two birds, both having landed on a sandbank after aerial chase in which one had seized other by wing (Watson 1955). Flying birds seen to turn and fly over people, uttering loud and raucous cry (Legge 1930; see Agonistic behaviour). When begging for food, a tame free-flying bird gave series of resonant calls with bill pointing skyward, further calls with head between legs, finishing with turkey-like gobble made with bill horizontal (Dove 1930). Sonagram B may show two anxiety calls.

Young Newly fledged chicks sometimes give *seep* when begging for food (B.I. Robertson).



A E. Slater; Chappell I., Furneaux Grp, Tas.; priv.



B ABC Nat. Hist. Unit; Westernport Bay, Vic.; P36

BREEDING Poorly known, no major studies; 172 records in Aust. NRS. Nest in loose colonies or singly, sometimes within colonies of Kelp Gulls (Aust. NRS).

Season Broadly Oct.–Jan. (e.g. Tarr 1961; North), Sept.–Nov. (Lashmar 1987), Sept.–Dec. (Aust. NRS); said to nest in spring and autumn in some areas (HASB). On Abrolhos Is and in Shark Bay, WA, begins Aug. (HASB); on Houtman Abrolhos, most eggs, Sept., and most young have flown by

mid-Dec. (Fuller *et al.* 1994); in SA, eggs and young, late Sept. (Wheeler 1960); in Tas., eggs, Oct. and Dec. (Liddy 1969).

Site Prefer elevated site; on rocky outcrops, headlands, small hillocks, ridges, side of cliffs, islands, offshore rocks; also low-lying sandy areas, such as beaches; in areas of grass, tussocks of *Stipa* or *Poa*, Marram Grass, *Mesembryanthemum*, pigface, thistles or bushes; in open exposed positions; between boulders or rocks. Nests placed just above high water or up to 37 m asl; from 5 to 90 m from sea (Tarr 1961; Liddy 1969; Aust. NRS). One pair per island on small islands off WA (Ford 1965; Fuller *et al.* 1994). Solitary pairs may nest only *c.* 46 m apart (Aust. NRS); 6–10 pairs in colony of 90 Kelp Gulls in *c.* 1900 m^2 (Aust. NRS). Same general areas used each year; one pair nested *c.* 3.5 m from site of previous year (Ford 1965; Lashmar 1987). Sometimes in colonies of Kelp Gulls, and on islands with other species of birds, including: Little Penguins *Eudyptula minor*, Silver Gulls, White-faced Storm-Petrels, Australasian Gannets, Short-tailed Shearwaters, Pied Oystercatchers *Haematopus longirostris*, Sooty Oystercatchers *H. fuliginosus*, Caspian Terns *Sterna caspia*, White-fronted Terns *S. striata*, Crested Terns, Fairy Terns *S. nereis*, Rock Parrots *Neophema petrophila*, Welcome Swallows *Hirundo neoxena* and Common Starlings *Sturnus vulgaris* (Aust. NRS; B.I. Robertson).

Nest, Materials Two types of nest: scrape or depression in ground, unlined or lined with gravel or small stones; or neat shallow bowl, constructed out of grass, sticks, flower stalks, seaweed or feathers, lined with finer material (Tarr 1961; Fuller *et al.* 1994; Aust. NRS). One pair carried material from mainland to offshore island (North). MEASUREMENTS (cm): diameter, 19.6–25.4; depth, 6.4–12.7 (Liddy 1969; HASB); inside diameter, 22.9; depth, 7.6 (Tarr 1961).

Eggs Oval, sometimes slightly elongate or slightly pointed at smaller end; coarse-grained, dull, lustreless, occasionally slightly glossy; ground-colour varies from pale olive to grey, light brown and dull green; more or less shaded with olive and fairly evenly spotted and blotched various shades of umber, brown or grey; rarely with brownish-black hue, intermingled with underlying markings of dull blue or inky-grey (North); olive-brown, blotched and spotted with brown and grey-purple (Liddy 1969). MEASUREMENTS: 75.4 (3.14; 70.7–81.5; 48) x 51.0 (1.29; 48.0–54.5) (Aust. NRS); Tas.: 74.4 (2.11; 71.4–78.9; 19) x 51.1 (1.05; 49.6–53.5) (Liddy 1969). WEIGHT: 98.4 (6.42; 85–110; 39) (Aust. NRS). Third egg of clutch often lighter and smaller (B.I. Robertson).

Clutch-size One to three, usually two; average 2.2: C/1 x 2, C/2 x 14, C/3 x 6 (Tarr 1961; Aust. NRS). Said to be usually three (North; B.I. Robertson).

Laying Eggs laid at 2-day intervals (Tarr 1961).

Incubation By both sexes, starting before clutch complete; hatching asynchronic but probably within 24 h (Tarr 1961; Aust. NRS). INCUBATION PERIOD: 26–28 days (Tarr 1961).

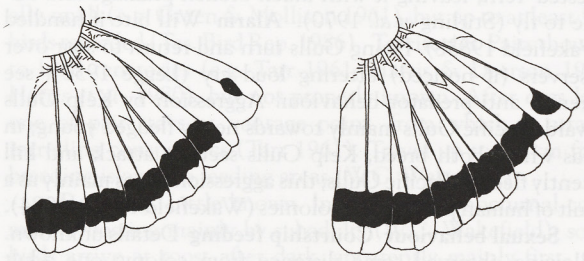
Young Remain in nest for a few days after hatching but later seek shelter in nearby vegetation, sometimes moving distances of up to 30 m; before able to fly, will take to water if threatened (Liddy 1969; HASB; B.I. Robertson). Ready to fly at 8 weeks old (Tarr 1961). Chicks in wild and in captivity show same rates of growth. Continue to increase in size for at least 2.5 years after hatching (B.I. Robertson).

Success From 35 eggs, 26 (74%) hatched (Aust. NRS). If nesting fails, do not renest (B.I. Robertson).

PLUMAGES Prepared by D.J. James. Slightly atypical large gull, maturing gradually over 4–5 years (slightly slower than Kelp Gull) with eight or ten recognizable plumages (including natal down) and eight or ten moults before reaching adult plumage. First-year plumages generally brown and mottled; subsequent plumages progressively neater and more black-and-white. Moult three times in first year. Hatch in natal down. Begin post-natal moult soon after hatching and fledge in mid-summer when *c.* 8 weeks old (Tarr 1961). Then undergo partial post-juvenile moult to first immature non-breeding, followed immediately by partial pre-breeding moult to first immature breeding plumage. Thereafter, moult twice annually: a complete post-breeding moult in late summer and autumn, and a partial pre-breeding moult in early spring; probably attain adult (definitive) plumage with fifth (sometimes fourth) non-breeding plumage. In young immatures, plumages and bare parts change greatly with each moult; but changes abate with age, and there is little seasonal variation in adults. Moults of immatures (and failed breeders) earlier than homologous adult ones, but gradually become later each year until breeding. Mostly breed first in adult plumage. Sexes similar but males slightly larger. Two subspecies, one in se. Aust. and one in s. and w. Aust.

Following descriptions of plumages not absolute because individuals progress through plumages at different rates (some mature faster than others), and show differing combinations of plumage characters. Patterns of flight-feathers and body-feathers (especially head) not strongly correlated (flight-feathers more consistent within age-groups than are body-feathers). Most immatures can be correctly aged by plumage, but proportion wrongly aged not known. Descriptions based on skins (AM, HLW, MV, QVM, SAM, TMAG, WAM), field observations (D.J. James; D.W. Eades) and photos (Harrison 1987; Pringle 1987; Trounson & Trounson 1987; Flegg & Longmore 1994; James 1995; unpubl.: M.J. Carter; J.N. Davies; D.W. Eades; W.C. & M. Wakefield).

Nominate *pacificus* Adult non-breeding and breeding (Fifth [sometimes fourth] and subsequent basic [winter] and alternate [summer]). **Head and neck** White. **Upperparts** Mantle, scapulars and back, dull black to greyish black (c89) with velvety sheen when fresh; develop black-brown (119) tinge with wear. Inner 1–2 rearmost scapulars have white tips <5 mm long and mostly covered by black outer rear scapular, so no prominent scapular crescent. Rump and tail-coverts, white. **Underparts** White. **Tail** White, with black subterminal band *c.* 40 mm wide and white tip *c.* 20 mm wide. Black band slightly wider in centre: 40–50 mm on t1 and 30–40 mm on t5; on t6, band *c.* 20 mm wide on inner web and shaft, with outer web white (see Fig. 1). During moult, tail-band sometimes not



Subspecies *georgii* (WA) Nominate *pacificus* (e. Aust.)

Figure 1 Tail-pattern of subspecies of Pacific Gull

visible and tail appears all white in field (Eckert 1971; Robertson 1977). **Upperwing** Marginal coverts, white, forming very narrow white leading-edge. Rest of coverts and alula, black, like scapulars. Tertials, black, with peppered gradation to fine white tips, which form small tertial crescent. Secondaries, black, with narrow white tips forming narrow trailing-edge that broadens inwards (tips *c.* 12 mm long on s1, *c.* 25 mm on s15). Primaries, black, with small white apical spots narrowing outwards from p1 (*c.* 10 mm) to p5 (*c.* 5 mm) and often only on inner web of p4–p5; p6 and p7 have narrow white fringes at tips of inner webs, which are rapidly lost with wear. Show no white spots on primaries when wing folded. **Underwing** Coverts and subhumerals, white, except outer greater primary coverts faintly speckled pale grey (86). Primaries and secondaries, black, with white tips from p5 inwards, forming trailing-edge; white tips of remiges broaden and length of greater coverts increases inwards, so that black band on wing tapers rapidly inwards.

Downy young Based on one SA skin (SAM) and photos of three Tas. birds (Pringle 1987; unpubl.: W.C. & M. Wakefield). Down, long and hairy. Head, cream (92) to pale brown-grey (pale 44) with many large black-brown (119) blotches; do not form pattern except for suggestion of broken lateral crown-stripes; large blotch on forehead at base of upper mandible. Neck, black-brown (119) at base of down, with cream (92) to pale brown-grey (pale 44) tips; bases visible, forming weak collar. Upperparts and wing, pale grey-brown (119D) with black-brown (119) blotches (slightly larger than those on head) and sparse streaking. Bold black-brown (119) stripe along innerwing present in at least some. Breast and belly, pale cream (92). Vent and thighs, pale grey-brown (119D) with dark brown-grey (c79) bases showing through.

Juvenile Head and neck Dark brown (121–221) with concealed white bases to feathers. With wear, bases to feathers of forehead, chin and throat become exposed, these areas becoming mottled off-white. Inconspicuous fine light-brown (239) fringes to feathers of nape and hindneck wear off by about time of fledging. Soon after fledging, chin, lores and forehead become white with dark-brown (c121) scaling. Inconspicuous brown-grey (c45) eye-ring, broken in front of eye. **Upperparts** Mantle (121, 221) like head, with very fine light-brown (239) to buff (124) fringes when fresh. Scapulars and back, dark brown (121–221) with broad pale-brown (223D) fringes that form neat sharp scaling that dominates upperparts; fringes bolder towards rear; some have narrower fringes and less obvious scaling. Some rear scapulars have rich-brown (121C) mottling towards centres, giving impression of slightly paler feather with dark subterminal band and neat pale fringe. Lower back and rump, dark brown (121, 221) with broad but diffuse fringes that grade from pale grey-brown (119D) to pale brown (223D) distally. Tail-coverts, dark brown (c121) grading to mottled pale grey-brown (119D) at base, with rich-brown (121C) blotches distally and buff (124) fringes *c.* 4 mm wide; probably much individual variation. **Underparts** Breast and sides, uniformly dark brown (121) with soft grey tinge. Belly, similar but with pale grey-brown (119D) tips giving slightly paler, mottled appearance. Flanks, dark brown (121) with broad buff (124) to cream (92) fringes, giving distinctly scaly appearance matching that of wing-coverts. Vent, cream (92) to very pale grey-brown (pale 119D). Tail-coverts, pale grey-brown (119D) with greyish-brown (28) spots at tips of outer coverts, giving boldly spotted or streaked appearance; rearmost coverts have dark-brown (121) tips (with narrow buff [124] fringes) grading through peppery pale grey-brown (119D) to white at bases. **Tail** Black-brown (119) with narrow pale tip *c.* 4 mm wide when fresh, which grades from white distally to buff (124) proximally. Rectrices have narrow concealed brownish-grey bases. **Upperwing** Plain, with no prominent wing-bars. Primaries, black-brown (119) grading to greyish brown (79) along inner edge; inner five have narrow buff (c124) tips. Greater primary coverts, black-brown (119) with light-brown (c27) fringes that are broader and more distinct on inner feathers. Lesser primary coverts and alula, black-brown (119) with narrow inconspicuous brown (119B) tips. Secondaries, mostly black-brown (119) with greyish-brown (79) tips and distal third of inner webs; outer feathers have obscure subterminal light-brown (c27) spot centred on shaft. Lesser and median coverts, dark brown (121) grading to faintly paler centres, with bold sharp buff (124) fringes like scapulars; fringes broader on rear rows of feathers. Greater secondary coverts, similar but paler and browner (28) with less well defined fringes. Tertials, dark brown (121) fading to brown (28) towards tips, with narrow cream (92) fringes. **Underwing** Remiges and greater coverts, dark grey-brown (grey 119A) with satin sheen; outer primary has whitish shaft. Greater primary coverts, black-brown (119) with light-brown (c27) fringes that are broader and more distinct on inner feathers. Rest of coverts and subhumerals, dark brown (121–221); slightly paler centres and bases to coverts can give slightly streaky appearance.

First immature non-breeding (First basic [winter]). Only some feathers of head and body replaced, so appear similar to juvenile, but less boldly patterned on upperparts. **Head and neck** Mostly dark brown (121) but front of face tends to look speckled; usually more white mottling present on forehead, chin and lores (up to 50% white); some birds have throat and foreneck, white, with grey-brown (28) spot on each feather giving mottled appearance. Crown, nape and ear-coverts have narrow off-white fringes. **Upperparts** Mantle similar to that of juvenile. Scapulars and back, brown (28) to dark brown (121), grading to paler brown in centres of feathers, with broader but much less tidy pale-brown (223D) fringes than juvenile; fringes tend to merge into ground-colour and do not give neatly scaled appearance. Rump, similar to juvenile, but fringes broader and less well defined, merging more into bases of feathers. Tail-coverts, probably retained from juvenile plumage. **Underparts** Mostly dark brown (121) but varying slightly; lose the uniform colouring of juvenile. Have broad but only slightly contrasting and poorly defined fringes on breast and belly. Vent and tail-coverts apparently not replaced; fringes of these gradually fade to dirty white or very pale grey-brown (pale 119D), looking untidy. Neat line of spots along outer tail-coverts persists. **Tail** Retained. Pale tip persists but worn. **Upperwing** As juvenile, except that pale fringes fade with wear and become untidy. When wing folded, finer fringes on coverts show slight contrast with broader ones on scapulars. In flight appears plain and dark. **Underwing** As juvenile.

First immature breeding (First alternate [summer]). Still dark and mottled brown; individual variation more marked. **Head and neck** Similar to first immature non-breeding, but generally have more white mottling on forehead, lores, chin and throat, and extending to crown and ear-coverts. Neck more uniformly brown than head, and contrast between these emphasized by thin faint off-white collar between ear-coverts and side of neck. Eye-ring, paler, off-white, and more conspicuous. **Upperparts** Similar to first immature non-breeding. Some probably renew tail-coverts, which are then like second immature non-breeding (see below). **Underparts** Similar to

first immature non-breeding but generally slightly more mottled and untidy. **Tail** Retained; tips worn off or nearly so. **Upperwing** Retained from juvenile. Fringes to lesser and median coverts lost with wear, appearing more uniform. Greater coverts bedraggled, with very bleached and frayed fringes, contrasting strongly with fresh upperparts; bleached greater coverts form faintly paler wing-bar contrasting with more uniform and darker secondaries and rest of coverts. **Underwing** Retained, and little changed.

Second immature non-breeding (Second basic [winter]). Mostly brown plumage. **Head and neck** Similar to first immature breeding. Ear-coverts, crown, nape and hindneck, dark brown (121, 119A) with fine off-white fringes producing fine scaling. Forehead and anterior lores, off-white to pale grey-brown (pale 119D), heavily mottled grey-brown (28); have lightly streaked appearance. Chin and throat, off-white, with elongated grey-brown (28) spots in centre of feathers. Neck, dark brown (121, 119A) with varying whitish tips, edges and bases giving untidy appearance. Side of neck separated from ear-coverts by thin faint off-white collar. **Upperparts** Mantle, scapulars and back, dark brown (219) grading to slightly paler dark-brown (c119A) at fringes of feathers; presents much less patterned appearance than first-year plumages (though moult of body occurs well after moult of flight-feathers and often retain some first immature non-breeding feathers for some time). Rump and tail-coverts, white to pale grey (86), sometimes mottled or speckled light-brown (c27) with irregular dark-brown (119A) edges. Some apparently have tail-coverts like first year till at least Mar. **Underparts** Uniform greyish brown (pale 91 to grey 27) fading to cream (92) on vent; slight mottling on breast caused by indistinct brighter and paler light-brown (c27) fringes to feathers. Undertail-coverts, white. Flanks and axillaries, brownish-grey (c80) lightly speckled with grey-brown (c28). **Tail** Renewed, but still similar to that of juvenile. White tips slightly narrower and less sharply defined. Bases, off-white speckled brown (c28) (grading into tip) for up to one-third of t6 and one-quarter of inner webs on t5 and t4; usually visible only when tail spread in flight. Some have only small pale bases concealed by coverts. **Upperwing** Primaries, black-brown (119) like juvenile, but have more rounded tips, and no pale tips to inner primaries. Secondaries, black-brown (c119) grading to grey-brown (c28) on inner edge, and with narrow off-white tips. Coverts, rather plain, much like mantle. Lesser secondary coverts, dark brown (219) with indistinct and messy light grey-brown (119C) fringes. Median secondary coverts, dark brown (219) with slightly darker shaft-streaks, appearing rather uniform. Greater secondary coverts, dark brown (219) grading to slightly paler but indistinct fringes, which become more prominent with wear. Tertials, dark grey-brown (grey 129) to dark brownish-grey (brown 83) with white fringes broader than in first year but less sharply demarcated. **Underwing** Rather uniformly dark, similar to juvenile. Remiges, dark grey-brown (grey 119A). Lesser and median coverts, dark brown (121), slightly paler at bases, giving uneven appearance. Greater coverts, grey-brown (c28) merging to dark-brown (121) fringes, slightly more patterned than rest of coverts. Some birds apparently have greater contrast between bases and tips of coverts, giving more mottled effect.

Second immature breeding (Second alternate [summer]). Acquire blackish saddle for first time. **Head and neck** Vary greatly, from extensively dark to mostly white. Feathers, white at bases, with grey-brown (28) to brownish-grey (brown 83) tips that vary in size, so that mottling can be dense to sparse. Neck generally more heavily mottled than head, and sometimes uniformly dark grey-brown (grey 121) and well demarcated from head. Broken eye-ring, white. **Upperparts** Mantle, scapulars and back, slaty grey-black (brownish 82), greyer than in adult. Brownish tinge to feathers increases with wear. Back, sometimes brown (119A–28) with black-brown (119) centres to feathers. Rump and tail-coverts, mostly white, with a little grey-brown (28) or brownish-grey (79) mottling along shafts or webs, heaviest on rear-coverts; area appears white. **Underparts** Grades from mottled breast to white tail-coverts. Breast of most birds heavily mottled, *c.* 70% grey-brown (c28) on white ground, sometimes mainly white, with obvious but sparse (*c.* 20%) mottling. Belly usually white sparsely mottled grey-brown. Vent sparsely mottled or white. Tail-coverts usually pure white. **Tail** Retained from second immature non-breeding. Pale tips worn. **Upperwing** Mostly retained from second immature non-breeding. Coverts wear to grey-brown (c28) and fringes bleach and fray, so pattern reduced. Some birds replace a few scattered secondary coverts and most median coverts; new coverts, slaty black like scapulars. Apparently some renew some tertials, which are like those of third immature non-breeding. **Underwing** Retained, with little change in appearance.

Third immature non-breeding (Third basic [winter]). Wing and tail similar to that of adult, head and body similar to second immature breeding. **Head and neck** Like second immature breeding, vary greatly from heavily to moderately mottled grey-brown (grey 28) or brownish-grey; overlap much with second immature breeding in appearance. Chin and throat usually white but often mottled. Neck usually more heavily mottled than head, the contrast between them moderately distinct. Some birds mostly white, with sparse grey-brown (c28, 129) mottling concentrated round nape, hindneck and upper foreneck. Eye-ring, white, its conspicuousness depending on darkness of head. **Upperparts** Mantle, scapulars and back, slaty black (c82) to black (similar to adult) when fresh, often tinged brown; tend to fade faster than in adults and attain distinct brown tinge with wear. Rump and tail-coverts, white. **Underparts** Vary. Some, mostly white, with sparse mottling mainly on upper breast; others with bib of dense mottling. Belly, white, with scattered dark smudges in darker birds. Vent and tail-coverts, white. **Tail** Very similar to adult; most have slightly wider tail-band (45–50 mm in centre); some, as adult. **Upperwing** Coverts, like scapulars; some lesser coverts may have narrow indistinct brownish fringes. Remiges similar to those of adult, except white tips to tertials not as cleanly demarcated from blackish bases, so tertial cres-

Plate 29

Black-tailed Gull *Larus crassirostris* (page 485)
1, 2 Adult non-breeding;
3, 4 First immature non- breeding;
5 Second immature non-breeding

Kelp Gull *Larus dominicanus* (page 490)
6, 7 Adult non-breeding; **8, 9** Juvenile;
10 Second immature non-breeding

Pacific Gull *Larus pacificus* (page 471)
11, 12 Adult non-breeding; **13, 14** Juvenile;
15 Second immature non-breeding;
16 Third immature non-breeding

cent not as sharp. **Underwing** Remiges like adult. Lining, white, mottled and smeared grey-brown; coverts white at base (often washed unevenly with pale brown [c223D]) and with varying grey-brown (c28) spots at tips that align to form mottled stripes along lining. Subhumerals, white, at least in some birds.

Third immature breeding (Third alternate [summer]). Few differences from third immature non-breeding. Head and underparts generally whiter and never densely mottled. Full extent of overlap unknown.

Subspecies *georgii* Plumages differ only in black on tail of adult; on t6 black confined to narrow shaft-streak (cf. black band on inner web and shaft; see Fig. 1).

BARE PARTS Based on photos (see Plumages) and field notes (D.J. James), except as stated.

Nominate *pacificus* Adult non-breeding Bill, orange-yellow (c18) with orange-red to bright-red (108A, 11) tip to upper and lower mandible from about angle of gonys; small area at tip of each mandible, paler red or orange (c17), possibly from wear. Commonly have faint dark smudge on upper tomium, possibly gained and lost seasonally. Iris, ivory or silvery white. Orbital ring, orange (17). Legs and feet, yellow to orange-yellow (18). Claws, black. **Adult breeding** In Aug. and Sept., colours intensify. Bill, bright orange (17–16) with bright-red tip. Inner edge of orbital ring, bright red (14). Legs, orange-yellow (18) to orange (17). **Downy young** At hatching: bill, black, with dark pink-grey mottling at base of lower and tip of both mandibles and small white egg-tooth; Tarr (1961) described base of bill as green. Within days, egg-tooth lost and prominent orange-brown tip develops on upper mandible. Iris, black. Orbital ring, dark grey (83–82). Legs, dark grey (c83); webs mottled dark grey (83) and dirty pink. Claws, black. **Juvenile** Bill, black, with small orange-brown spot developing at tip of upper mandible just before fledging. Develop dull-pink (pale 7, 5) to pink-buff (c121D) base, which quickly expands forward along sides of mandibles. Iris, dark brown. Orbital ring, dark grey (83). Legs and feet, dirty pink (c221D, 5) with dark-grey (83) mottled patches, especially on webs. **First immature non-breeding** Basal two-thirds of bill, dull pink (c5) with varying grey mottling, and poorly defined black tip from slightly behind angle of gonys; small oval pink-buff (121D) patch near tip of upper mandible. Iris, dark brown to brown (c121C). Orbital ring, dark grey (83). Legs, like juvenile. **First immature breeding** Similar to first immature non-breeding. Base of bill, cleaner pale pink, with little or no mottling; and black tip demarcated cleanly in fairly straight line, except for extensions back along tomia. **Second immature non-breeding** Pattern of bill similar to that of first immature breeding but line of demarcation of tip straighter, and base, cream (54) and no longer mottled. Iris becomes light brown or grey-yellow, apparently rapidly, with onset of first post-breeding moult. Orbital ring, dark grey (83). Legs, similar to those of juvenile, but with paler pink-buff (121D) or buff (c124) ground-colour. **Second immature breeding** Bill, pale yellow for basal two-thirds, with sharp and straight demarcation of black tip beyond nostril, at about gonydeal angle; small oval spot at tip of upper mandible, pink-buff (121D) to pale yellow. Iris, grey-yellow to straw-yellow (56) or silvery white. Orbital ring, yellow-brown to dull orange. Legs, grey-buff (grey 124) lightly mottled grey. **Third immature non-breeding** Like second immature non-breeding except bill turns brighter yellow (c18) at base and black tip begins turning dull red or orange-red, starting from rear; oval spot at tip turns orange-red. **Third immature breeding** Bill similar to that of third non-breeding but red on tip more extensive, encroaching from front and rear, and black reduced to messy subterminal band or dark patch, mostly on upper mandible.

Subspecies *georgii* Few details. **Adult** Bill, like that of nominate *pacificus* but adults retain black line on upper tomium in red at tip of bill (similar to some third- and fourth-year *pacificus*, but typically sharper); also have yellow on ridge of culmen extending through red almost to tip and which reduces size of red tip (J.B. Cox). Mouth: pharynx, orange-pink; tongue and gape, orange; palate, yellow to dull yellow (Parker & Cox 1978). Iris, varies: SA: in all adults, iris appears to be white to cream (based on thousands of observations over many years; J.B. Cox). SW. WA: most birds have whitish irides (J.B. Cox; R.E. Johnstone); two skins from Arch. of the Recherche and Thomas R. have dark-brown irides (R.E. Johnstone; WAM); Mathews described the iris of an adult male and adult female from Recherche as silvery white and brown respectively. W. COASTAL WA: photos from Shark Bay (Pringle 1987; Trounson & Trounson 1987; Aust. RD) and Houtman Abrolhos (M.J. Carter) suggest that all or most adults have dark-brown irides. In SA, orbital ring, orange-yellow to orange; legs and feet, bright yellow to pale yellow or yellow-grey (Parker & Cox 1978). Orbital ring of dark-eyed birds possibly redder than usual (J.N. Davies). **Subadults** Skin from SA in second post-breeding moult (SAM) had waxy yellow bill tinged green, with orange-scarlet tips to mandibles, black distal tomia and black smudges elsewhere in area of scarlet; palate pale yellowish-buff; tongue, pale fleshy-orange; rest of mouth, light greenish-yellow; iris, cream, heavily tinged dusky; orbital ring, ochreous yellow; legs, pale yellow faintly tinged green; claws, black (Parker & Cox 1978).

MOULTS Based on 56 skins, photos (as above) and field observations (D.J. James); some data on captive birds in Robertson (1981b). Probably moult more or less continuously from onset of post-juvenile to completion of third post-breeding. **Adult post-breeding** (Fourth and subsequent pre-basic). Complete, mostly symmetrical. Begins with p1, ends with p10; spans *c.* 4 months between Jan. and July (one skin still moulting Sept.); individuals beginning in Dec. probably non-breeding birds. Primaries outwards; usually two, sometimes three, active at a time. Secondaries begin when primaries between p3 and p6; moult inwards, sequentially, from s1 to s17. Tail, outwards or irregularly synchronous, moulting 6–12 rectrices at a time (Eckert 1971; Robertson 1977; skins); begins when moult of remiges advanced (Feb.–Apr.). **Adult pre-breeding** (Fourth and subsequent pre-alternate). Partial. Begins mid-July to Aug., probably finishes by late Oct. Possibly sometimes begins while preceding post-breeding moult still under way. Restricted to head and body. **Post-juvenile** (First pre-basic). Partial; involves at least most of head, neck, upperparts and underparts (but not tail-coverts). Begins from late Mar. to

Plate 30

Kelp Gull *Larus dominicanus* (page 490)
1 Adult breeding; 2 Adult non-breeding;
3 Downy young; 4 Juvenile 5 First immature non-breeding;
6 First immature breeding; 7 Second immature non-breeding;
8 Second immature breeding;
9 Third immature non-breeding;
10 Third immature breeding

mid-Apr. and continues without pause into first pre-breeding. Begins with forehead, lores and chin. **First pre-breeding** (First pre-alternate). Partial. Continues from post-juvenile and into first pre-breeding moult without significant pauses. Two skins showed active moult, May and July. **First post-breeding** (Second pre-basic). First complete moult. Begins late Oct. of first year, most birds having shed 1–3 primaries by end of Oct.; finishes Mar.–Apr. Greater coverts replaced last, in clumps. Other sequences similar to adult post-breeding. **Second pre-breeding** (Second pre-alternate). Partial. Begins soon after finishing first post-breeding moult. Sequence and extent much like first pre-breeding, except: often moult many upperwing-coverts, particularly median coverts; some renew some or all tertials. **Second post-breeding** (Third pre-basic). Complete. Begins mid-Nov. to late Dec., finishes May to early June. Sequences as for adult post-breeding. **Third pre-breeding** (Third pre-alternate). Partial. Begins shortly after finishing second post-breeding moult, in May or June.

MEASUREMENTS All skins; Bill D = depth of bill at base; Bill G = depth of bill at gonys (AM, HLW, MV, QVM, SAM, WAM). (1) Nominate *pacificus*; NSW, Vic. and Tas.; ages combined.

		MALES	FEMALES	
WING	(1)	461.7 (11.7; 446–477; 6)	436.7 (12.6; 425–450; 4)	*
TAIL	(1)	176.4 (6.7; 165–183; 7)	165.8 (6.2; 159–174; 4)	*
BILL	(1)	61.6 (2.0; 59.5–64.9; 6)	53.8 (2.8; 50.3–57.3; 6)	**
BILL G	(1)	28.5 (0.9; 27.4–29.6; 5)	28.0 (1.1; 26.4–28.8; 4)	ns
BILL D	(1)	25.6 (0.2; 25.4–25.8; 4)	24.0 (0.6; 23.5–24.9; 6)	*
TARSUS	(1)	73.8 (3.0; 68.8–77.7; 7)	69.4 (3.1; 65.6–74.2; 6)	*
TOE	(1)	57.4 (2.1; 54.8–59.9; 6)	54.3 (1.5; 52.0–55.7; 6)	*

(2) Subspecies *georgii*; SA and WA; ages combined.

		MALES	FEMALES	
WING	(2)	455.2 (1.8; 430–471; 10)	446.8 (11.3; 436–460; 5)	ns
TAIL	(2)	174.0 (6.1; 162–180; 10)	172.0 (4.5; 166–176; 4)	ns
BILL	(2)	59.3 (1.8; 56.7–61.9; 11)	57.4 (3.2; 52.1–59.9; 5)	ns
BILL G	(2)	28.0 (1.5; 26.0–30.8; 11)	27.2 (2.7; 22.4–29.0; 5)	ns
BILL D	(2)	24.5 (1.4; 22.4–26.7; 11)	23.2 (2.4; 19.5–25.4; 5)	ns
TARSUS	(2)	69.9 (2.6; 66.8–74.5; 11)	69.1 (3.6; 64.6–72.7; 5)	ns
TOE	(2)	54.2 (2.9; 49.5–58.7; 11)	54.2 (2.6; 51.0–57.3; 5)	ns

(3–6) Geographical breakdown; ages and sexes combined: (3) Vic.; (4) Tas.; (5) SA; (6) sw. WA.

		UNSEXED
WING	(3)	444.8 (15.8; 424–473; 15)
	(4)	453.3 (16.8; 425–477; 9)
	(5)	454.0 (12.3; 434–475; 17)
	(6)	457.8 (4.6; 453–465; 5)
BILL	(3)	58.6 (2.5; 53.5–64.0; 17)
	(4)	57.4 (4.7; 50.3–64.9; 12)
	(5)	59.1 (2.6; 52.1–64.2; 19)
	(6)	57.8 (1.8; 56.5–60.8; 5)
TARSUS	(3)	70.5 (3.9; 62.5–77.6; 18)
	(4)	72.0 (3.9; 65.6–77.7; 12)
	(5)	70.5 (3.1; 64.6–76.7; 18)
	(6)	69.6 (2.3; 66.8–72.7; 5)

(7) Breakdown by age; sexes and geographical populations combined; first-years include all birds still with juvenile outer primaries; adults include all birds with at least their fourth set of primaries.

		FIRST YEAR	ADULTS	
WING	(7)	449.1 (15.3; 424–474; 23)	456 (13.7; 435–477; 15)	ns
TAIL	(7)	171.3 (6.7; 158–183; 21)	172.1 (6.1; 162–180; 14)	ns
BILL	(7)	57.9 (2.6; 52.1–62.5; 24)	59.9 (2.6; 55.2–64.9; 20)	**
BILL G	(7)	26.4 (2.0; 22.0–29.6; 19)	29.0 (1.4; 26.4–31.8; 19)	**
BILL D	(7)	24.1 (1.8; 19.5–26.8; 17)	24.9 (1.6; 22.2–28.7; 16)	ns
TARSUS	(7)	70.3 (3.6; 62.5–77.7; 24)	71.1 (3.5; 64.6–77.6; 20)	ns
TOE	(7)	54.5 (2.7; 49.4–59.9; 23)	55.7 (2.2; 51.0–60.1; 20)	ns

Few data available and following trends need confirmation. In nominate *pacificus*, males larger than females, especially in length and stoutness of bill (consistent with sexual dimorphism in Laridae [Ingolfsson 1969]); no difference detected in subspecies *georgii*; might be that *georgii* is not very sexually dimorphic, but more likely that sample misrepresentative or confounded by combining ages. No differences detected between subspecies and only differences between populations are possibly shorter wing in Vic. and possibly longer tarsus in Tas. (see Geographical Variation). Length of bill and depth at gonys increase significantly with age, which should be considered when deriving discriminant functions for sexing. Though differences not significant, other measurements possibly increase slightly with age.

WEIGHTS From museum labels (AM, HLW, MV, QVM, SAM, WAM): (1) Nominate *pacificus*; (2) Subspecies *georgii*.

	MALES	FEMALES	
(1)	1550 (300; 1200–1800; 5)	1077 (219; 910–1400; 4)	*
(2)	1002, 1135, 1232	1000, 1010	

STRUCTURE Wing, long with pointed tip; rather broad and straight for large gull. Eleven primaries: p10 longest, p9 4–10 mm shorter, p8 23–29, p7 56–66, p6 61–90, p5 112–123, p4 144–153, p3 172–182, p2 181–212, p1 205–233; p11 minute. Twenty-one to 23 secondaries, including 4–5 tertials; tips of longest tertials fall near tip of p5 on folded wing. Tail, square, rather long for large gull; 12 rectrices. Bill, massive, very deep, greatly expanded vertically at tip. Culmen straight for basal half to two-thirds, strongly decurved near tip. Very prominent gonydeal angle, with steep terminal angle to lower mandible. Nostril about half-way along upper mandible; varies in shape, from round to shaped like tear-drop (with point facing to base of bill), unique among gulls. Loral point differs between subspecies: more pointed in *pacificus* and more rounded in *georgii* (J.N. Davies; photos). Head, large and rounded, with peak of crown well forward on head. Neck, short. Tarsus, heavy, laterally compressed; scutellate in one row on front and two on rear of tarsus; *c.* 30 mm of lower tibia unfeathered. Toes moderately long, fully webbed; hindtoe small and raised. Outer toe 87–97% of middle, inner 70–91%, hind 8–12%.

AGEING Approach to ageing discussed in Kelp Gull (q.v.). Differ from Kelp Gull in slower rate of maturation; do not attain black feathers on mantle till second immature breeding; many fourth-year birds show slight signs of immaturity; a captive took 5 years to reach maturity (Mathews). Below,

changes in colour of iris not necessarily relevant to WA birds (see Bare Parts) and timing is only approximate.

First-year plumages Generally mottled brown. Remiges, black-brown; primaries have more pointed tips than older birds, especially when worn; underwing, dark brown; tail, dark with narrow pale tip; head and underbody, uniform or softly mottled dark brown; upperparts and coverts, scaly; no tertial crescent; bill, dark with pink base. JUVENILE: Persists till Apr. All plumage fresh; upperparts and wing-coverts, neatly scaled; head, underparts and underwing almost uniform, dark brown; rump, dark brown and slightly scaly; bill has only small pinkish base. FIRST IMMATURE NON-BREEDING: About May-Sept. Forehead and lores, mottled white; upperparts have broader but more diffuse fringes, so appear less scaly; coverts, worn and fringes reduced, so appear less scaly; flight-feathers, slightly worn (especially primaries); bill, pale pink (mottled grey) for basal two-thirds. FIRST IMMATURE BREEDING: Sept.–Nov. Much white on forehead and lores; primaries and wing-coverts, frayed and bedraggled, with pointed primary-tips visible in flight; greater coverts bleached to produce faint pale innerwing-bar; moult of primaries produces contrast between rounded new primaries and pointed old ones, diagnostic of moult from first immature breeding to second immature non-breeding; pale tip to tail, worn; pale pink base to bill not mottled and sharply demarcated from black tip. **Second-year plumages** Remiges and tail, dark brown; underwing, dark brown; upperparts, brown or black; rump, white; bill, yellow at base. NON-BREEDING: Jan.–June. Upperparts, brown but more uniform than in first-year plumages; wing-coverts, brown, without distinct fringes, even when fresh; head and underparts, brown except for white forehead and undertail-coverts; base of bill, cream to pale yellow, sharply cut-off from black tip. BREEDING: July–Nov. Upperparts, black-brown, contrasting sharply with worn, plain-brown coverts, or mixture of brown and black coverts; head and body like non-breeding or mottled brown and white; bill, pale yellow at base, still sharply demarcated from black tip; iris, usually pale. **Third-year plumages** Remiges and tail, like adult; upperparts and wing-coverts, black, with slight brown tinge; underwing, white smeared with brown; rump and uppertail-coverts, white. NON-BREEDING: Feb.–July. Head, neck and breast usually heavily mottled brown and not reliable in separation from second breeding; bill, yellow, with traces of red at tip (though tip mostly black); iris, pale. BREEDING: Aug.–Feb. Head and breast, generally paler; develop contrast in wear between wing-coverts and scapulars; bill, mostly red at tip, with only small black subterminal marks. **Fourth-year plumages** Some adult-like birds have very small traces of immaturity, such as small amount of speckling on nape, neck and sides of breast, or faint brown wash on some underwing-coverts, and particularly (in nominate *pacificus*) a black line along tomia in the red at tip. Probably most such birds are in fourth year but some might be advanced third-year birds. Beware of adults that may develop dusky tomium at tip of upper mandible in non-breeding. Many birds probably reach definitive plumage in fourth year. **Adult plumages** Upperparts and wings, black, with only slight brownish tinge when worn. Head, rump, underparts, and wing-lining, white; tail, white with broad subterminal band; bill, orange-yellow with red tip and, in subspecies *georgii*, black distal tomium. NON-BREEDING: Jan.–July. Dark smudge on distal upper tomium possibly normal in nominate *pacificus*. BREEDING: Aug.–Feb. In Aug. and Sept., colours of base of bill and legs intensify to orange and orange-yellow respectively; in summer, contrast in wear between wing and upperparts can be seen.

RECOGNITION Downy young of Pacific Gull differ from Kelp Gull by: 'hairier'; upperparts more boldly blotched; more diffuse pattern of stripes on head; orange-brown tips to mandibles gradually increase (not shrink) after hatching. The proportionately shorter and deeper bill of Pacific Gull and round or oval nostrils always apparent.

GEOGRAPHICAL VARIATION Poorly known. Two allopatric subspecies: nominate *pacificus* in se. Aust.; and subspecies *georgii* in three discrete populations in SA and WA; subspecies separated by break in breeding distribution between Bass Str. and Victor Harbour, SA. At all ages, subspecies differ by shape of loral point (see Structure); when adult, also differ by pattern of t6 (see Plumages: Fig. 1), though little difference in width of tail-band; and amount of black on tomium and amount of red on tip of culmen (see Bare Parts).

In subspecies *georgii*, breeding distribution broken across Great Aust. Bight and along w. coast of sw. WA (Aust. Atlas). Few differences in morphology and measurements between populations (though no adult skins from w. coast examined). However, colour of iris of adults (and possibly immatures) does vary: in *pacificus*, white; in *georgii* from SA, white; in *georgii* from sw. WA, white or dark or intermediate (ratios not known); in *georgii* from w. coast WA, dark (see Bare Parts). More information on colour of iris and orbital ring in WA and measurements from w. coast needed.

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Volume 3, Plate 28

Pacific Gull *Larus pacificus* (nominate *pacificus* unless stated) (page 471)
1 Adult breeding; **2** Adult non-breeding; **3** Adult, subspecies *georgii*, Shark Bay, WA; **4** Juvenile; **5** First immature non-breeding; **6** First immature breeding; **7** Second immature non-breeding; **8** Second immature breeding; **9** Third immature non-breeding; **10** Third immature breeding

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Volume 3, Plate 29

Black-tailed Gull *Larus crassirostris* (page 485)
1, 2 Adult non-breeding; **3, 4** First immature non-breeding; **5** Second immature non-breeding

Kelp Gull *Larus dominicanus* (page 490)
6, 7 Adult non-breeding; **8, 9** Juvenile; **10** Second immature non-breeding

Pacific Gull *Larus pacificus* (page 471)
11, 12 Adult non-breeding; **13, 14** Juvenile; **15** Second immature non-breeding; **16** Third immature non-breeding

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