

Order CHARADRIIFORMES

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

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

Thinororidae	seed-snipes; four species, S. America.
Pedionomidae	Plains-wanderer; monotypic, Aust.
Scolopacidae	sandpipers, snipes and allies; c. 85 species, cosmopolitan.
Rostratulidae	painter snipes; two species, s. America and Old World.
Jacaniidae	jacanas; seven species, pantropical.
Chionididae	sheathbills; two species, Antarctica and subantarctic islands.
Burhinidae	thick-knees, stone-curlews; nine species, widespread in Old World and two in Neotropics.
Haematopodidae	oystercatchers; c. 11 species, worldwide in tropics and temperate regions.
Recurvirostridae	avocets and stilts; about seven species, worldwide in tropical and temperate regions.
Ibidiorhynchidae	Ibisbill; monotypic, central Asia.
Charadriidae	plovers and lapwings; c. 60 species, cosmopolitan.
Pluvianellidae	Magellanic Plover; monotypic, S. America.
Dromadidae	Crab Plover; monotypic, Arabian region.
Glareolidae	pratincoles, coursers, and Egyptian Plover; c. 15 species, widespread in Old World.
Stercorariidae	skuas and jaegers; about seven species, mostly in Arctic and Antarctic regions.
Rhynchopidae	skimmers; three species, pantropical.
Laridae	gulls; c. 47 species, cosmopolitan.
Sternidae	terns; c. 42 species, cosmopolitan.
Alcidae	auks; c. 20 species, Arctic and temperate regions of n. hemisphere.

Apparently monophyletic. Pteroclididae (sandgrouse) probably sister-group of Charadriiformes (e.g. Fjeldså 1976, 1977; Sibley & Ahlquist 1990; BWP), though whether best placed within Charadriiformes or in separate order is debated. Flamingoes (Phoenicopteridae) and divers (Gaviidae) have also been treated as Charadriiformes (Olson & Feduccia 1981; Fjeldså 1976, 1977) but DNA–DNA hybridization studies (Sibley & Ahlquist 1990) inconsistent with these theories. Affinities to other orders still controversial; DNA–DNA hybridization has suggested closest links are to large waterbirds, such as storks, herons and allies, Pelicaniformes, Procellariiformes, penguins, grebes, divers (Gaviidae) and also Falconiformes. All these were combined in huge order Ciconiiformes by Sibley & Ahlquist (1990).

Taxonomy and relationships reviewed in Sibley & Ahlquist (1990), Christian *et al.* (1992) and BWP (and references therein). Recent reviews have included: patterning of downy young (Jehl 1968; Fjeldså 1976, 1977), osteology (Strauch 1978; Mickevitch & Parenti 1980; Olson & Steadman 1981), DNA–DNA hybridization (Sibley *et al.* 1988, Sibley & Ahlquist 1990) and electrophoresis of tissue proteins (Christian *et al.* 1992). The studies of allozymes, DNA–DNA hybridization and the most recent osteological study of the entire order (Strauch 1978) have agreed in finding two or three well-knit, monophyletic assemblages within the Charadriiformes: scolopacids and allies (Thinororidae, Pedionomidae, Scolopacidae, Rostratulidae, Jacaniidae) and charadriids and allies (Chionididae, Burhinidae, Haematopodidae, Recurvirostridae, Ibidiorhynchidae, Charadriidae, Pluvianellidae, Dromadidae, Glareolidae, Stercorariidae, Rhynchopidae, Laridae, Sternidae, Alcidae); Strauch (1978) treated Alcidae as separate lineage, but skeletons may be so highly modified for foot-propelled diving that they do not reflect relations well (Sibley & Ahlquist 1990); gulls and allies have also been regarded as a separate lineage (Christian *et al.* 1992) or as allied to charadriids (e.g. Sibley & Ahlquist 1990). Further relationships within the Order discussed in introductions to families.

Because the Order comprises so many species and adaptations are so diverse, few characters shared by all species; those that are shared are mostly anatomical features of the skull, e.g. most or all have schizorhinal nostrils, schizognathous palates, well-developed vomer, lachrymals fused with ectethemoid and pre-frontal bones, well-developed supra-orbital grooves; see Olson & Steadman (1981) for more information on osteological characters. Wings usually have 11 primaries, with p10 longest and p11 minute; 15–24 secondaries; diastataxic except in *Scolopax minor*, as far as is known. Usually 12 tail-feathers. Necks usually rather long with 15–16 cervical vertebrae. Oil-gland bilobed and tufted. Syrinx, tracheo-bronchial; two carotids (type A-1 of Glenny 1955); caeca present. Legs usually rather long; hind toe small or lacking in most but all toes greatly elongated in Jacaniidae. Feathers with small thin afterfeathers. Normally two moults annually: complete post-

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

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

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Family LARIDAE skuas, jaegers, gulls and terns

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

Stercorariinae Skuas and jaegers; about six species; cosmopolitan.

Larinae Gulls; c. 47 species; cosmopolitan.

Sterninae Terns; c. 42 species; cosmopolitan.

Rynchopinae Skimmers; three extralimital species, pan-tropical.

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

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

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

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

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

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

Plate 23

Oriental Pratincole *Glareola maldivarum* (page 366)

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

Australian Pratincole *Stiltia isabella* (page 373)

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

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

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

See subfamily accounts for summaries of social organization and breeding.

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Subfamily 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
<i>Larus</i>	41–45 species; cosmopolitan
<i>Pagophila</i>	Monotypic; Ivory Gull <i>P. eburnea</i> , extralimital in Arctic
<i>Rhodostethia</i>	Monotypic; Ross's Gull <i>R. rosea</i> , extralimital in Arctic
<i>Creagrus</i>	Monotypic; Swallow-tailed Gull <i>C. furcatus</i> , extralimital in e. tropical Pacific Ocean
<i>Rissa</i>	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 extraliminally 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 secundarium 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 plumage 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 dominicanus Kelp Gull

COLOUR PLATE FACING PAGES 480 & 481

Larus dominicanus Lichtenstein, 1823, *Verz. Doublett. zool. Mus. Univ. Berl.*: 82 — coasts of Brazil.

The specific name pays homage to the shared colouring, black and white, of the Gulls' plumage and the habits of the Dominican Friars or Jacobins, prominent as missionaries to Latin America.

OTHER ENGLISH NAMES Southern or Antarctic Black-backed Gull, Dominican Gull.

POLYTYPIC Nominate *dominicanus* Aust., NZ, subantarctic islands, Antarctica and South America; subspecies *vetula* (Bruch, 1853) coasts of s. Africa.

FIELD IDENTIFICATION Length 49–62 cm; wingspan 106–142 cm; weight: male 1050 g, female 830 g. Second-largest gull in region; black-backed gull with thickset deep-chested appearance, thick heavy bill with prominent gonys and slit-shaped nostril, sloping forehead, and long broad wings extending a little beyond tip of tail at rest. Smaller and less bulky than Pacific Gull *Larus pacificus*, with less massive bill, smaller head with flatter forehead, less rounded crown and slightly narrower wings. Bigger and bulkier than vagrant Black-tailed Gull *L. crassirostris*. Adult has diagnostic combination of all-white tail and slate-black saddle and upperwing, with prominent white leading- and trailing-edges, white mirror on outermost primary, and white primary-tips. Sexes similar, but male larger and bulkier, with more powerful bill. Slight seasonal variation in bare parts. Juvenile separable. Immatures separable but ageing complex, with individual variation in plumage, bare parts and rate at which adult plumage and bare parts acquired. Juveniles and older first immatures can be aged because pattern of bare parts and juvenile remiges and rectrices (retained in first immatures) rather constant and distinctive. Ageing of older immatures much less certain because appearance of a few advanced second immatures and retarded third immatures overlap, as does that of some advanced third immatures and adults (see Ageing). Descriptions of second and third immatures below thought to be of typical birds, but definitive ageing probably not possible (see Plumages, Ageing).

Description Adult breeding Head, neck, underbody, rump and tail, white. Saddle and upperwing, slate-black, with (1) white leading-edge; (2) broad white trailing-edge to secondaries and inner primaries; (3) white tips to outer six primaries; and (4) white mirror on outermost primary, often with second smaller mirror on second outermost. At rest, prominent white scapular and tertial crescents. Underwing: coverts, white, contrasting with blackish primaries and bases of secondaries, which form dark subterminal band tapering inwards to body, bordered by broad translucent white trailing-edge, and with isolated white tips and mirrors on outer primaries obvious from below. During austral summer and autumn, white tips of outer primaries reduced or lost. Bill, bright yellow, with bright-red spot on lower mandible at gonys. Iris, cream to pale yellow. Orbital ring, bright red. Legs and feet, bright mustard-yellow. **Adult non-breeding** As breeding except: plumage fresh throughout, with prominent neat white tips to outer primaries; bare parts duller: bill, pale yellow; occasionally pale olive-grey or blue-grey, with reduced or no red gonydeal spot; orbital ring, orange-red; legs and feet, yellow, grey-green or grey-blue. **Juvenile** Generally rich dark-brown, with varying pale streaking and mottling on head, neck and underbody;

nape, hindneck and sides of neck, off-white, with narrow dark-brown streaks, forming varying pale collar. Saddle and tertials, dark brown, with narrow cream fringes (restricted to tip on tertials), appearing chequered. Pattern of upperwing, diagnostic: in flight, outerwing and secondaries, brown-black, contrasting with paler, browner and chequered coverts and with dark band across greater secondary coverts (tapering inwards) and fine white trailing-edge to innerwing. At rest, folded wing like saddle, but more coarsely chequered, and with diagnostic dark band, broadening outwards, along lower edge of wing. Rump and undertail-coverts, white, faintly barred brown. Tail, mostly dark brown, barred at base of outer feathers and with narrow white tip. Underwing: lining, dark brown, faintly mottled paler brown, contrasting somewhat with uniform glossy grey-brown remiges and greater coverts; narrow translucent trailing-edge to secondaries. Bill, black. Iris, dark brown. Orbital ring, dark grey. Legs and feet, grey to light grey, with pink or brown tinge. **First immature non-breeding** Similar to juvenile, differing by: Face, chin, throat and neck, generally whiter, and pale collar more prominent, though much variation. Feathers of saddle, plainer and slightly paler, more grey-brown, with broader, more diffuse pale tips or fringes, contrasting with more coarsely marked coverts and tertials. Underbody more heavily streaked and mottled white. Most develop pale tip to bill from about May. **First immature breeding** Very similar to first immature non-breeding, but with much individual variation and overlap. Head, neck, underbody and rump, generally whiter, with fewer dark markings. Secondary coverts and tertials, worn and faded, with pale fringes reduced, typically contrasting with fresher saddle. Remiges and tail, worn and faded, browner, with pale trailing-edge to secondaries and pale tip to tail reduced or lost; worn outer primaries have frayed pointed tips, readily visible in flight. Bill develops small creamy area at base of lower or both mandibles and pale tip larger than in first non-breeding; legs and feet usually slightly paler, olive-grey or blue-grey. **Second immature non-breeding** Intermediate between brown plumages of first-year birds and black-and-white plumages of older birds, but varies much. Differ from first-year birds by: Head, neck and underbody more white than brown, with brown mottling extending to belly on retarded birds. Saddle, mostly slate-brown to slate-black. Secondary coverts, brown, sometimes with a few slate-grey feathers admixed; median coverts often slate-black, forming darker band between brown lesser and greater coverts. All have white tertial crescent, with dull black marbling, and most have white scapular crescent, also marbled with black. Rump and uppertail-coverts vary, from white to heavily barred brown. Tail varies greatly, from mostly dark with untidy white base, to mostly

white with narrow irregular dull black subterminal band. In flight, brown-black remiges contrast with browner coverts; white trailing-edge varies from narrow and confined to base of wing, or, occasionally broader and extending to primaries; sometimes none; rarely, have narrow white leading-edge. On underwing, dark grey-brown remiges contrast with brown-and-white mottled coverts. Bare parts vary; bill: in retarded birds, mostly black, with varying pale tip and base; usually, cream to dull yellow, with diffuse black subterminal band; rarely, brighter yellow, with trace of red at gonys. Iris, light brown. Orbital ring, grey to light grey or yellow. Legs and feet, dark brown to light blue-grey. **Second immature breeding** Difficult to distinguish from second immature non-breeding; differ by: Sparser or no brown streaking and smudging on head, neck and underbody. Saddle and a few secondary coverts (especially medians), slate-black. Bill, brighter yellow, with reduced dark subterminal markings; rarely, pale yellow. Iris, light yellow, flecked brown. Orbital ring, yellow to orange-yellow. Legs and feet, as second immature non-breeding. **Third immature non-breeding** Differences from adult non-breeding: Usually have brown streaking and mottling on head, neck and upper breast and, rarely, on belly. Saddle and wing-coverts, slate-black, sometimes with faint brown tinge to coverts (but never wholly brown). Rump and tail, white, or white with small dark subterminal tail-band. Upperwing: no white mirrors in outer primaries and white tips to outer primaries smaller. Underwing: lining usually has varying light-brown wash and some speckling. Bare parts like duller non-breeding adult: bill usually paler yellow, with little or no red at gonys. Iris, pale grey or light yellow, flecked brown. Orbital ring usually orange. Legs and feet, blue-grey to green-grey. **Third immature breeding** As third immature non-breeding, but: head, neck and underbody more often white. Retained worn wing-coverts and tertials develop brown tinge and contrast with fresh slate-black saddle. Bare parts as adult non-breeding except bill slightly duller.

Similar species Pacific Gull (q.v.). Kelp Gull, especially second-year birds, can be confused with **Black-tailed Gull**; Black-tailed differs by: smaller and slimmer, with narrower wings, finer legs and more slender bill, with less prominent gonydeal angle; proportionately longer wings project much farther beyond tip of tail at rest, giving more attenuated appearance. Second-year and adult Black-tailed Gull have paler blue-grey saddle and upperwing and more clear-cut black tail-band. Juvenile and first immature non-breeding best distinguished from brown-plumaged Kelp Gulls by size and structural differences and: (1) black tail without pale base; (2) bright-pink bill, with neat black tip; and (3) bright-pink legs and feet. First immature breeding best separated from brown-plumaged Kelp by differences in size, structure and tail-pattern (as above) and: whiter head, neck and underbody, with varying brown wash; and much paler lime-white legs, feet and base of bill, latter with neat black tip.

Gregarious; at breeding strongholds in NZ, Tas. and subantarctic islands, can form large flocks; elsewhere, generally seen singly, in pairs or small groups. Use wide variety of coastal habitats; in NZ and se. Tas., also frequent farmland and other open grassy areas, sometimes well inland, and also abundant in towns and cities, where often feed at artificial sources of food; in NZ, also braided inland rivers. Follow ships, normally staying inshore in sheltered waters, but occasionally well out to sea. Gait less heavy and waddling than that of Pacific Gull. Flight similar to that of Pacific Gull, with slow, deep measured wing-beats between glides. Less shy and more noisy

and aggressive than Pacific Gull. Voice distinctive; normal call strident repeated *ee-ah*; also wide variety of raucous and yelping notes; calls similar to those of many other large gulls (*Larus*), and a familiar sound from the soundtracks of many movies.

HABITAT Antarctic to subtropical zones, with sea-surface temperatures ranging from 0 ° to 23 °C (Brown *et al.* 1975). In Aust., almost exclusively coastal; in NZ, occur from coasts to inland subalpine zones. Rarely > 10 km offshore and generally within sight of land; occasionally follow boats beyond continental shelf (Falla 1937; Bartle 1974; Smith 1987; Wood 1991). Mostly occur in sheltered parts of coast, such as harbours, bays, inlets and estuaries, sandy or rocky beaches, mudflats and banks, and rock platforms; generally in greater numbers in estuaries rather than on adjacent beaches (Wodzicki 1962; Powlesland & Robertson 1987); in some areas, large numbers can gather on exposed sandspits, e.g. Farewell Spit (J.M. Hawkins). Often on offshore islands. Less common on coasts with cliffs. Also wetlands near coast. In NZ, often on inland wetlands and farmland; in SI, in high country up to at least 1800 m asl (Guy 1947; Child 1960, 1975; Caughley 1966); often above treeline, in tussock-grass, cultivated land, and subalpine scrub of varying density (10–50+% cover) and up to 3 m tall (Caughley 1962, 1966; Child 1975; Pierce 1983). Inland, always near permanent wetlands, including cirques, tarns, lakes and swampy basins, and high-altitude rivers and streams, round headwaters, in broad glaciated valleys, and deltas of rivers ending in alpine lakes (Soper & Jardine 1957; Child 1960, 1975; Pierce 1983).

Breed on coast throughout range, and, in NZ, at inland sites up to 1800 m asl (Soper & Jardine 1957). Mostly breed along coasts (Oliver 1953), often in sheltered places, such as inlets, harbours and estuaries, above high-water mark on low islands, reefs, spits, peninsulas, mudflats and sandbanks; less often on sandy, pebbly or rocky beaches, and in sandhills (Harris 1954; Munro 1971; Watson 1975; Owen & Sell 1985; Vincent 1988; CSN). In Hawke's Bay, Canterbury, Otago and Southland, colonies in shingle river beds (Parrish 1988; P.M. Sagar). On less sheltered coasts, nest on offshore islands, headlands, rocky outcrops, stacks and, less often, on cliffs (Fordham 1963, 1964b; Watson 1975). Occasionally in cleared areas of pine plantations, near beaches (J.M. Hawkins); on near-coastal lakes and lagoons, and sometimes on adjacent pastureland (Fordham 1967b; Pierce 1980; Tas. Bird Rep. 17); and swamps in lowland valleys (CSN 19). In NZ, some breed above timberline on peaks and flat tops of mountain ranges, always near permanent water (Oliver 1953; Taylor 1953; Caughley 1966); on bare rocks, sand or mud, or on grass or beneath vegetation ranging from pasture and rank green grass, sedge, rushes, flax and other herbaceous plants, to shrubland and beneath bushes and clumps of trees, such as *Olearia* (Falla 1937; Taylor 1953; Rand 1954; Fordham 1964b; CSN 19). Sometimes among driftwood (Fordham 1964b). May nest close to urban areas, or other reliable, artificial food sources, such as rubbish tips, meatworks, sewage outfalls and fish-processing factories (Fordham 1967b; J.M. Hawkins). Recorded nesting on roofs (Fordham 1967b; Turbott 1969; CSN 24); in a disused concrete gun-shelter (Fordham 1964b); and once in a burning mine (CSN 24). On Marion I., breed on ledges just above high-water-mark, tops of low cliffs and headlands and, often, among rocks; also on grassy slopes and sometimes inland, in areas where glaciation has scoured away all soil (Crawford 1952; Rand 1954; Williams *et al.* 1984). On Macquarie I. and

Iles Kerguelen, breed on rocks and islands (Falla 1937). On Antarctic Pen., nest on rocky ice-free peninsulas (Maxson & Bernstein 1984).

Forage on land or in water, but rarely in air (2–50 m) (Leishman 1982). Throughout range, mostly forage on coasts, in either inshore waters or intertidal zone. Mainly feed from sublittoral to supralittoral zone; in shallow water or scavenging on beachcast food, often among seaweed or seagrass. Feed round trawlers and other ships, mostly in inshore waters. Also in open water or in kelp beds off beaches beyond breaking waves (Rand 1954; Wodzicki 1962; Fordham 1963; Thomas 1967; Vooren 1972; Bartle 1974; Watson 1975; Brooke & Williams 1984; Williams *et al.* 1984; Powlesland & Robertson 1987; Smith 1987; Wood 1991). Pick food from water to depth of 0.7 m (Falla 1937; Duffy 1980, 1982; see Food). On Antarctic Pen., generally feed in open shallow water close to shore, especially at low tide; when much pack-ice (ice condition ≤ 5), forage farther out to sea (Bernstein 1983; Maxson & Bernstein 1984); also feed at seal colonies (Falla 1937). In NZ, also forage inland, usually on farmland (ploughed or under pasture), especially during wet weather or lambing season; also on playing fields (Falla 1937; Hodgkins 1949; Fordham 1963; Pierce 1980; J.M. Hawkins). In Hawke's Bay, mostly feed on farmland, in urban areas and at refuse tips near rivers (Parrish 1988). These habitats used less often in Aust. (Smith 1987; Tas. Bird Rep. 18). Occasionally forage in rivers (Fordham 1963). Also feed on golf courses (Chafer 1989). Often forage at artificial sources of food, especially rubbish tips; also outflows from abattoirs, freezing works and piggeries (Fordham 1963; Pierce 1980; Owen & Sell 1985; Tas. Bird Rep. 6); and sewage outfalls (e.g. Owen & Sell 1985; Fordham 1967b); on Antarctic Pen., observed consuming raw sewage pumped into harbour (Bernstein 1983).

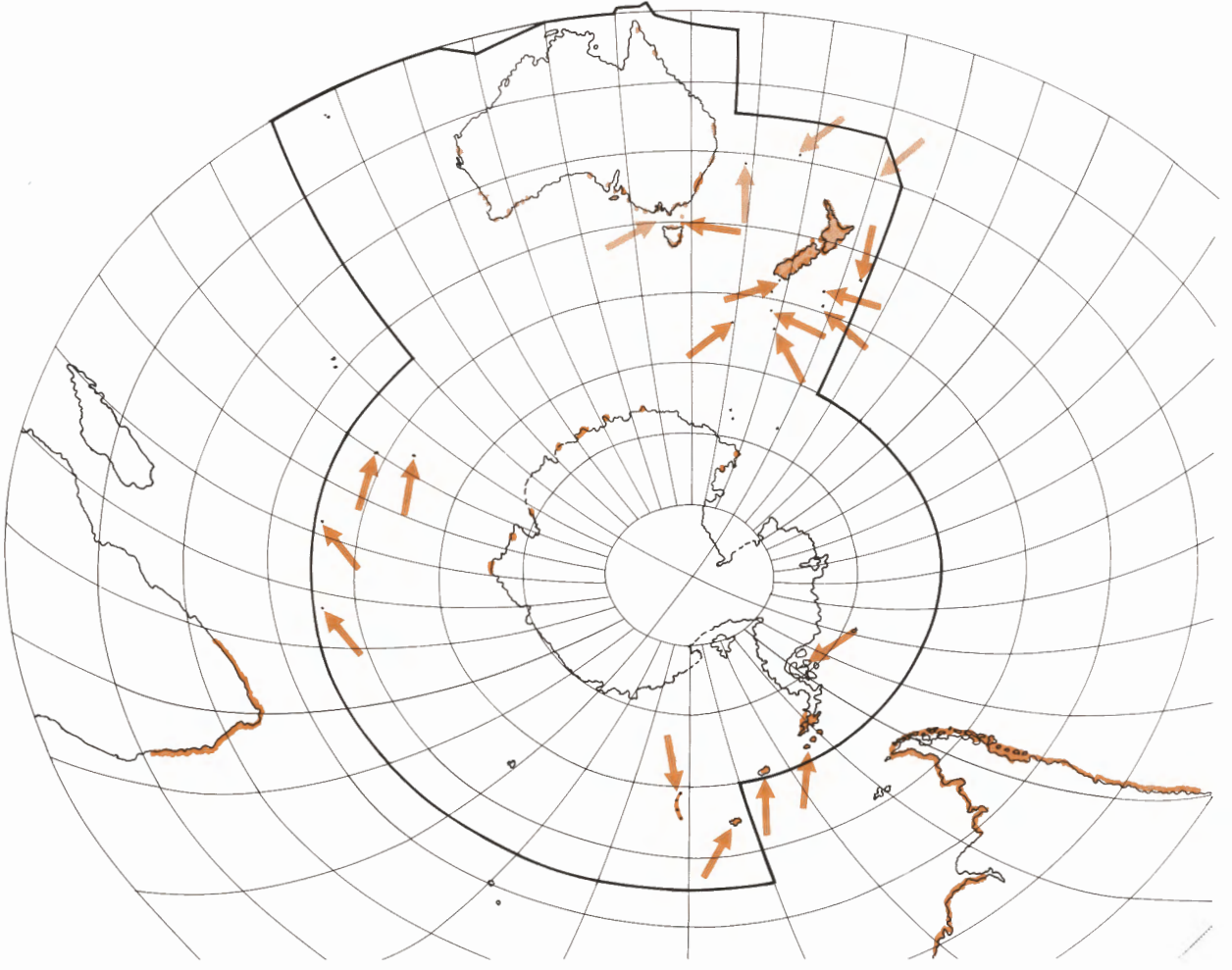
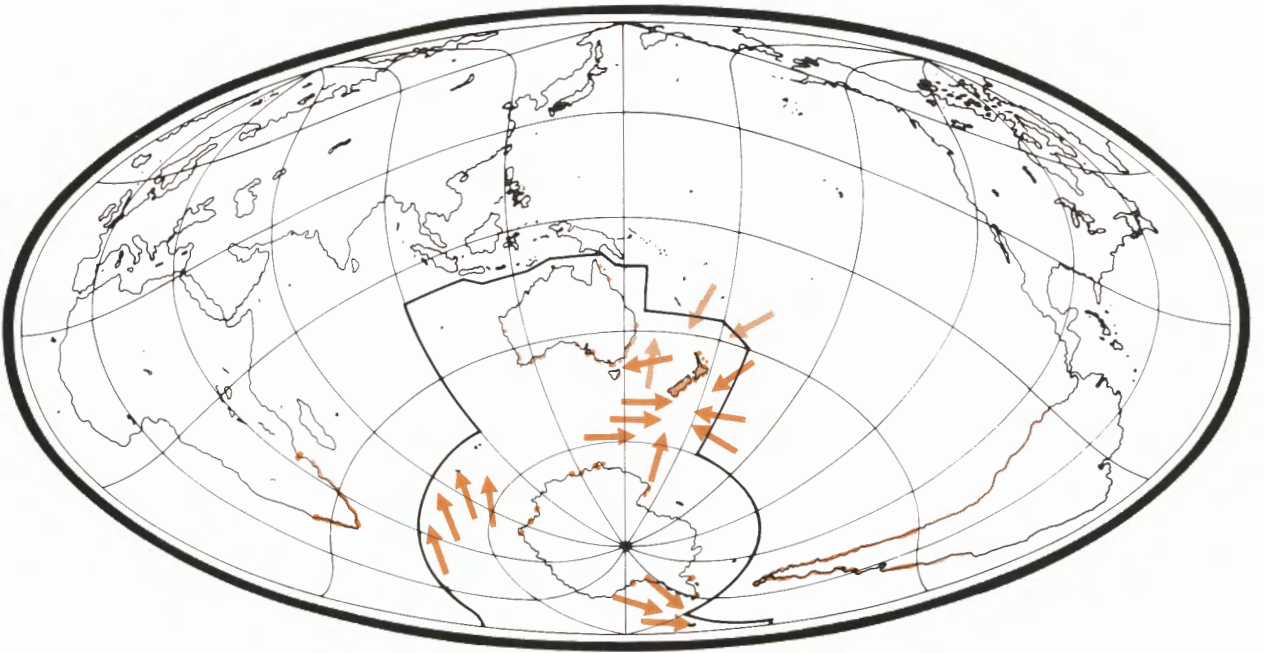
Roost on islands and rock stacks, beaches and estuaries, farmland and playing fields (where birds may also breed or feed). In stormy weather, may roost at sea off breeding islands, or ashore below high-water mark, away from nest-sites (Fordham 1963, 1967b). Also on wharves and wetlands (Pierce 1980, 1983; Smith 1987) and glacial meltwater ponds (Maxson & Bernstein 1984). Sometimes among vegetation, such as rank green grass, low scrub or beneath trees (Taylor 1953; Fordham 1963, 1964b). Once recorded perched in tree (Moncrieff 1928). Occasionally on artificial structures: on buildings, especially those with large sloping roofs (Maxson & Bernstein 1984; J.M. Hawkins) and even forecasting of submarine (Norris 1965).

DISTRIBUTION AND POPULATION Circumaustral. In Aust., mainly on s. and se. coasts; widespread in NZ; on most subantarctic islands; S of Antarctic Convergence, on islands and Antarctic Pen., but infrequently recorded elsewhere in Antarctica. Vagrant Gough and Tristan da Cunha. Widespread in South America, mainly S of n. Peru and se. Brazil, with occasional records farther N in Ecuador and central-e. Brazil (c. 10°S). In Africa, from Luanda in nw. Angola, round coastal Namibia and South Africa to Delagoa Bay in s. Mozambique; isolated records Senegambia (Johnson 1967; Blake 1977; Clancey 1980; Urban *et al.* 1987).

Aust. Qld Few published records (singles unless stated). Cairns: Feb.–24 June 1969; 23 Apr.–13 May 1970; 10 Mar. 1972; 16 Nov. 1988 (Gill 1970; Jack 1971; Knight 1972; Qld Bird Rep. 1988); Southport, 13 Feb. 1971 (Fien 1971); Breakfast Ck, Brisbane, 14 June 1986 (Qld Bird Rep. 1986);

Shelburne Bay, 21 Nov. 1986 (Qld Bird Rep. 1986); Scarborough, 18 Mar.–Apr. 1989 (Qld Bird Rep. 1989); Caloundra, early June 1989 (Qld Bird Rep. 1989). Also two records (undated) from mouth of Brisbane R. (Roberts 1979). No Atlas records. Unverified claim, Green I., 19 Apr. 1970 (Gill 1970). NSW First record, 15 Jan. 1938, Morna Pt, near Port Stephens (D'Ombra 1973). Occasionally recorded in NE, from Ballina to Myall Ls; more often on Central Coast and, formerly, in Hunter Region, but now rare since demise of Moon I. colony. Most records in Illawarra Region, S to Shoalhaven Heads. Also along South Coast, S to Congo Beach (McGill 1955; D'Ombra 1973; Recher 1975; Gosper 1983, 1986; Smith 1987; Whiter 1989, 1991; Chafer 1991; NSW Bird Reps; Aust. Atlas; C.J. Chafer). One record at sea, 12.7 km E of Eden (Barton 1978). Vic. First recorded, Port Phillip Bay, either Mar. 1953 (Wood 1955) or Feb. 1954 (Wheeler 1967). Scattered records on e. and s. coasts of Gippsland, round L. Tyers, Lakes Entrance, Corner Inlet and Wilsons Prom. Mostly along central coast, from Venus Bay, W to Breamlea. Occasionally on w. coast, round Warrnambool, Killarney, Port Fairy and mouth of Fitzroy R. (Vic. Bird Reps; Vic. Atlas). Tas. First recorded, mouth of Derwent R., 26 Dec. 1955 (Wall 1956). Numerous in SE; sporadic records in other coastal areas. On n. coast, recorded Smithton, Stanley, Low Head and C. Portland (also up Tamar R. at Legana); scattered records on e. coast, S of St Helens (Thomas 1979; Tas Bird Reps; Aust. Atlas). In SW, recorded Recherche Bay, Catamaran and Leprena (White 1985; Aust. Atlas). Also on King I. and Furneaux Grp (Green 1969; McGarvie & Templeton 1974; Aust. Atlas). SA First records, escapes from Adelaide Zoo, Apr. 1932 (Sutton 1935). Next records 2 Mar. 1968 at Outer Harbour (SA Bird Rep. 1967–68); acceptable records summarized by Close (1981). Recorded at few locations (singles unless stated): Little Dip, near Robe, 11 Sept. 1977; Kingscote, Kangaroo I., 7 Mar. 1975; Grange-Henley Beach-Glenelg, Nov. 1968 (two), 29 Jan. 1972, 8 May–25 June 1979; Outer Harbour, 2 Mar.–20 Apr. 1968 (one or two), 27 Oct. 1970 (two), 3 Nov. 1984, 29 Dec. 1986–6 Nov. 1987 (two); Port Neill, 14 Sept. 1979; Ceduna, Dec. 1969, 19 Aug. 1977–Apr. 1978 (one or two), 22 Feb. 1979, 4 May 1979 (Close 1981; Winslet & Winslet 1987; Vincent 1988; Aust. Atlas). Several unconfirmed records on Adelaide beaches between late 1968 and early 1969 (SA Bird Rep. 1968–69). WA Generally scarce. First record, single, collected Claremont, 22 Aug. 1924, but misidentified till mid-1960s (Ford 1965b). Most records scattered along s. coast from Duke of Orleans Bay to Augusta. Farther N, singles recorded Seal I., Shoalwater Bay, Alfred Cove, Claremont and Jurien Bay (Ford 1964, 1965a,b; McHugh 1965; Storr 1987; Storr & Johnstone 1988; West. Aust. Bird Notes; Aust. Atlas). Single also much farther N at Carnarvon, 13 Mar. 1981 (Roberts 1982). NT Record of two black-backed gulls, Melville Bay, 27 Oct. 1974 (Boekel 1976) almost certainly Kelp Gulls (Close *et al.* 1979) (see text for Lesser Black-backed Gull *Larus fuscus* for additional details).

NZ Widespread. Most common gull. **NI** Widespread in all coastal regions, generally sparsely scattered inland. Most sparse in inland regions of Northland, from s. Coromandel Pen., S through e. Waikato to Taranaki, and regions from ne. Volcanic Plain and w. East Coast, S through e. Hawke's Bay to n. Wairarapa (NZ Atlas). **SI** Widespread in all regions though more sparsely recorded inland Marlborough and Nelson regions, ne. West Coast, highest sections of Southern Alps, w. Otago and Fiordland (possibly reflecting the distribution of observers





rather than Gulls). Widespread on Stewart I. (NZ Atlas).

Norfolk I. Singles: specimen, Mar. 1970; 17 Sept. 1983 (Hermes *et al.* 1986).

Lord Howe I. Singles: 21 Aug. 1949, 29 Nov. 1959, Nov. 1960 (Hindwood & Cunningham 1950; McKean & Hindwood 1965).

Kermadec Is Single, 4–7 Dec. 1966 (Merton 1970); said to be accidental (Oliver).

Chatham Is Breeding (see below).

Snares Is Two adults and a juvenile, Mar. 1992; one adult, Mar. 1993 (P.M. Sagar).

Antarctica and subantarctic islands Widespread; see Breeding (below). Widespread Antarctic Pen., S to round Marguerite Bay (68°S); elsewhere in Antarctica, vagrants recorded round coast: Halley Bay, SANAE, Mawson Base, Davis Base, Mirny Base, Wilkes and Casey Stns, BANZARE–Sabrina coast, Dumont D'Urville, C. Hallet and Ross I. (Ingham 1962; Spellerberg 1971; Watson *et al.* 1971; Johnstone & Murray 1972; Derksen 1975; Watson 1975; Sagar 1976; Ainley *et al.* 1978; Griffiths 1981; Bassett *et al.* 1988; Thomas & Bretagnolle 1988; van Franeker *et al.* 1990; ANARE). Scattered records at sea in s. oceans between 48°S and 68°S (Griffiths 1981; Bassett *et al.* 1988; Woehler *et al.* 1990).

Breeding Breed on all s. continents. Breed se. Aust.; widespread NZ and associated islands, subantarctic islands and Antarctic Pen. **Aust.** NSW First recorded Dec. 1958 (Gray & Gwynne 1974). Moon I., 2 nests (no breeding for some years); Flinders Isl., 1 pair; Bass Isl., 10 pairs; Martin I., c. 4 pairs (Gray & Gwynne 1974; Battam 1976a,b; Smith 1987; C.J. Chafer). **Vic.** First recorded 1970–71 (Loyn 1975; Vic. Atlas). Seal Rocks, off Phillip I., 3 pairs (Harris & Bode 1981). **Tas.** First recorded Aug. 1963 (Wolfe 1969). Little Chalky I., Furneaux Grp (ABBBS 1981); Paddys I., 4 pairs (Tas. Bird Rep. 20); Lachlan I. (ABBBS 1984a,b, 1985); Visscher I., c. 30 pairs (Tas. Bird Rep. 9); Blackman Bay (Aust. NRS); Orielson

Lagoon (Tas. Bird Rep. 17); Barilla Bay (Tas. Bird Rep. 17); Green I., 275 nests (Coulson & Coulson 1993); Curlew I., S. Bruny I., 1 pair (Wolfe 1969). **SA** First recorded Dec. 1986. Outer Harbour, one nest (Vincent 1988).

NZ In NI, from Kokota Spit in Far North S to Palliser Bay and, in SI, from Farewell Spit S to Invercargill and islands S of there. Fordham (1967b) recorded 31 colonies between Kapiti I. and C. Palliser, 1963–64. Major colonies (≥ 100 nests, or ≥ 200 birds, or listed as large colony) (CSN 19–34 unless stated): Ashburton R., 21 colonies, 10,881 birds; Invercargill, six or more colonies, each of up to 800 pairs; Nelson Boulder Bank, 1577 nests (1983), 762 nests (1989), c. 400 nests (1994) (J.M. Hawkins); L. Wainono, c. 12,600 birds; Waimakariri Gorge, c. 1000 birds; Lyttleton Harbour, three colonies, 980 birds; Rangitoto I., 342 nests; Rabbit I., 314 nests; Matakana I., >500 birds; Bells I., 223 nests; Waitotara R. mouth, several hundred nests; Wairoa, 184 nests; Foxton Beach, 150 nests; Kokota Spit, c. 300 birds; Kowhai Beach, Houhora, c. 300 birds; Portland I., 120 nests; Ngamotu Lagoon, Wairoa, 119 nests; Whakaki bar, 109 nests; Farewell Spit, three colonies of c. 100 nests; Ngaruroro R., 2056 birds, including one colony of 1000+ birds (Parrish 1988); Millerton, 'large colony'; Denniston, 'large colony'.

Chatham Is Chatham I., large colonies (Fleming 1939); South East I., c. 30 pairs (Nilsson *et al.* 1994); Star Keys, 3 nests, Nov. 1977 (Imber 1994).

Macquarie I. 50–100 pairs (Rounsevell & Brothers 1984).

Heard I. 100+ pairs (Woehler 1991).

Auckland Is (Robertson & Bell 1984).

Campbell I. (Westerskov 1960; Bailey & Sorensen 1962).

Bounty Is (Robertson & Bell 1984).

Antipodes Is (Robertson & Bell 1984).

Prince Edward Is Prince Edward I., 30 pairs; Marion I., 200 pairs (Williams *et al.* 1979).

Iles Crozet Ile aux Cochons, 300–400 pairs; Ile de la

Possession, 92 pairs; Ile de l'Est, hundreds of pairs; Ile des Pingouins, tens of pairs; Ile des Apotres, 20 pairs (Jouventin *et al.* 1984).

Iles Kerguelen 4000–8000 pairs (Weimerskirch *et al.* 1989).

S. Shetland Is 2100 pairs in several colonies: Admiralty Bay, King George I., 164 nests; Nelson I.; Deception I.; Penguin I., 63 pairs (Jablonski 1980; Croxall *et al.* 1984); Elephant I., 300 pairs (Croxall *et al.* 1984).

S. Orkney Is About 500 pairs: Larsen Is; Signy I., c. 50 pairs; Powell I.; Laurie I. (Croxall *et al.* 1984; Rootes 1988).

S. Georgia About 750 pairs; Bird I. (Croxall *et al.* 1984; Tickell & Cordall unpubl.).

S. Sandwich Is 100 pairs: Visokoi I.; Candlemas I.; Saunders I.; Bellingshausen I.; Thule I. (Croxall *et al.* 1984).

Antarctic Pen. James Ross I.; Cockburn I.; Hope Bay; C. Andreas; Trinity I., Valdivia Pt; island near Gaston I.; Nansen I.; Andvord Bay; Melchior I.; Bryde I.; Wiencke I.; Goudier I.; Litchfield I.; Anvers I.; Joubin Is; Booth I.; Hovgaard I.; Petermann I.; Yalour I.; Argentine Is; Detaille I.; Webb I.; Leonie I.; Jenny I.; Avian I.; Horseshoe I.; Lagotellerie I.; Stonington I. (Watson *et al.* 1971; Croxall *et al.* 1984).

May breed Bouvetøya (Watson *et al.* 1971).

Extraliminally: In South America, along coasts from Lobos de Tierra Is, n. Peru (6°S), S to C. Horn, and N to round Cabo Frio, Brazil (22°S); also inland in Argentina. Falkland Is. In Africa, widespread breeding along coasts from nw. Namibia to Algoa Bay, South Africa; also sw. Madagascar (Johnson 1967; Blake 1977; Clancey 1980; Urban *et al.* 1987). Twice recorded nesting in n. hemisphere in Africa, in Saloum R. delta, Senegambia (Dupuy 1984; Erard *et al.* 1984).

Population Estimates of breeding populations above. Along Otaki–Ohau coast in 1986, 20.4% of population ($n=2447$) in subadult plumage (≤ 4 years old), significantly less than 23.9% ($n=1549$) recorded earlier (Wodzicki 1962; Powlesland & Robertson 1987); also see Fordham (1968). Population at Motoaka (non-breeding area) has larger proportion of juveniles and subadults than Nelson (breeding area), where mostly adults (J.M. Hawkins).

Change in range Have become established in Aust. since the 1940s; since the 1960s, numbers have rapidly increased and range has expanded (Murray *et al.* 1989). In NZ, a rapid increase in numbers recorded in many regions recently (e.g. Fordham 1967b). However, numbers breeding at Nelson Boulder Bank, SI, have declined from 1577 nests in Nov. 1983 (CSN 32) to c. 400 nests in 1994; decrease associated with increased control of rubbish (J.M. Hawkins).

Congregate wherever there is offal or refuse (Hodgkins 1949), including rubbish tips, abattoirs, freezing works, sewage outlets, fish-processing factories, fishing activities and piggeries. In NZ, eat sick or dead lambs in lambing paddocks (Falla 1937). Occasionally become tangled in fishing line (ABBBS 1984b). Occasionally shot illegally (Robertson 1964; ABBBS 1984a). At least 2131 birds, of a breeding population of 1250 pairs, near an airfield in Napier, NZ, were poisoned with alpha-chloralose in 1965 (Caithness 1968). Tame birds have been used to eat snails in domestic gardens, and one tame bird was attracted to, and even accompanied, children's morning piano practice (Turbott 1967). Regularly eaten by Maori (Sibson 1992).

MOVEMENTS Dispersive, extent varying between colonies. In some colonies, part of population apparently resident or sedentary (Fordham 1966). In S of range (e.g. Antarctica) or

where winter severe (e.g. Cass R. Valley, NZ), most or all leave breeding areas during winter (Bernstein 1983; Pierce 1983). In many parts of Aust., resident all year (e.g. Westernport and Port Phillip Bays, Vic. Atlas) though adults and immatures recorded away from breeding areas (Close 1981). In NZ, seasonal movements apparent, most probably moving only short distances (Moncrieff 1928; see Fordham 1968). Resident at Marion I. (Williams *et al.* 1984). No evidence of movement away from subantarctic islands such as Heard I., Iles Crozet, Iles Kerguelen, and S. Georgia (Downes *et al.* 1959; Prince & Payne 1979; Weimerskirch *et al.* 1985; Bassett *et al.* 1988), but farther S, at Signy I., only partly resident (Rootes 1988). In Antarctica, in winter, most seem to leave breeding areas, unless food available (Bernstein 1983; Bassett *et al.* 1988; Parmelee 1992). Some immatures disperse far from natal colonies (see Banding). Adults and subadults recorded following ships, e.g. across Cook Str., NZ, and from Bounty Is to Antipodes Is (Fordham 1968; Robertson & van Tets 1982).

Departure In Antarctica, juveniles and adults form separate groups before leaving in autumn, though not known where most of these then spend non-breeding season (Bernstein 1983); at least some move to s. South America (see Banding). Near Palmer Stn, Antarctica, many first-year birds leave by May, with last in July (Parmelee *et al.* 1977); in 1979, birds began to leave in Mar. when main food source declined, and most others left by mid-May (Bernstein 1983). On Signy I. those that leave generally do so by June, though timing depends on ice conditions (Rootes 1988). In Cass R. Valley, NZ, most leave by Mar. (Pierce 1983). At Nelson Boulder Bank, no juveniles present after Mar. (J.M. Hawkins). At East Clive, NZ, hundreds recorded on coast in May, after nesting inland on river beds (CSN 38). In Wellington Harbour, NZ, adults begin to leave breeding colonies, Jan.; proportion and number of adults in non-breeding flocks, and size of flocks, increases Feb.–May as birds move from breeding colonies; most first-year birds appear to arrive in flocks in Feb.–Mar.; flocks reach maximum size, Mar.–May (Fordham 1968). In 1986, at Windang, NSW, influx began early June; maximum numbers, July (NSW Bird Rep. 1986).

At well studied colonies in NZ, dispersal of first-year and older birds was restricted, randomly directed and varied with each colony and apparently related to availability of food. Recoveries of birds banded as fledgelings indicate that birds raised in or near Wellington Harbour apparently do not disperse long distances to obtain food, but many young, banded as fledgelings elsewhere, move to Wellington Harbour in autumn and early winter to feed (Fordham 1968). Similarly most of those banded as fledgelings at Nelson do not disperse far (J.M. Hawkins), but see Banding. At least some young disperse quickly, e.g. one moved c. 50 km from colony in 3 weeks, another travelled at least c. 450 km in 9 months (Fordham 1966). Soon after able to fly, young in NSW leave natal island; young banded on Moon I., NSW, disappeared from colony when 4–5 months old (Gray 1967; Battam 1970).

Non-breeding Form non-breeding flocks in some areas, e.g. Wellington Harbour, NZ. Some mixing of birds from different breeding colonies occurs; birds in Wellington Harbour come from as far S as Awarua, Southland, and as far N as Auckland (Fordham 1966, 1968); numbers in Wellington Harbour 40% higher in autumn and early winter than in breeding season (Robertson 1992). Some remain at or near breeding sites (e.g. in Wellington Harbour, NZ, Fordham 1968; at Cass R. Valley, NZ, Pierce 1983; in Nelson region, J.M. Hawkins). Some winter Signy I., though may leave during severe weather

(Rootes 1988). In Antarctica, numbers wintering vary, apparently with availability of food; greater numbers occur when artificial food available, or suitable number of limpets available because of favourable ice conditions. Both adults and immatures of all ages recorded. At Palmer Stn, movements during winter apparently dispersive, as birds appeared (including colour-marked breeders) when unseasonal ice-free conditions exposed feeding grounds; such movement rapid, e.g. in Oct. at Anvers I., considerable influx within 1.25 h of ice clearing (Bernstein 1983; Fraser 1989; Parmelee 1992). Recorded N of normal range in non-breeding period, e.g. Qld, Feb.–Aug., may appear irregularly for weeks at a time (Storr 1984; Qld Bird Rep. 1989; see Distribution). Local movements dispersive; include apparently moving to sheltered areas in strong winds or bad weather (Thomas 1973; CSN 38), and concentrating at sources of food (D'Ombra 1936; Hadden 1990; Hunter 1991). Also move in response to rainfall (Fordham 1968). Some dispersal to mountains and out to sea (Fordham 1966).

Return Most of breeding population returned to Palmer Stn in mid-Sept. when ice cleared and exposed feeding grounds (Bernstein 1983); though uncommon, a few first-year birds return during spring and summer (Parmelee *et al.* 1977). Birds that do not spend winter on Signy I. return during Sept. (Rootes 1988). Arrive at breeding colony on King George I., South Shetland Is, Sept. (Jablonski 1986). Most adults leave Hutt Valley, NZ, spring and early summer, probably bound for breeding colony at Baring Head (Bull 1959). At Cass R. Valley, main increase in numbers in Aug.–Oct. (Pierce 1983). Percentage of adults in non-breeding flocks in Wellington Harbour, NZ, declines from July to Aug. as birds gather at breeding colonies (Fordham 1968). Usually arrive at colony on Dog I., off s. SI, NZ, in Aug. (CSN 24). In 1986, at Windang, NSW, where winter influx occurred, numbers fell to normal levels by late Aug. (NSW Bird Rep. 1986).

Breeding High fidelity to breeding area (e.g. Merilees 1969). In Antarctica, occasional records of adults and immatures well away from breeding areas in Oct.–Mar. (Derksen 1975; Sagar 1976; Ainley *et al.* 1978; see Bassett *et al.* 1988; Thomas & Bretagnolle 1988; van Franeker *et al.* 1990). In Wellington Harbour, NZ, population lowest, Nov.–Jan., at height of breeding (Fordham 1968); numbers low at Waimea Inlet, NZ, Aug.–Dec. while adults at breeding areas (Owen & Sell 1985). Many juveniles remain in Hutt Valley, NZ, after most adults have left for breeding areas (Bull 1959). Rarely, observed N of breeding range during this period (e.g. Kermadec Is, Dec.; Merton 1970).

Banding, Colour-marking Of 310 banded Iles Crozet and Kerguelen, 1951–82, no recoveries elsewhere, suggesting birds resident (Weimerskirch *et al.* 1985). On Macquarie I., birds retrapped at or near banding site up to 13 years after banding (Merilees 1969). At Palmer Stn banded adults seen every month of year; of birds banded as adults, none recovered beyond Anvers I.; of birds banded as nestlings, six recoveries, all near Atlantic sector of s. Argentina and Chile; few nestlings returned to natal grounds as breeding adults (Parmelee *et al.* 1977; Parmelee 1992). Over 5 years, birds colour-marked at Five Is breeding colony, NSW, recorded N to The Entrance and Norah Head (c. 150 km) and S to Ulladulla (c. 100 km), though mostly in Illawarra area (Chafer 1991; NSW Bird Rep. 1989). In s. NI, NZ, maximum distance moved by birds banded and colour-marked as fledgelings, 450 km; of recoveries in first year, mean distance moved c. 27 km, with 10% >50 km; of recoveries after first year, mean distance moved c. 19 km, with

8% >50 km. Bird banded at roost in Wellington (age unknown) sighted c. 480 km N in Auckland (Fordham 1968). At Nelson Boulder Bank, most banded birds remain within 30 km of breeding colony, though a few juveniles travel much farther; one bird moved to and nested at colony c. 10 km away; birds returned to colony when 3–4 years old (J.M. Hawkins). Some movement between NI and SI (Fordham 1968). In Tas., many recoveries of immatures within c. 50 km of natal colonies. However, in other areas, immatures sometimes recorded farther from natal area, e.g. runner banded Vic., 28 Feb. 1974, found dead 190 km SSW on King I., Bass Str., 10 Dec. 1977 (ABBBS 1978); one banded as nestling on Moon I., NSW, 30 Dec. 1962 recovered just S of Fremantle, WA, 29 Aug. 1966 (HASB); juveniles and immatures from area of Palmer Stn recovered Argentina and Chile (Parmelee *et al.* 1977; Bernstein 1983; Parmelee 1992); at Nelson Boulder Bank, a few juveniles travelled 100+ km and three were sighted 600+ km S from colony (J.M. Hawkins). In Aust., few recoveries of birds banded as adults: one banded Tas. recovered only 17 km away 5+ years after banding (ABBBS 1990). For discussion of durability of bands, see Fordham (1967a).

33S151E	12	P	F	43	3355	262	ABBBS
42S147E	12	P	U	34	108	356	ABBBS
34S150E	12	P	U	18	107	42	ABBBS

FOOD Carnivorous; general predators and scavengers; opportunistic; diet includes molluscs, fish and crustaceans. Diet varies between seasons and localities. **Behaviour** Mainly diurnal, though nocturnal on Heard I. (possibly as a result of interactions with Great [Subantarctic] Skua *Catharacta skua lonnbergi*) (Downes *et al.* 1959). Diet varies between seasons and localities; said to depend on availability of prey (Stahl & Mougouin 1986). At Palmer Stn, Anvers I., Antarctic Pen., feed mainly on limpets *Nacella concinna* throughout year, though proportion of total diet varies with availability of limpets and other prey and with annual cycle of gulls: in May, diet mostly amphipods *Nototropis*; from June to Aug., mainly limpets *N. concinna* (85% of samples); from Sept. to Dec. (during courtship and laying), mainly limpets *N. concinna* (84% of samples); rest included euphausiid crustaceans and fish; Jan.–May (including chick-rearing), proportion of limpets decreased (only 53%) and proportion of fish increased (chicks were fed almost exclusively *Pleuragramma*) (Parmelee 1992). At Palmer Stn, prefer large limpets (>6 mm) with conical shells; on Marion I., also selected large limpets (*Nacella delesserti*) (Parmelee 1992). In Antarctica, ice-cover can affect feeding on *Nacella* (Bernstein 1983). In NZ, South America and South Africa, bivalves are a major source of food. In South America, feed almost exclusively on mussels *Mesodesma donacium* (Hockey *et al.* 1989). In Illawarra region, NSW, and Tas., bivalves appear not to be eaten at all; in Illawarra region, also not observed to take chitons or echinoderms; preferred prey are gastropod molluscs: *Turbo torquatus* and cart-rut shell *Thais orbita*; also regularly take molluscs *Turbo undulatus*, *Cabestana spengleri*, and, occasionally, crabs (C.J. Chafer). On Rangitata R., Canterbury, mostly eat fish *Retropinna* (McMillan 1961). **FORAGING METHODS:** In Illawarra region, hover 1–2 m above swash zone or perch on exposed area of shore overlooking swash zone; dive head-first into shallows and snatch molluscs (mostly gastropods) in bill; will also walk into water and search within swash for prey (C.J. Chafer). At Palmer Stn, forage by swimming slowly, parallel to the shoreline, searching with head cocked in stiff-necked posture; take limpets by surface-seizing to depth of c. 30 cm; and by surface plunging: lift short

distance from water then plunge to depth of c. 70 cm; take different sizes of limpets at different tide-levels: take large limpets at low and high tides, taking each one to shore to eat; take small limpets at mid-tides and eat them whole while swimming, regurgitating shells later on land (which, over time, forms large middens of shells) (Parmelee 1992). On Marion I., take limpets *Nacella* by surface-seizing (as above); seven birds made 77 dives in 175 min, taking 25 limpets (Blankley 1981). Also make shallow dives from air. To open molluscs, drop them from air onto hard surfaces, such as sealed roads, rocks and hard wet sand (Waite 1909; Stead 1932; Wodzicki 1946; Turbott 1967; Bain 1969; Brunton 1978; McLachlan *et al.* 1980; Murphy; CSN 19 Suppl., CSN 39). In Illawarra region, drop shell 1–5 times from 3–10 m in air onto rock-platform. All molluscs taken were >50 mm diameter, except *T. undulatus* (>35 mm). Success rate 70–82% for adults, 43–52% for immatures (C.J. Chafer). Once shell of bivalve broken, bird snips adductor muscle with bill. In NZ, take toheroas *Paphies ventricosa* exposed by waves or dig for them; also foot-tremble to expose recently settled shells; small toheroas eaten whole (Brunton 1978). Away from coast, take insects (Turbott 1967); in autumn and winter, large flocks take crickets in pasture (Moncrieff 1928). Record of 32 birds extracting earthworms from golf-course (Chafer 1989). Once recorded feeding on kelp flies that had been washed into water off rocky shore (Burger 1978). Perch 20–25 m high in Rimu *Podocarpus cupressinum*, to feed on fruit; forage in similar manner to New Zealand Pigeon *Hemiphaga novaeseelandiae* (CSN 35). In South America, six different categories of foraging attempts (65% overall foraging success, dropping to 45% in immatures) (Hockey *et al.* 1989). SCAVENGING: Scavenge round feeding cormorants, hovering over them, apparently waiting for dropped fish (CSN 38). On Marion I., Iles Crozet and coasts of Argentina and South Africa, commonly accompany Southern Right Whales *Eubalaena glacialis*, Killer Whales *Orcinus orca* and Leopard Seals *Hydrurga leptonyx*, scavenging on disturbed invertebrates, scraps and offal (Downes *et al.* 1959; Condy *et al.* 1978; Ridoux 1987; Williams *et al.* 1990; Verheyden 1993). Two subadults seen trying to take viscera from beachcast ascidian *Pyura stolonifera* that had been opened by a Sooty Oystercatcher *Haematopus fuliginosus* (C.J. Chafer). Follow ships, eating rubbish and offal. Feed on scraps discarded by fishermen (C.J. Chafer). In NZ, take food from urban bird tables (J.M. Hawkins) and occasionally scavenge road-kills (Common-Brushtail Possums *Trichosurus vulpecula*, Hedgehogs *Erinaceus europaeus*, rabbits, hares) (P.M. Sagar). Recorded eating dead Song Thrush *Turdus philomelos*; shook feathers off prey before eating it (CSN 37). Successfully stole food from Crested Tern *Sterna bergii* chick, shaking chick till it regurgitated fish (HASB); and adult King Penguins *Aptenodytes patagonicus* feeding young (Hunter 1991); also feed on regurgitations at colonies of Australasian Gannet *Morus serrator* (J.M. Hawkins). Reported chasing many species, e.g. Little Egret *Egretta garzetta* (Jenkins 1962) and gulls and terns (Fordham 1963). Birds slowly hawking over open bush may be looking for young birds in exposed nests (Fordham 1964b). Recorded killing old sick sheep *Ovis aries*, pecking out eyes, brain and tongue (Oliver). Carry whole small eggs in bill (Taylor & Wodzicki 1958) and may drop them on water to break them before eating (Moon 1992). Swallow rats, whole or without heads (Fordham 1963; CSN 3). Swallowed whole fish 150 mm long (C.J. Chafer). Wait outside burrows of Tuataras *Sphenodon punctata* until Tuatara emerges, then grab it and repeatedly drop it from air into water to kill it (Oliver).

Olfaction poorer than in procellariiforms (Lequette *et al.* 1989). For further details of diet and feeding behaviour at Palmer Stn, see Fraser (1989); on Marion I., Branch (1986).

Adults On **Marion I.** (obs. and regurgitations; Blankley 1981): Molluscs: gastropods: Patellidae: *Nacella delesserti*; bivalves: *Gaimardia trapesina*; Echinoderms: asteroids: Asteriidae: *Anasterias rupicola*; Fish: Harpagiferidae: *Harpagifer bispinis*; Nototheniidae: *Notothenia macrocephala*. On **Ile de la Possession, Iles Crozet** (317 pellets; Stahl & Mougin 1986): Molluscs: gastropods: Patellidae: *Nacella deaurata* 27.1% freq.; cephalopods 0.9; Crustaceans: barnacles: Lepidae: *Lepus australis* 3.2; Fish 0.6; Birds: penguins 81.4; Salvin's Prion *Pachyptila salvini* 0.9; diving-petrel *Pelecanoides* 5.0; Mammals: Muridae: Black Rat *Rattus rattus* 4.1. On **Heard I.** (11 stomachs; Downes *et al.* 1959): Plants: algae (possibly ingested incidentally) 27.3% freq.; Molluscs: gastropods: Patellidae: *Nacella kerguelensis* 36.4; Fish 27.3; penguin feathers and seal hair 27.3. On **Macquarie I.** (144 regurgitations; Merilees 1984): Plant material 3.7% freq. in winter, 5.7% freq. in spring; Molluscs: polyplacophorans 8.8, 10.6; gastropods: limpets 10.4, 14.4; snails 12.5, 17.3; cephalopods: squid 1.7, 4.8; Crustaceans: isopods: 6.4; 3.9; barnacles: Lepidae: *Lepus australis* 10.8, 1.0; Insects: Diptera: Coelopidae 7.4, 1.0; Birds: penguins 21.9, 5.7; Mammals: Phocidae: Southern Elephant Seal *Mirounga leonina* 2.3, 18.3. Sand, pebbles and pumice 11.4, 9.6. At **Palmer Stn, Antarctica** (Fraser 1989), diet included: Molluscs: limpets: Patellidae: *Nacella concinna* (6–60 mm long; none <6 mm recorded in diet); bivalves: *Kidderia subquadratum*; Crustaceans: euphausiids: *Euphausia superba*; amphipods: *Nototropis*; Fish: Paraphaeidae *Pasiphaca longispina*; Hexagrammidae: *Pleuragramma antarcticum*; also *Trematomus bernacchi*.

On **Green I., se. Tas.** (44 pellets; Coulson & Coulson 1993). Plants: 25.0% freq. Animals: Molluscs: polyplacophorans: chitons 36.4; Chitonidae: *Chiton pelliserpentis* 25.0; Mopaliidae: *Plaxiphora albida* 27.3; cephalopods: 6.8 (squid); Crustaceans: decapods: Porcellanidae: *Petrolisthes elongatus* 6.8; crabs 11.4%; Grapsidae: *Cyclograpsus granulatus* 2.3; Portunidae: *Ovalipes australiensis* 2.3; unidentified: 2.3; Fish: (mostly Platycephalidae *Platycephalus bassensis*, >20 cm long) 34.1. Refuse (incl. glass, string, plastic, paper, bones, and aluminium foil) 54.5. Stones 15.9.

Off **Otago Pen., NZ** (5 stomachs; McClatchie *et al.* 1989): Crustaceans: crabs: Galatheidae: *Munida gregaria* larv. 63.7% dry wt; Fish: 36.3. At **Wellington, NZ** (129 stomachs, obs. and pellets; Fordham 1970): Plants (algae, pteridophytes, Poaceae, Fabaceae) 5.1% vol., 53% freq., 8 species. Annelids (oligochaetes, polychaetes) 0.9, 4, 3; Molluscs (cephalopods, bivalves, gastropods, amphineurans) 2.0, 43, 8; Arthropods (including Insects [Hymenoptera, Diptera, Lepidoptera, Neuroptera, Coleoptera, Hemiptera], Crustaceans [Isopoda, Decapoda, Malacostraca]) 1.5, 14, 27; Echinoderms (asteroids, holothuroids, echinoids) 0.2, 1.0, 5; Fish 3.0, 15, 7; Amphibians –, –, 1; Birds –, –, 4; Mammals –, –, 2. Offal 49.9, 35; refuse 37.0, 53; grit 0.9, 51.

Other records Plants: Podocarpaceae: Rimu fruit (CSN 35). Animals: Annelids: oligochaetes (Stead 1932); Molluscs (Pietz & Strong 1986; Murphy; CSN 34): polyplacophorans (Murphy); gastropods (Stead 1932): Patellidae: *Nacella concinna* (Bernstein 1983; Maxson & Bernstein 1984); *N. kerguelensis* (Ealey 1954); *Patella* (Murphy); Muricidae: *Neothais* (Oliver 1953); *Cabestana spengleri* (C.J. Chafer); Helicidae: *Helix hortensis* (Turbott 1967); Ranellidae: *Thais orbita* (C.J. Chafer); Trochidae: Cooks Turban (CSN 39); Turbinidae: *Turbo torquatus*, *T. undulatus* (C.J. Chafer); bivalves (Stead 1932;

Turbott 1967); Mytilidae (Waite 1909; Murphy); Semelidae: *Pipi Semele (Amphidesma) forsteriana* (Wodzicki 1946; Oliver 1953; CSN 19 Suppl.); Mesodesmatidae: *Toheroa Paphies ventricosa* (Rapson 1954; Brunton 1978); Mactridae: *Mactra*; *Spisula*; Veneridae: *Dosinia* (Brunton 1978; Oliver); *Chione* (Oliver); *C. stutchburyi* (Bain 1969); cephalopods (Pietz & Strong 1986); Crustaceans (Turbott 1967; Pietz & Strong 1986); isopods: Sphaeromatidae: *Cerceis* (Ealey 1954) barnacles: Lepidae: *Lepus australis* (CSN 39); euphausiids: Euphausiidae: *Euphausia superba* (Pietz & Strong 1986); amphipods (Turbott 1967); decapods: crabs (Oliver 1973; Murphy; C.J. Chafer); Insects: Orthoptera: Gryllidae (Moncrieff 1928); Coleoptera; Lepidoptera larv. (Stead 1932); Diptera: Coelopidae seaweed fly larv. *Cheatoceolopa sydneyensis* (C.J. Chafer). Echinoderms: echinoids (Oliver 1973; Murphy). Fish (Stead 1932; Ealey 1954; Pietz & Strong 1986; HASB): sharks (CSN 32); Anguillidae: eels (CSN 23; Oliver 1973); Retropinnidae: *Retropinna anisodon* (Stead 1932; McMillan 1961); Notheniidae: *Pleurogramma antarcticum* (Maxson & Bernstein 1984). Reptiles: Tuataras (Oliver). Birds: King Penguin eggs, chicks, ads, carcasses and abandoned eggs (Hunter 1991); albatross *Diomedea*; shearwaters *Puffinus* (CSN 19 Suppl.); Australasian Gannet eggs and young (Taylor & Wodzicki 1958; Robertson 1964; J.M. Hawkins); Domestic Chickens *Gallus gallus* (Oliver); Double-banded Plover *Charadrius bicinctus* egg (Moon 1992); gull and tern young (Stead 1932; HASB); White-fronted Tern *Sterna striata* chicks (CSN 36); Black-fronted Tern *S. albobriata* (Stead 1932); House Sparrow *Passer domesticus* (Stead 1932; Oliver 1973); Song Thrush (CSN 37); Blackbird *Turdus merula* (Oliver 1973). Mammals: Muridae: rats (CSN 3; Oliver 1973); Bovidae: Sheep (Stead 1932; Oliver). Scavenged food: Birds (Stead 1932; Ealey 1954; Pietz & Strong 1986); giant-petrel regurgitations (Murphy); Mammals: stranded whale (Stead 1932; CSN 19 Suppl.); whale offal (Murphy); Southern Right Whale skin (Verheyden 1993); Killer Whale excreta (Condy *et al.* 1978; Williams 1990; Ridoux 1987); seals (Bryant 1945; Ealey 1954; Pietz & Strong 1986; Murphy); human refuse (Oliver 1973; Thomas 1977; Wood 1991; Murphy); lambs' tails (CSN 19); sheep bones (Oliver 1953); road-kills, including Common Brushtail Possum, Hedgehogs, rabbits and hares (P.M. Sagar); raw sewage (Bernstein 1983).

Young Rarely fed on first day and feeding sporadic on second day. Parent regurgitates onto ground or holds food in bill. If items too large for chick, often re-swallowed by adult (Fordham 1964b). Juvenile observed harassing adult until adult regurgitated a whole fish c. 150 mm long, which juvenile then swallowed whole, head first (C.J. Chafer). On **Somes I., Wellington Harbour** (stomachs, pellets of adults feeding chicks, and remains round nest; Fordham 1964b): Annelids: oligochaetes: Lumbricidae unident.; *Lumbricus rubellus*; Megascolecidae (c. 25 cm); Molluscs: polyplacophorans: unident.; Chitonidae: *Chiton*; Ichnochitonidae: *Eudoxochiton*; gastropods: Turbiniidae: *Turbo (Lunella) smaragda*; Haliotidae: *Haliotis*; Neritidae: *Nerita melanotragus*; Buccinidae: *Cominella*; bivalves: Mytilidae: *Perna*; Semelidae: *Semele (Amphidesma)*; Veneridae: *Chione stutchburyi*; cephalopods: Octopodidae: *Octopus*; Crustaceans: shrimps; crabs; Insects: Coleoptera: Scarabaeidae: *Chlorochiton suturalis*; *Costelytra zealandica*; *Pyronota festiva*; Chrysomelidae: *Paropsis dilatata*; Diptera: Syrphidae: *Eristalis* larv.; Calliphoridae: *Calliphora quadrimaculata*; Tipulidae ads; Echinoderms: asteroids: Asterinidae: *Patiriella regularis*; echinoids: Echinidae: *Evechinus choloroticus*; Fish: Anguillidae: *Anguilla* (c. 50 cm, c. 450 g); A.

australis schmidtii (c. 15 cm); Syngnathidae: *Stigmatophora longirostris*; Tripterygiidae: *Tripterygion*; Labridae: *Pseudolabrus celidotus*; Mugilidae: *Aldrichetta forsteris*; possibly Sparidae: *Chrysophrys auratus*; Amphibians: Hylidae: *Litoria aurea* tadpoles; Birds: Hedge Sparrow *Prunella modularis*; House Sparrow; Common Starling *Sturnus vulgaris*; Mammals: Hedgehog; Brown Rat *Rattus norvegicus*. On **Rangitoto I., NZ** (86 food items regurgitated by chick; Oliver 1973): Annelids: earthworm 41.9% freq.; Fish (up to c. 4 cm) 15.1; eels 8.1; scraps and offal 30.2; and unidentified (including starfish and pieces of a large fish) 4.7. At **Palmer Stn, Antarctica Pen.** (Fraser 1989): mostly fish *Pleurogramma antarcticum* (98.1% of 396 feeding observations). **Other records** Plants: algae. Animals: Molluscs: gastropods (Downes *et al.* 1959); Insects: Coleoptera (Downes *et al.* 1959); Lepidoptera: Noctuidae: *Persectania ewingi* larv. (Bell 1960); Diptera (Downes *et al.* 1959); Fish: Nototheniidae: *Notothenia macrocephala* (90 mm; Blankley 1981).

Intake In Illawarra region, NSW, each bird usually takes 3–5 molluscs per tide (10–25 g dry weight; 315–525 kJ/g/day ash-free) (C.J. Chafer). On Dargaville Beach, NZ, each bird takes c. 20 toheroas/day, each 4–6 cm long (Brunton 1978). Off Otago Pen., five stomachs contained mean 0.331±0.740 mg dry weight of *Munida* and 0.189±0.423 g dry weight of fish (McClatchie *et al.* 1989). For estimates for South Africa, see McLachlan *et al.* (1980).

SOCIAL ORGANIZATION Major studies in Wellington area, NZ (Fordham 1963, 1964a,b, 1966, 1968), on which account mostly based; some information from Auckland area, particularly Flax Pt, Rangitoto I., and nearby colonies (Oliver 1973), and time-budgets studied in small colony in Antarctica (Maxson & Bernstein 1984). Social organization influenced by human activity. Generally gregarious throughout year. Roost, breed and often feed in flocks. Small numbers regularly seen singly, in twos or in small groups (e.g. Fordham 1963, 1966; Robertson 1964; Watson 1975); some pairs breed solitarily and some pairs roost apart from flocks over winter. When disturbed, flocks fragment (Fordham 1964a, 1968). In Wellington area, age-structure and size of flocks varies over year: In non-breeding season, most birds in flocks, usually near food; where population less dense, may be in small flocks of ≤10 (Fordham 1968). From July to Aug., numbers of adults in flock declines as birds move to breeding colonies (Fordham 1966, 1968). During breeding season, most adults at breeding colonies and flocks smallest; adults will visit flocks (usually those closest to breeding colonies). At breeding colonies, small numbers of non-breeding first- and second-year birds occasionally present, sometimes in Clubs of non-breeding adults (see Sexual behaviour). Towards end of breeding season (Feb.–Mar.), breeding adults and young join flocks; flocks increase in size and usually include birds of all ages (Fordham 1963, 1964a, 1966, 1968; Thomas 1973). At first, only small numbers of young in main roosting flocks but by May–June nearly all have joined, though small groups occasionally found roosting and foraging away from main flocks. Flocks reach maximum size, Mar.–May (Fordham 1963, 1964a,b). In Auckland area, at rubbish tips, flocks largest, Mar.–Apr.; at sites of breeding colonies, largest numbers at roost during breeding season (often only adults) (Oliver 1973). Size of flocks varies much. In Wellington area, flocks at main feeding and roosting sites usually large, >1000 birds (Fordham 1967b, 1968). At sea, outside coastal waters, seen singly or in small flocks

(Fordham 1966). Flocking related to distribution and density of human populations (Fordham 1966, 1968); gather at sites where food plentiful, such as rubbish tips (Fordham 1967b; Oliver 1973), freezing works (Oliver) and newly ploughed fields (Stead 1932); off Auckland c. 1400 used to gather at ocean site where refuse dumped (Oliver 1973). When moving to feeding sites, occasionally gather on nearby fields or water then move *en masse* (Oliver 1973); similar behaviour sometimes seen at roosting sites (see Roosting). When foraging in colonies of Australasian Gannets, usually patrol singly or in twos, though up to 20 seen (Robertson 1964). Feeding flocks usually contain more young birds than resting flocks, and sometimes comprise mainly one age-class (probably result of breeding or feeding requirements of absent age-group) (Fordham 1966, 1968). During daytime away from roosts and colonies, flocks can include birds from different colonies or roosts; birds in such flocks may not perform similar activities at same time or stay with flock the entire day; some birds attend same flock regularly, but some pairs or individuals are itinerant; in Wellington area, itinerants average 9.4% of population throughout year (Fordham 1968). For further details of composition of flocks and population, see Fordham (1963, 1964a,b, 1966, 1968) and Oliver (1973). Outside NZ, observations of flocks include: On S. Georgia, as soon as chicks fledge, Gulls form flocks of 40–50 (Murphy). In Antarctica, juveniles and adults flock separately before autumn dispersal; sometimes congregate to forage on limpets; in winter, some flocks of 20–30 immatures with a few adults seen (Bernstein 1983; Parmelee 1992). In Illawarra region, NSW, immatures (1–4 years old) tend to roost together in groups of 10–35 birds during autumn–winter (C.J. Chafer). Generally seem to roost independently of other species (Fordham 1963) though, in Aust., sometimes roost with small numbers of Pacific Gulls (Wakefield 1984). Often follow schools of fish in mixed flocks with Cape Petrels *Daption capense*, Silver Gulls *Larus novaehollandiae*, White-fronted Terns and Common Diving-Petrels *Pelecanoides urinatrix*, all of which fish independently without much conflict (Fordham 1963). Follow inshore fishing trawlers with other species of seabirds (J.M. Hawkins).

Bonds Monogamous (Fordham 1964a; Oliver 1973). Of eight pairs, five, possibly six, bred together following year, one pair did not return to nest, and one bird bred with new mate (Oliver 1973). Not known if bonds maintained outside breeding season; some birds appear to remain paired. Established pairs probably re-form before winter, as pair-displays (e.g. Head-tossing, Mewing, Choking) seen in flocks from at least Apr. and, in winter, some pairs roost away from other birds or roost together at nest-sites (Fordham 1964a; Oliver 1973; J.M. Hawkins). In winter in Antarctica, some birds remain paired and perform pair-maintenance displays (Parmelee 1992). In NZ, new pairs form when birds congregate at colony before breeding (Fordham 1964a). In Antarctic and Subantarctic, pairing occurs mid-Sept. to late Oct. (Watson 1975) with courtship feeding seen Sept. (Parmelee 1992); on Campbell I., seem to have paired by Sept. (Bailey & Sorensen 1962); on S. Orkney Is, pairing seen Nov. (Murphy). In Wellington area, in age-classes >1 year old, sex-ratio appears to become increasingly uneven until adult females outnumber adult males by c. 2:1; possibly as a result of different patterns of dispersal of sexes (Fordham 1966). Most first breed when 4 years old, though some probably breed in third year; 2-year-olds show some brief and incomplete breeding behaviour towards end of season, but not seen to copulate; complete copulation probably does not occur before end of third year (Fordham 1963, 1964b, 1966).

Parental care Male mainly builds nest. Both sexes incubate, brood and feed young, though female spends more time incubating and, in some circumstances, males more active in defence of territory (Maxson & Bernstein 1984) (see Breeding). Do not form crèches and family groups do not mix (Fordham 1964b). Few details on how long fledged young depend on parents for food: After young can fly (45–75 days old; see Breeding), parental care weakens and, though most young accompany and beg for food from parents for some time after this, demands rarely met (Fordham 1964b). Young said to be able to fend for themselves at 7 weeks, but occasionally fed by parents till 3 months old (Oliver); after flying young start to accompany parents to feeding grounds, fed for c. 1 month then gradually weaned (Stead 1932); young can feed themselves shortly after they can fly, but may still accompany parents for several months; often seen begging unsuccessfully for food up to at least 6 months old (Fordham 1964b; J.M. Hawkins). In Antarctica some parental care after chicks able to fly, e.g. young begged for food up to 29 days after first flight (Maxson & Bernstein 1984).

Breeding dispersion Colonial but sometimes breed as single pairs (e.g. Fordham 1963, 1966; Oliver 1973; Williams *et al.* 1984; Weimerskirch *et al.* 1989; Parmelee 1992). Colonies can be very large, up to 10,000–12,500 birds. For details of colony sizes, see Populations. As size of colonies increases, density of nests increases. In Wellington area, topography does not seem to affect density of nests but predation appears to cause dispersed nesting in some colonies. Laying seems to start earlier in dense colonies (Fordham 1966). Near Wellington, mean minimum distance between nests 3.2–4.3 m (at various sites) (Fordham 1966). On Somes I., NZ, average nest-density 33.6 nests/ha; in areas of greatest density many nests c. 1 m from neighbours (Fordham 1964a). On Rangitoto I., density of nests often greatest on ridges or mounds; density increases towards centre of colony but distribution of nests also clumped (Oliver 1973). In open areas (e.g. river beds and beaches), distances between nests said to be usually >4.5–5.5 m (Stead 1932). On Campbell I., nests seldom close together, with pairs c. 0.8 km apart (Bailey & Sorensen 1962). In Porangahau district, NI, NZ, nests scattered, closest being c. 4.5 m apart, but most at least c. 180 m (Cunningham & Wodzicki 1948). At Nelson Boulder Bank, colony stretches along c. 6 km of narrow bank, with nests seldom closer than 6 m (J.M. Hawkins). On Marion I., nests dispersed (Williams *et al.* 1984). On Iles Kerguelen, not close together (Falla 1937). Tend to nest at same colonies and in association with other species from year to year (Fordham 1966); some birds return to same territories (Oliver 1973; Parmelee 1992); also see Breeding. Evidence that some birds return to natal colonies to breed (see Movements). **Territories** Once bonded, pair establishes territory; male likely to select site of nest (Fordham 1964a). At Rangitoto I., territories gradually established with few violent disputes; some activity Apr.–June, with first birds seen defending sites about mid-May; after this, attachment to territories increases; most birds returned 3–4 months before laying (Oliver 1973). Till hatching, territory comprises nest and surroundings; later, nest loses significance as centre of territory and adults defend chicks only (Fordham 1964a). In Antarctica, some pairs also defend feeding territory on shoreline next to nest-site; such pairs had larger territories and nested at lower densities than those without foraging territories; intruders sometimes tolerated near nest for several minutes, but rarely so on feeding territory, except on odd occasions when large numbers of Gulls gathered to feed on limpets (Maxson & Bernstein 1984);

Parmelee 1992). In Aust., resident adult pairs recorded chasing immatures if they strayed onto rock platforms, but did not defend adjacent sandy beaches (C.J. Chafer). Size of territories varies with aggression of males and density of breeding pairs, pairs nesting farther from other birds holding larger territories; arrival of additional pairs in area forces existing pairs to withdraw boundaries, thus territories smallest at height of breeding season; on Somes I., approximate size of three territories: 23 m², 28 m², and 129 m² with most territories being >23 m², though in areas of greatest density pairs averaged 15.2 m². Deserted territories soon occupied by neighbouring Gulls (Fordham 1964a). In Antarctica, proportion of time parents spend on territory varies. Before laying, and after chicks hatch, spend much time off territory. As laying approaches spend more time on territory, especially female. Throughout breeding, both sexes usually inactive when on territory (up to 70% of total time-budget), and little time (0–6.9%) spent flying, walking, swimming, building nest, courting, or in agonistic behaviours. While producing eggs, females spend more time inactive and less time foraging, gathering nesting materials, flying, and off territories compared to their mates (Maxson & Bernstein 1984). In NZ, after bout of incubating, bird usually flies off to feed and bathe, then returns to territory, usually close to neighbouring nest, to preen, sleep, stretch, and defend territory (Fordham 1964b). In NZ, territories abandoned at end of breeding season (Oliver 1973). In Antarctica, some Gulls territorial over winter (Parmelee 1992). **Home-ranges** Daily movements of birds discussed by Fordham (1966) and Oliver (1973). First-year birds do not usually travel >16 km from natal colony (Oliver 1973).

Roosting Nocturnal (e.g. Fordham 1963, 1966; Oliver 1973); in NZ, generally do not fly after dark except on moonlit nights (J.M. Hawkins); in Antarctic and Subantarctic some feed at night (Watson 1975). Roost in isolated pairs or small (<100) to large (1000) flocks (Fordham 1963, 1966). Flocks form in roughly same areas each night (Fordham 1966, 1967b), and at least some birds consistently return to same spot (Fordham 1963). Sometimes roost at sea next to roosting sites (Fordham 1967b), or on ponds (Murphy). In some cases, roosting site almost exactly same as nesting area (Fordham 1966 1963); at Flax Pt, birds resumed roosting at colony in May (Oliver 1973), at Nelson Boulder Bank, in June (J.M. Hawkins), only a few months after end of breeding season. In Auckland area, two main types of roosts: colonial (those associated with breeding) and non-colonial roosts (those not associated with breeding). Colonial roosts used only by adults; non-colonial roosts used by immatures and adults and are typically large sandbanks covered by tide for not much more than 4 h at a time. Use of some roosting sites varies with weather (Oliver 1973). For further details of roosting sites, see Habitat. **ARRIVAL:** In Wellington area, loafing birds move slowly towards night roosting sites in late afternoon, singly or in small groups; arrive individually at roost at about dusk. On Somes I., begin to arrive near roost from late afternoon (c. 2.5 h before sunset), usually gathering on water 100–200 m offshore; if arriving after dusk, fly straight to land; sometimes stay on water till early hours of morning before flying, almost *en masse*, to roosting site; at other times, especially in stormy weather, may remain on water all night (Fordham 1963). In Auckland area, many birds remain at rubbish tips till after sunset before flying to roosts; many birds that leave earlier settle on temporary resting sites (e.g. mudflats and, in wet weather, grassy playing fields) before moving to roosts; sometimes flights to roosts begin with large group lifting off to-

gether, wheeling and Long Calling (Oliver 1973). At Nelson Boulder Bank, when rubbish tip closed at 17:00 and human activity stopped for day, birds moved to or near roost (J.M. Hawkins). In Auckland area, at non-colonial roosts, from Apr. to Aug., most birds arrive during last hour before complete darkness, with most arriving after sun below horizon; if roosting site still covered by tide, arriving birds settle on water till able to stand. At Flax Pt (colonial roost), in Mar., settled offshore 15 min before sunset, then moved to roost at dusk; time of arrival offshore became earlier through Apr. and, by late May, some Gulls spent all day at roost and others returned by 08:00; at this site birds spread out, as if roosting on their previous breeding territories. At another colonial roost, did not stay at roost all day till Oct. Mass flights before roosting occur at many roosts, but are most obvious at colonial sites at certain times of year (see Flock behaviour below) (Oliver 1973). In Aust., some, possibly mainly immatures and juveniles, do not arrive at larger communal roosts until after dark (Wakefield 1984). On arrival at roost, land and settle in one spot (especially birds in apparently established pairs) or land then walk before settling; often give Long Calls and occasionally Alarm Calls; birds preen and look round for at least 10 min, usually longer, before sitting; some sparring and restless behaviour before flock settles. Distance between individuals varies with terrain, but on flat ground c. 1–1.5 m. Flock eventually silent except for intermittent Long Calls. Sleep with eyes closed, either standing or sitting, with bill tucked beneath scapulars, or with head pointing forwards. Usually remain in one place during night unless disturbed (e.g. by aggressive interactions); more unsettled on moonlit nights than completely dark nights; disturbance common in roosting flocks of non-breeding adults and immatures, and birds sleep little (Fordham 1963). **DEPARTURE:** On Somes I., some birds fly off a few hundred metres at first light but return again; members of flock start Long Calling, and after 30–45 min all birds active, with much calling, preening, stretching, sparring and walking (in breeding season also other displays and chicks give Begging Calls). Birds gradually spread out; c. 1 h after first light, much calling heard in colony as birds begin to fly off singly, in pairs, and in small groups; leave in almost constant stream, which lasts c. 0.5 h, with many birds wheeling over colony. Between 1.5–2 h after first light, most birds have left (Fordham 1963). In Auckland area, at non-colonial roosts, birds may leave before first light. On Rangitoto I., departure times vary; at colonial roosts, birds sometimes move before first light but generally leave between first light and sunrise; at non-colonial roosts, birds usually leave after sunrise; departure delayed by fog and high winds; generally leave in small groups, though sometimes large numbers leave roosts at same time, noisily giving Long and Short Calls as they do so and wheeling for several minutes before dispersing (Oliver 1973). Further roosting notes in Stead (1932). At night during breeding season only smallest chicks brooded; older chicks find own shelter beside or near nest (Fordham 1964b); in Antarctica, chicks and flying young may return to nest in evening (Stead 1932; Maxson & Bernstein 1984). **LOAFING:** Loaf during daylight, with breast facing towards wind (Oliver 1973; Murphy). Usually gather well before midday at customary place, often in or next to feeding site, and remain there most of afternoon; members of loafing flock, which may come from several night roosts, mainly stand about, sleeping, preening, or bathing, but may leave to feed (Fordham 1963); may also perform courtship and aggressive behaviour, particularly as breeding approaches. Adults spend little time loafing at feed-

ing sites when feeding chicks (Oliver 1973). On hot days, older chicks often pant in shade of rock (Oliver 1973). Fledglings sometimes move to shade, away from nests, during day (Fordham 1966). In bad weather, perform all activities in subdued manner or for shorter time; in storms, stand with head into wind and do not seek shelter, and normal individual and contagious flock behaviour prevented (Fordham 1963); at S. Georgia, in strong winds, said to move to water and shelter in lee of long lines of kelp (Murphy).

SOCIAL BEHAVIOUR Fairly well known; behavioural studies in NZ by Fordham (1963, 1964a,b) with some material in Oliver (1973). Extraliminally, study of breeding behaviour in captivity by Steinbacher (1938). Colonies readily disturbed by human activity (Fordham 1963). Breeding behaviour similar to that of Herring Gull *Larus argentatus* and Lesser Black-backed Gull (Steinbacher 1938; White 1952; Moynihan 1962; Fordham 1963). Generally do not perform most main calls and postures until c. 6 months old, and some calls not until 2 years old; those associated with breeding only given by birds of breeding age. However, immature birds, at end of their second or third year, may perform brief and incomplete postures and calls that are associated with pair-formation (Fordham 1963). **Flock behaviour** Many behaviours seem to spread throughout flock, such as bathing, feeding, Alarm and other calls, and perhaps also paddling, preening and drinking. Other activities not infectious, e.g. stretching and yawning (Fordham 1963). May be able to maintain long-range contact by sight and sound. At Flax Pt, resumption of roosting in May characterized by spectacular noisy mass flights as birds move into colonies; flights decrease as birds become more familiar with colony; often at intervals during breeding season, spectacular and often inexplicable social flights occur, where large numbers wheel over colony giving both Long and Short Calls (Oliver 1973). Laying more synchronized in subcolonies than colony, though this varies between areas (Fordham 1966; Oliver 1973) (see Breeding). **Comfort behaviour** Daily activities at feeding grounds include preening, sleeping, bathing and standing (Fordham 1963). During daytime, adults found to spend more time resting and subadults more time flying, but all ages spend about same amount of time feeding (Powlesland & Robertson 1987: Table 2). **RELAXED POSTURE**, with neck withdrawn shown in Figure 1. From this posture bird may give CALL NOTE, thrusting head forward with neck straight, then bending neck slightly down as call uttered. **STRETCHING**: At least two types; both seen in quite small chicks; in first, bird leans forward on one leg and straightens leg and wing on other side, stretching them backwards and slightly down; in second type, which is more elaborate but less common, bird leans forward on toes, flexes or flaps wings slightly, puts tail and wing-tips in air, and moves head and throat parallel to, and almost touching, ground (Fordham 1963). **PREENING**: Also begins at early age; seen in one chick 2–3 days old (Fordham 1964b). **HEAD-TOSSING**: Occasionally seen throughout year, and performed by birds

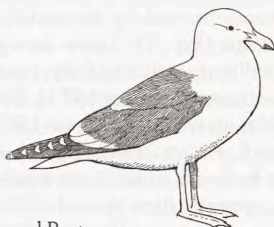


Figure 1 Relaxed Posture

nearly 2+ years old (see below). **BATHING**: Occurs with vigorous splashing of wings and ducking of heads; young first bathe when c. 2 weeks old, without totally immersing (Fordham 1963). Immatures and adults commonly bathe during high tide (C.J. Chafer). **Play** Some behaviour possibly play: fly off water and dive from height of 30–60 cm to grasp an object; then object turned in bill, dropped, or dived for, and dropped again; may repeat behaviour several times (Fordham 1963).

Agonistic behaviour Chase and steal food from conspecifics (Oliver 1973). Outside breeding colony, changing composition of flocks results in many aggressive disturbances (Fordham 1966); birds often driven away by members of flock (Fordham 1968). Within roosting flocks, antagonism usually involves only threat postures, some of which seen any time of year; rarely fight while resting. Adults usually dominant over young in flock hierarchy; relationship between second- and first-year birds less clear (Fordham 1963). During breeding season, agonistic behaviour more frequent in high-density areas of colony, where intrusions onto territories more common (Fordham 1966; Maxson & Bernstein 1984); most attacks directed at unfamiliar conspecifics near nest; aggression between long-established neighbours less frequent, particularly as season advances. Strangers, young and old, usually wary of landing among group of incubating birds, and start at least display of aggression; some walk slowly among nests inspecting them carefully, and occasionally approach sitting birds whose mates are absent. Wandering chicks attacked by adults, and defended by own parents; many chicks pecked on back of heads by adults, killed and eaten; during practice flights, young often land metres away from nests, and can be attacked and occasionally killed; even juveniles that have been flying for 2 months may be mobbed by adults (Fordham 1963, 1964b, 1966; Oliver 1973). When disturbed and colony takes flight, birds repeatedly attack each other (Fordham 1964a). **Threat** Often give Long Call (see Sexual behaviour) as challenge when defending resource (Fordham 1963), including during or after disputes (Oliver 1973). **HUNCH**: Threat posture of low intensity, usually seen in birds guarding food: withdraw neck and hunch shoulders, with feathers slightly ruffled; walk stiffly round food that they are guarding. When threatening birds arrive, guard assumes Upright Posture (see below) and drives them away (Fordham 1963). Hunch also Appeasement, see below. **FORWARD POSTURE**: Lower and thrust head forward, without calling, e.g. if one bird adopts Upright Posture, recipient may assume Forward Posture then move away. Not common (Fordham 1963). **CHOKING** (Fig. 2): Threat posture of low to medium intensity, where bird leans forward, lowers chest and floor of mouth so that throat seems swollen, and moves head and chest rapidly and rhythmically up and down for several seconds while calling. Occurs on land or sea, when sitting, standing, or walking alone or with mate; seen in birds ≥ 2 years old; somewhat infectious. Example of use: one female, sitting near incubating partner, began Choking when approached by strange male who was Mewing; she quickly stood

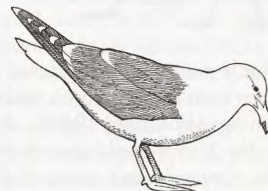


Figure 2 Choking

and walked to nest, and resident male left nest, Choked, then drove intruder away. Choking displays also associated with nest-building and nest-relief (Fordham 1963); see also Oliver (1973). **UPRIGHT POSTURE**: Usually more aggressive than Choking; bird about to attack adopts tense pose, holding wings high against body, extending neck, and bending head slightly down, looking toward ground; do not call. Upright Posture or Choking first reaction when neighbour trespasses onto territory, or approaches too close in flock. May cause alarm or flight in trespassing bird; usually leads to Charge, which may lead to Grass-pulling or fighting. **CHARGE**: Bird attacks with wings raised and then either continues attack, drives opponent away, or begins Grass-pulling (Fordham 1963); may chase for up to c. 100 m (Fordham 1964a). **GRASS-PULLING** (= Pecking-into-the-Ground) (Fig. 3): High-intensity threat consisting of pecking and tugging strenuously at grass, shrubs, rocks, or nearby

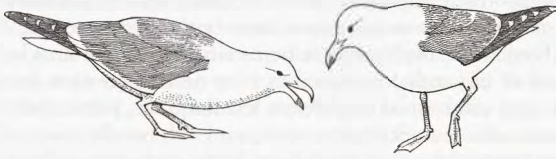


Figure 3 Grass-pulling

objects; do not call. Commonly seen if intruder does not flee after Upright Posture or Choking (Fordham 1963). Unfamiliar intruders usually fly when owner of territory behaves aggressively and do not often fight (Fordham 1964a). **Fighting** Occurs constantly in defence of territory or brood, and may result in death (Fordham 1963). Others have found fighting not so common (Oliver 1973; Maxson & Bernstein 1984). Between periods of Grass-pulling, birds strike at each other with bills, trying to grasp part of opponent (usually bill or wing); then each bird settles back to tug, with wings flailing in air, delivering heavy blows with wings when possible (Fig. 4); feathers plucked out are shaken off bill; fighting continues till one bird manages to break away. Adult being beaten often calls. During fight, females standing nearby occasionally Choke or Mew, and sometimes Chase other birds. Dog-fights may develop between onlookers because several territories violated at once. On Somes I., most breeding adults found dead were males that had died from wounds inflicted by other Gulls (Fordham 1964b). Fordham (1963) considered dead adults were intruders that were killed in mob attacks; victims often

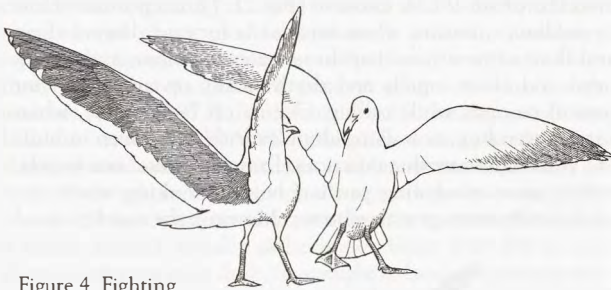


Figure 4 Fighting

had broken wings, which presumably hindered escape. **Appeasement** Hunch often seen in immatures, and sometimes in females approaching mates (Fordham 1963). **Alarm ALARM CALL POSTURE** (Fig. 5): Neck stretched forwards and, with each call, head arcs slightly forwards and down (bill about one-quarter open) and breast swells and wings and tail dip by several centimetres. Bird appears alert and often cocks head

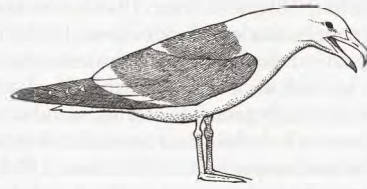


Figure 5 Alarm Call Posture

(Oliver 1973). Alarm Call Posture associated with preparation for flight. Alarm Call causes all birds to stretch necks, look about, and take to air uttering same call (Fordham 1963). Heard any time of year by birds >2 years old; given in air or on ground. When disturbed at roosts: some birds may Moan, then almost immediately Alarm Call, after which birds begin to fly off; may fly over water and not return for several hours (if at all), or may return within a few minutes. Young birds never initiate alarm; in normal circumstances away from breeding colony, do not sound alarm, but in breeding colonies, young 2–3 months old with adults call while circling above intruder in colony (Fordham 1963). Aggressive to other species; observed to harass or attack Silver Gulls and Rock Doves (Feral Pigeons) *Columba livia*, Great Cormorants *Phalacrocorax carbo*, Australian Magpies *Gymnorhina tibicen* and Caspian Terns *Sterna caspia* (Fordham 1963); will attack and kill White-fronted Terns (adults and chicks) in adjacent colonies (J.M. Hawkins). Adults usually chase Silver Gulls away, but first-year birds more tolerant, joining and accompanying flocks of Silver Gulls (Fordham 1963). In Aust., attack, sometimes fatally, newly fledged Pacific Gulls by striking their heads from behind as they fly (Wakefield 1984). In Illawarra region, NSW, not seen to be aggressive to Silver Gulls, and seem submissive toward immature Pacific Gulls when disputing food (C.J. Chafer). Regularly concede food or space to Arctic Jaegers *Stercorarius parasiticus* and giant-petrels *Macronectes* (Fordham 1963). On Marion I., behaviour influenced by more aggressive Great (Subantarctic) Skuas (Williams *et al.* 1984); on Heard I., immature pursued by South Polar Skua *Catharacta maccormicki* swooped and altered direction several times till Skua gave up (Bassett *et al.* 1988).

Sexual behaviour Postures and calls include: **LONG CALL** (Fig. 6): Gives first notes with bill partly open and tilted slightly down; then bends head between legs, with bill almost touching ground; utters high-pitched note, then snaps head up, holding body at about 30° above horizontal and gives series



Figure 6 Long Call

of loud cries, with wings drooping slightly and whole body shaking with each call (Fordham 1963; Oliver 1973). Given in wide variety of situations and by juveniles (see Voice) (Oliver 1973). **MEW CALL** (Fig. 7): Leans forward, feathers sleeked and neck arched and stretched fully; partly open bill pointed c. 45° below horizontal (Oliver 1973). Birds ≥2 years or older, call; never given on water (Fordham 1963); also used to call young (see below). **FACING AWAY** (Fig. 8): One or both members of pair tense bodies slightly, turn heads away from each other and look in opposite directions; bodies may be side by side or facing one another; no call given. Birds may then



Figure 7 Mew Call

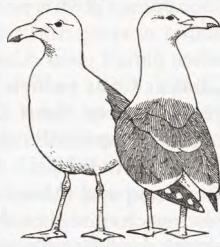


Figure 8 Facing Away

preen, Mew, or Head-toss. Probably only occurs in birds of breeding age (Fordham 1963). **CLUBS:** Unmated adults at colony, along with a few immatures, gather at particular resting place; numbers present in Club increase before start of breeding and is where pair-formation most often seen; Club often present all day (Fordham 1964b). At Nelson Boulder Bank colony, several groups of subadults also present in Club (J.M. Hawkins). Complete sequences of behaviour associated with new pair-bonds and copulation may be seen when members of pair first start to associate; shortened displays more common as season progresses (Fordham 1964a). **Pair-formation, Courtship** When members of new pair fly and land together, or one member lands beside other, they may immediately break into Long Call and assume Upright Posture, quickly followed by Facing Away; both birds then face same direction and Mew while walking together; male appears to walk directly to particular spot, which becomes site of vigorous, sometimes prolonged, Choking; there may be slight pause before female begins Head-tossing, which becomes more intense if male also Head-tosses; activity culminates in copulation (series leading to copulation being: Long Call, Upright, Facing Away, Mew Call, Choking, Head-tossing, copulation). If male does not respond with Head-tossing or if he begins and then stops, female usually fed by male (Fordham 1964a). Occasionally during pair-formation ceremonies, male may attack and peck head, neck, wing, or tip of tail of female; occurs after female Food-begs or Mews (Fordham 1963). Pair-forming displays rarely evoke interest from neighbours (Fordham 1964a). **Courtship feeding FOOD-BEGGING (= Head-tossing) (Fig. 9):** When begging for food, female moves to male, tossing head upwards

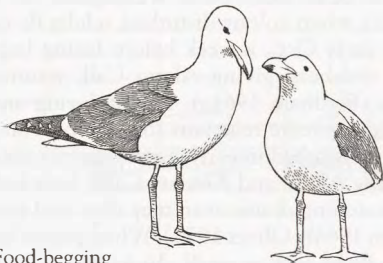


Figure 9 Food-begging

and giving Food-begging Call; male responds similarly. Solicitations by female vary in intensity: between flicks of head may peck frantically at bill, chest and feet of male or at ground; Head-tossing can vary from hitting male under chin with head, throwing head and bill vertically, to small upward movements of bill from horizontal; generally Head-tossing by male is of last type mentioned. Male responds to insistent advances by walking to and fro as if to avoid female, and by sinuous sideways movements of head; his neck swells and he regurgitates food, which female eats, often reaching into his bill to take it. Occasionally, pair shares food, and sometimes male

regurgitates food without prompting from female, in which case she walks slowly to food and eats it slowly. Once, female regurgitated food and male consumed it but she was probably disgorging indigestible food fragments (Fordham 1963). When producing eggs, females receive much food by courtship feeding (Maxson & Bernstein 1984). **Greeting Facing Away** often occurs when one member of breeding pair lands beside mate. Other postures include: Mew Call usually given when walking towards nest or mate; Hunch sometimes seen when female approaches mate; Choking given when relieving at nest (Fordham 1963). Nest-relief varies from voluntary departure by sitting bird to forcible ejection. Usually relieving bird Mews as it approaches nest, then Chokes beside sitting bird; in another common approach, bird carries nesting material and, occasionally, food to sitting bird; both these methods may be unsuccessful at first, but after two or three attempts, sitting bird may stand, step from nest, and either preen or walk away. Sometimes no displays given by relieving or brooding birds. Sometimes sitting bird forced to move: relieving bird, which has usually been Choking vigorously, steps on side of nest, gradually edges feet under chest of mate and pushes it out of nest; Choking changes to 'muffled' Choking during change-over (Fordham 1964b). Partly formed nests beside some nests thought to be made from material brought by non-sitting bird during nest-relief, and then moulded into nest as displacement activity if incubating bird refuses to leave (Fordham 1964a). **Copulation (Fig. 10)** Rarely seen (J.M. Hawkins). Food-begging Call said to be important pre-copulatory behaviour of both sexes (Oliver 1973). Copulation also usually preceded by Head-tossing. Giving Copulation Call, male mounts female and begins to flap wings slowly and moves backward from shoulders of female. Just before copulation, male wags tail from side to side, and then thrusts it to side under tail of female, fanning

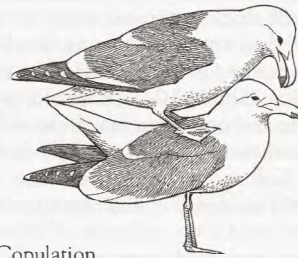


Figure 10 Copulation

it as he does so. During copulation, female may flick head upward, peck gently at chest and bill of male (Fordham 1963), and may give Food-begging Calls. Male remains mounted c. 1.5 min during which time copulation occurs average of five times; 10–50 s may elapse between mounting and first copulation. After copulation, birds usually preen; also seen to: Face Away, Food-beg, or look at feet; once, male crouched and began to Choke vigorously, wagging tail from side to side, then stood, gazed at his feet, and wagged tail again (Fordham 1963). First copulation (unsuccessful) seen late Sept. (Fordham 1964a); copulatory activity finished c. 4 weeks before small chicks present, though females with small chicks occasionally seen begging food from male (Fordham 1963); in Antarctica, courtship feeding not seen once clutch complete (Maxson & Bernstein 1984).

Relations within family group When choosing nest-site, male collects material in bill, Mews as he carries it to female, and together they move to place where material strewn round with vigorous Choking. When building nest, male approaches nest-site with material in bill and Mews loudly; at

site, puts material down and Chokes; if mate nearby, may join him and begin Choking. For further details of nest-building, see Breeding and Fordham (1964a). Incubating bird spends much time sleeping, preening, sitting still and, on hot days, gasping; may join in infectious calls, such as Long Calls or Alarm Calls, and may occasionally Choke (Fordham 1964b). When ready to brood, adult normally stands or sits in nest and gives Mewing Calls (Fordham 1963; Oliver 1973); parents relieve each other during brooding in same manner as during incubation (Fordham 1964b); for further details of brooding, see Breeding. Young fed by regurgitation. Chicks Food-beg soon after hatching but parents appear to ignore chick for at least first day and if food offered on Day 1 may not be accepted because chick too weak. **FOOD-BEGGING:** Chick begs by moving head and neck vertically, pecking at bill of parent, and giving piping calls. (Calling by young may trigger Long Calling in neighbouring adults.) Parent responds by walking about and, at intervals, regurgitating in slow and controlled manner; usually parent gives Mew Call before offering food. Food held loosely in bill while chicks peck at it. Generally give well-fragmented food to very small chicks; if item too large, chick may tug at it, possibly attempting to break it up, and may leave it. Older chicks may pursue running parent for several metres before parent will regurgitate. In early stages, chicks ignore food that drops to ground, but later parent draws attention of chicks to it; after 5–6 weeks, chicks eat most food from ground (Fordham 1964b). When aged 1–2 months old, young defend food with loud call (Fordham 1963). Chick may miss a feed if out of sight of parent while rest of brood fed. Some feeding of young almost certainly occurs on moonlit nights, though not on very dark nights (Fordham 1963, 1964b). Generally no dispute between chicks over food (Fordham 1964b); Williams *et al.* (1984) noted parental preference for feeding strongest (often oldest) begging chick. One case of aggression within brood, where two small chicks attacked newly hatched third chick (Fordham 1963). Fighting and sparring develops as soon as chicks come into contact with chicks of another brood (Fordham 1963, 1964b). Chicks 10–12 days old, and possibly younger, appear able to recognize parents; do so at least partly by call. Adults more commonly give Mew Call when chicks in sight whereas Short Call more usual when they are out of sight. **SHORT CALL POSTURE** (Fig. 11): Call with neck extended in slight downward arc and some inflation of breast; posture sometimes exaggerated, with neck stretched out, bill pointing vertically down and bobbing head with each call (Oliver 1973). **Anti-predator responses of young** Basic response is to leave nest and hide, crouching motionless (e.g. Stead 1932;



Figure 11 Short Call Posture

Murphy); said to do this within 24 h of hatching or as soon as down dry (Stead 1932). Responses to threats develop gradually (Fordham 1964b): chicks up to 3 days old may squeal at person but then gape in feeding response if given appropriate stimulus; when a few days old, run and hide, except chicks in nests on edge of cliffs, who usually employ displacement activities such as preening, stretching, and looking at their feet; at 3 weeks old, chick may squeal at and defy attacking adult

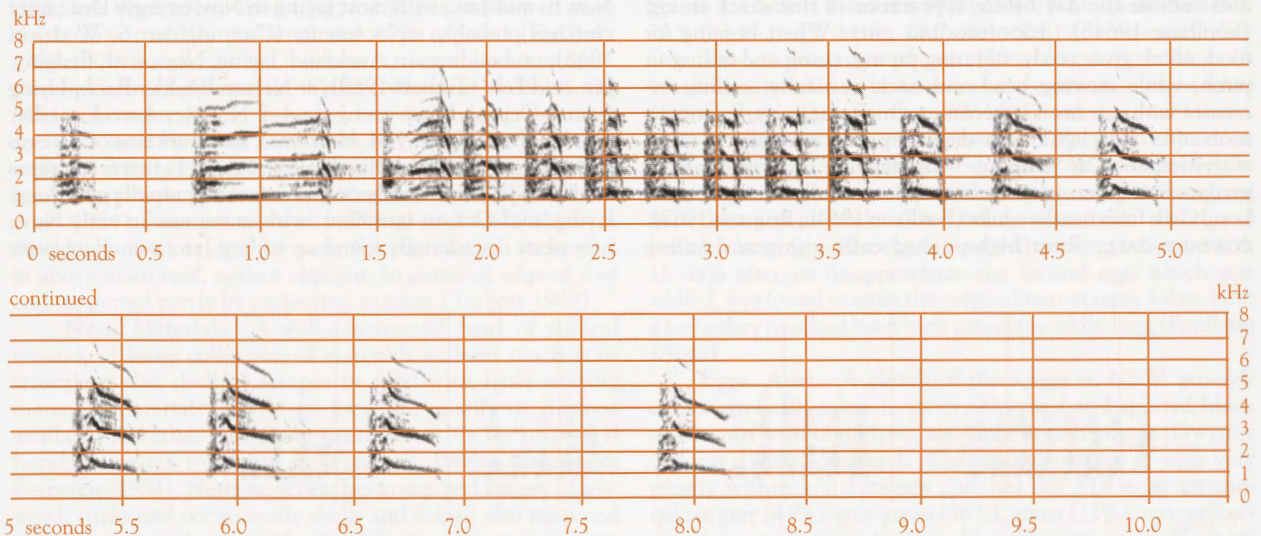
(Fordham 1964b); juveniles also occasionally attack strange adults straying into natal territory (Oliver 1973). Also: hide when parent gives Alarm Call, then emerge later, often giving Chatter Calls (which indicate fear or distress) when parent gives Mew or Short Calls; take to water, usually bunching together, especially when attacked by older Gulls (Fordham 1964b; Oliver 1973); sometimes give Alarm Calls, to which adults respond (Murphy). When hiding, often return to same place each time even though little protected, e.g. chick pushed empty shell round nest while trying to clamber into it; when hiding may curb other activities, such as gasping on hot days. May be attacked by neighbouring Gulls when moving to and from hiding place (Fordham 1964b); in particular, older chicks may panic and stray over neighbouring territories to hide (Oliver 1973); in these cases, try to run from attacking neighbours (Fordham 1966). Occasionally chicks regurgitate when handled (Oliver 1973). **Parental anti-predator strategies** Defence measures used by parents when disturbed or alarmed include: giving Alarm or Anxiety Calls; if danger close to nest, diving and giving Charge Call, sometimes striking predator with bill, feet, or wing at climax of call (occasionally Grass-pull before attack); performing Upright Posture towards intruding small birds and sheep; taking flight, circling overhead, while giving Alarm or Anxiety Calls, which may stimulate all birds in colony to fly; attacking as part of a group of adults, e.g. in response to Swamp Harrier *Circus approximans*. Defecation or disgorging by some birds flying over intruders, possibly performed intentionally (Fordham 1963), though said not to defecate or disgorge when disturbed (Oliver 1973). Diving attacks usually performed alone, though some birds never dive (Fordham 1964a). Form of response often varies individually (Oliver 1973). During breeding season, intolerance toward all other animals increases markedly, so that sheep and even small birds such as House Sparrows, finches, and Common Starlings driven from near nest. Intruding Swamp Harriers mobbed or chased (Fordham 1963; Stead 1932); one parent observed locked with Harrier, birds separating as they fell to ground (Stead 1932); on Rangitoto I., nesting birds said not to react strongly to Harriers (Oliver 1973). Adults seen swooping at flying jaegers *Stercorarius*; once, jaeger near young was mobbed, knocked from air and pecked on ground (Murphy). When chicks wander, parents try to protect them from other Gulls (see Agonistic behaviour). Near Wellington, till late Sept. (before laying), when colony disturbed, adults fly out and sit on water; by early Oct., a week before laying begins, some adults circle overhead giving Alarm Call, returning a few minutes later (Fordham 1964a). During laying and incubation; birds become more reluctant to leave nest and increase defence: when disturbed in early stages, parents usually circle overhead giving Alarm and Anxiety Calls; later hover above intruder; as hatching draws near, may dive and give Charge Call (Fordham 1964b; Oliver 1973). When parent leaves nest, it sometimes flicks eggs or small chicks out of nest. One or both parents nearly always stay near chicks till young able to fly. At this stage, Fordham (1964b) found diving attacks more common, occurring with greatest frequency before chicks fledged; parents emitted Long Calls as they attacked, and hit with their wings and pecked; after warding off attack, parents shepherded chicks to safety. In contrast, on S. Georgia, adults said to respond to people by circling overhead and calling, but made no attempt to protect offspring actively (Murphy). In Antarctica, during laying and incubation, both sexes spend much time (up to 86%) within 5 m of nest during laying and incubation; proportion of time near nest drops steadily through

chick-rearing to low of 13% as chicks near fledging (Maxson & Bernstein 1984).

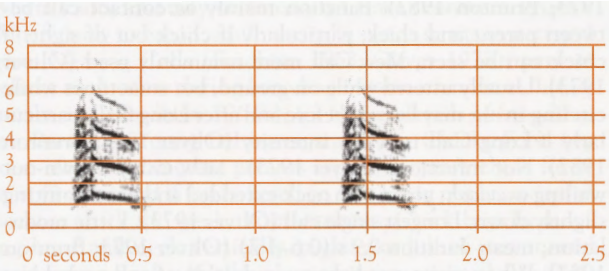
VOICE Well known from studies of Fordham (1963, 1964b), Oliver (1973) and Brunton (1982) (the last two with sonagrams); account based on Fordham (1963) unless stated. Have wide range of calls, some made only when breeding. When birds return to roost at dusk, commonly give Long Calls and occasional Alarm Calls; birds eventually silent, with intermittent Long Calls; at night in breeding season, Choke Calls or Long Calls given throughout night, especially on moonlit nights. In morning, give Long Calls and, in breeding season, Choke Calls soon after first light, with volume of sound increasing till all birds active 30–45 min after first light. Copulation Call given only by male; all other calls by both sexes. Individual differences in calls apparent. Variation in Long, Mew, Alarm and Anxiety Calls greater between individuals than variation in calls of an individual (Oliver 1973). Calls of individual may differ with intensity of stimulus. Chicks appear to develop ability to distinguish calls of individual adults before hatching: eggs were collected, placed in incubators and exposed to 15 min of recorded calls (equally divided between Mew Calls, Short Calls and Alarm Calls of individual adults) 8–10 times per day for 4 days before hatching; at 1–3 days old, chicks responded significantly more often to Short Calls of 'parent' (Brunton 1982) but sample small (two experimental chicks and one control). No regional variations reported; 'cry' said to be the same on Iles Kerguelen, at Wellington and at Cape Town (Falla 1937).

Adult LONG CALL: Call starts with soft notes, given with bill tilted slightly down; head then bent beneath chest, so that bill almost touches ground, and give high-pitched note before snapping head up and giving long series of loud cries, with wings drooping slightly and whole body shaking at each cry: *uh, uh, ee-ah-ha-ha-ha-ha-ha-ha-ha* (sonagram A); mean number of notes, 14 (5–42). Most common call in flocks. Infectious and heard throughout year; bouts of Long Calling repeatedly sweep through breeding colonies. Used as territorial challenge. Commonly used against Gulls that intrude on territory, no matter how young; often given by bird on ground when another Gull arrives nearby: when mate arrives in territory; when neighbour arrives in its territory; or when another Gull

flies low over territory. Often given during territorial disputes and fights, which may be broken off while participants call; also given after fights end (Oliver 1973; Brunton 1982). **SHORT CALL:** Similar to Alarm Call (see below), though generally shorter and harsher; mean duration 0.26 s (0.17–0.42) (Oliver 1973; Brunton 1982). Function mainly as contact call between parent and chick, particularly if chick out of sight; if chick can be seen, Mew Call more commonly used (Oliver 1973). Usually uttered while on ground, but sometimes while circling in air; may be used before and after Long Call, particularly if Long Call is of low intensity (Oliver 1973; Brunton 1982). Not infectious (Oliver 1973). **MEW CALL:** Drawn-out wailing *waaaaah*, given with neck extended and head pointing slightly down. Longest single call (Oliver 1973). Little modulation; mean duration 0.9 s (0.6–1.2) (Oliver 1973; Brunton 1982). When given on alighting, pulsation of call probably a result of vigorous movements of wings (Oliver 1973). Usually given by bird walking slowly towards nest or mate; not heard from birds on water. Used in courtship; in change-over when incubating or brooding; to call chicks to food or shelter (Fordham 1963); to call chicks from hiding (Fordham 1964b); and when carrying nesting material, whether in flight or on foot (Oliver 1973). Not infectious (Brunton 1982). **CHOKE CALL:** Rhythmical *wo-wo-wo-wo-wo*, each syllable c. 0.25 s long, uttered while leaning forward, with chest and floor of mouth lowered so that throat seems swollen, head and chest moving rapidly and rhythmically up and down in time with rise and fall in pitch of call. Mainly given when building nests and at change-over when incubating or brooding; change-over may occur without calls, but if physical force used, usually preceded by vigorous Choking by relieving bird, with calls becoming muffled during change-over (Fordham 1964b). Oliver (1973) suggested function is to reaffirm pair-bond. Also used as low to medium intensity threat (Fordham 1963). Somewhat infectious. **FOOD-BEGGING CALL:** Soft fluty *kle-oo, kle-oo*, given while tossing head up. Given by female when begging for food from male, which responds with similar Head-tossing and calls. Also given before copulation. Not infectious. **COPULATION CALL:** Rapidly repeated *cor-cor-cor*, becoming louder and harsher *car-car-car* as copulation proceeds. Given only by male. Not infectious. **ALARM CALL:** Loud repeated staccato *kwe-ah, kwe-ah*; calls usually trisyllabic (Brunton 1982), though disyllabic



calls shown in Sonagram B. Mean duration 0.37s (Brunton 1982). Given on ground and in flight. Infectious, causing all birds to stretch necks, look about, and take to air uttering Alarm Call. Common throughout year; at feeding sites and at colonies; if given by lone Gull as person approaches colony,



B H. Pollock; Wellington, NZ, Apr. 1966; P36

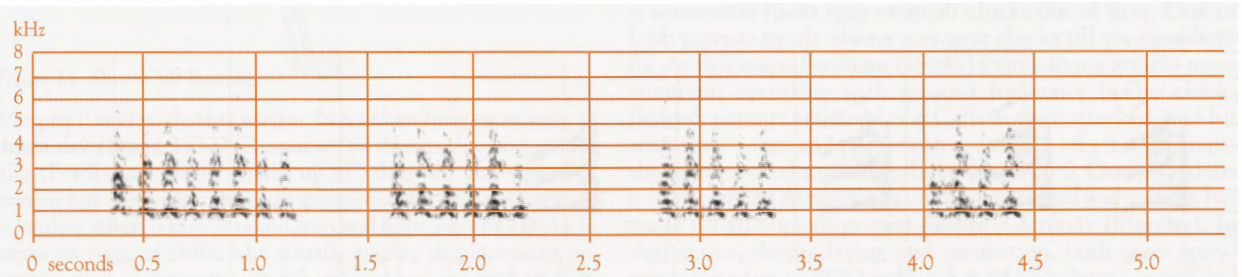
often serves as mobbing call, and given by mobbing birds (Oliver 1973). Uttered rapidly by lone bird harassing Swamp Harrier (Oliver 1973). Also used to make young hide (Fordham 1964b). **ANXIETY CALL:** Chattering *ha-ha-haha* (sonagram C), varying in loudness and sometimes very quiet. Almost never heard away from breeding colonies. Given when alarmed to low intensity threats (at higher intensity, give Alarm Calls). Probably expresses conflict between fear and attachment to nest-site (Oliver 1973). Mostly given by breeding birds, in flight and on ground, near nest-site (Fordham 1963; Brunton 1982). Slightly infectious. **MOAN:** Muffled moan, given by some birds when flock disturbed, sweeping rapidly through flock, and accompanied by rustling sounds, as heads of sleeping birds withdrawn from beneath scapulars and wings shaken. Then give Alarm Call and birds fly off. **CHARGE CALL:** Sudden piercing scream *oo-waaaaaah!* Call pulsed in some individuals, not in others (Oliver 1973). Given only in flight and only during breeding season, when diving at predator near nest. Not infectious. **CALL NOTE:** Hoarse *gor-ah! gor-ah!*; duration c. 0.5 s (Oliver 1973). Not common; given in direct flight (Oliver 1973; Brunton 1982).

Young BEFORE HATCHING: Clicks, peeps, and Contact Calls heard in 48 h before hatching; calling often unprompted, but chicks may call in response to outside stimulus, such as movement of egg (Brunton 1982). Faint tapping and peeping also audible the day before appearance of first crack in egg (Fordham 1964b). **FOOD-BEGGING CALL:** When begging for food, chick gives reedy vibrating piping, rising and falling in pitch, while moving head and neck vertically; calling increases with age until it becomes a major activity, beginning soon after first light each day; may also accompany other activities, such as jumping, wing-flapping and retreat from predators; if given when colony quiet, usually causes bout of Long Calls from nearby adults (Fordham 1964b; Brunton 1982). **CONTACT CALL:** Short high-pitched calls, rising and falling

sharply in frequency; given intermittently at nest-site (Brunton 1982). **SLEEPING CALL:** Similar to Contact Call; given when settling to sleep and when asleep (Brunton 1982). **DISTRESS CALLS:** Loud penetrating chatter, most often used when frightened and out of sight, but within hearing, of parent; often given in response to Short Call of parent, less commonly in response to Mew Call. Give harsh and extended chatter when highly excited or very distressed, which may elicit Alarm Calls from parent (Oliver 1973; Brunton 1982). Chicks ≤ 3 days old squeal if human intruder present; at 3 weeks old, squeal at attacking adults (Fordham 1964b). Individual differences in this call develop over first week or so (adults do not recognize own chicks till they are c. 10 days old) (Oliver 1973). **DEVELOPMENT OF ADULT CALLS:** Juveniles 1–2 months old defend food with tremulous scream, a juvenile form of Long Call. Most do not develop Long Call till late in first year; up till then, call squeaky and incomplete, though one bird 5 months old gave almost complete call. Mew and Choke Calls given by birds ≥ 2 years old. Alarm Call does not develop till second year. When with adults giving Alarm Calls while circling above intruder in colony, juveniles 2–3 months old give hoarse squeaky cries, but do not initiate calling; juveniles do not give Alarm Calls at all away from colony or roost. First- and second-year birds visit breeding colonies in small numbers and, at a disturbance, circle in air with breeding birds but stay silent while breeding birds give Alarm Calls (Fordham 1964b). At end of second or third year, many birds perform calls (and displays) associated with pair-formation, but performance brief and incomplete.

BREEDING Well known, studied on Somes I., NZ, by Fordham (1964a,b) and on Marion I. by Williams *et al.* (1984); five records in Aust. NRS up to Mar. 1993. In pairs or loose colonies, occasionally with Pacific Gulls (Aust. NRS); often alongside Caspian and White-fronted Terns in NZ (J.M. Hawkins).

Season Aust. NSW, SA Eggs, early Nov. and mid- to late Dec.; also second clutch in early Jan. (Gwynne & Gray 1959; Vincent 1988; Aust. NRS). **Tas.** Eggs, late Aug. and mid-Nov.; eggs or young, mid-Dec.; young, mid-Nov. to late Jan. (Wolfe 1969; Aust. Atlas; Aust. NRS). **NZ** Palliser Spit: laying from early Jan. (Fordham 1964a); Porangahau, NI: early Nov. to mid-Jan., with most laying in Nov. or early Dec.; later clutches probably replacements (Cunningham & Wodzicki 1948); on buildings in Auckland: laying, Nov., with fledging, Jan. and Feb. (Turbott 1969); at Nelson Boulder Bank, laying from 7 Oct. and first young on 4–7 Nov. (c. 4 weeks earlier than Farewell Spit) (J.M. Hawkins); in mountains of SI: eggs and young, early Jan. (Oliver 1953); Somes I.: first few scrapes made late July, and numbers start to increase rapidly mid-Aug.; laying, mid-Oct. to late Nov., with maximum in early Nov.; new nests occasionally found up to late Jan.; some late nests



C T. Howard; Macquarie I., Dec. 1991; priv. M18/9

probably replacements (Fordham 1964a). **Chatham Is** On South East I., clutches, late Oct. to Nov. (Nilsson *et al.* 1994). **Macquarie I.** Laying, early Nov. to at least early Dec.; first young, late Dec. (Falla 1937). **Heard I.** First young, early Dec. (Falla 1937). **Campbell I.** First eggs, mid-Nov.; first young, late Dec.; first young fledge, early Feb. (Bailey & Sorensen 1962). **Iles Kerguelen** Laying begins mid-Nov.; eggs, early Dec.; most young flying by early Feb. (Sharpe 1879; Falla 1937). **Iles Crozet** Laying, mid-Nov. to mid-Dec.; hatching, up to mid-Jan.; fledging, early Feb. to early Mar. (Despin *et al.* 1972; Derenne *et al.* 1976). **Marion I.** Laying, Nov. (Rand 1954); early to late Dec.; hatching, late Dec. to late Jan.; fledging, mid-Feb. to early Mar. (Williams *et al.* 1984); fledge, early Mar. (Crawford 1952). **S. Orkney Is** Laying from mid-Nov. to at least mid-Dec. (Murphy); late Oct. to late Nov.; hatching, early to late Dec.; mean fledging date, 23 Jan. (Rootes 1988). **S. Georgia** Laying, early Nov. to early Dec. (Matthews 1929); fledging from mid-Jan. (Murphy). **S. Shetland Is** Laying from early Nov.; well-grown young from mid-Dec. (Murphy); arrive 13 Sept.; hatching from 11 to 24 Dec. (Jablonski 1986). **Antarctica** Build nests, Sept.–Mar.; laying, mid- to late Nov., occasionally to mid-Dec.; small young and hatching eggs, mid-Dec. (Parmelee *et al.* 1977; Maxson & Bernstein 1984; Parmelee 1992).

Site On beaches just above high-water mark, on rising ground, mounds of sand, tops of rocks, low headlands, offshore islets, glacial moraines, artificial islands, grassy slopes, ledges in rock; on exposed sand dunes; among vegetation or in bare places, close to logs or bushes on beaches (to shelter from wind-blown sand), beside or under rocks (Sharpe 1879; Stidolph 1926; Wilkinson 1927; Matthews 1929; Cunningham & Wodzicki 1948; Crawford 1952; Rand 1954; Gwynne & Gray 1959; Vincent 1988; Parmelee 1992; Murphy; J.M. Hawkins); also, shingle river beds in NZ (Parrish 1988); on rocky slopes and tussocks in mountain ranges up to 1520 m asl on SI, NZ (Oliver 1953). On *Somes I.*, site of 278 nests: 19% among or under rushes, 15% on bare rock or soil with little or no shelter, 14% among herbaceous plants (e.g. Horehound), 11% in cropped pasture, 10% on pebbly or rocky beach with little or no shelter, 7% by or under flax, remaining 25% sheltered under or among *Olearia* trees, various types of vegetation, in concrete gun emplacement, or exposed in open areas, such as cliffs, low vegetation, on old log; for 95 nests: 8% well sheltered, 25% partially sheltered and 67% exposed (Fordham 1964a). On South East I., Chatham Is, nest at sites not occupied by Great (Subantarctic) Skuas (Nilsson *et al.* 1994). On Marion I.: nests widely dispersed but small groups occur in areas not used by skuas; most nests on coastal headlands but some on areas where glaciation had removed soil and so few burrowing petrels to attract skuas (Siegfried *et al.* 1978; Williams *et al.* 1984). Nest on roofs of buildings and wharf sheds in Auckland, on roof ridge, flat roofs, flat roof of small shelter 2.1 m above main roof, against skylight, in gutter at edge of roof and supported partly by projecting window (Turbott 1969).

Nest, Materials A well-constructed bowl or conical mound, or loose collection of materials without much construction, also shallow scrapes in sand with little nesting material. Materials depend on location; usually use nearest available material; if nothing nearby, may fly up to several hundred metres to obtain it (Fordham 1964a; Maxson & Bernstein 1984). Nests near beaches composed largely of seaweed, sticks and occasionally shells and debris; also moss and lichen; nests on slopes of islands made of grass, sticks, leaves, fresh shoots and bits of wool, feathers and old bones, some-

times entirely of one material, such as pine needles or moss, far from nearest supply of such material (Cunningham & Wodzicki 1948; Gwynne & Gray 1959; Fordham 1964a; Maxson & Bernstein 1984; Parmelee 1992; Murphy); on Ashburton R., nests on sandbanks often no more than unlined bowl scooped in sand; nests on mud, stones, grass or riverbed vegetation vary from small flat constructions, with shallow depression, to mounds up to 47 cm high, made of small sticks, grasses, grass roots and some binding mud, and lined with lambs tails (CSN 19); on mountain ranges, nests made of sticks, leaves, tufts of grass, lichen and moss, which is green on some soggy nests (Oliver 1953); on roofs, made of grass, bits of paper and other material (Turbott 1969). Nests may contain objects, such as stones, clods of earth, sheep dung and round shells; garden snails sometimes found in nests on *Somes I.* after wet weather (Fordham 1964a). May pull out whole grass plants. Occasionally steal material from neighbouring nest when owner away (Fordham 1964a).

Both sexes build, though males do more than females (Maxson & Bernstein 1984; Parmelee 1992; cf. Fordham 1964a). Excavate new nests and re-excavate old nests (Fordham 1964a); rake out level sites on grassy slopes (Crawford 1952). On *Somes I.*, build nests in three stages: initial active stage, when most of nest is formed, followed by a pause, then a final burst of activity when nest takes shape and first egg laid. Build mostly in late afternoon but sometimes in morning and even at night, especially during full moon. In early stages of building, male collects beakfuls of material and carries them to female, dropping material round site; gradually, over a period of days or weeks, most material dropped at final nest-site. When male arrives at nest with material, he steps onto nest, squats and pats feet against sides of bowl, which compresses material to form sides of nest, and tends to work material upwards, depending on how high male raises his feet. Does not turn in nest while patting. Sometimes material is placed on edge of nest after male has stepped into bowl, where it helps build earlier material into nest; male may work other material into nest with bill. Damaged nests may be strengthened by adding new material (Fordham 1964a). Sometimes two nests built but only one used (J.M. Hawkins). **MEASUREMENTS (cm):** **Aust.** For one nest in NSW, diameter at base, 55.8; height, 12.7; inside diameter, 25.4; depth, 7.6 (Gwynne & Gray 1959). **Somes I.** Outside diameter, 44.5 (25.4–76.2); inside diameter, 22.9 (17.8–26.7); depth, 12.7 (6.4–17.8) (Fordham 1964a). One nest-scraper contained over 470 g of fresh grass. Nests in beach areas tended to be larger; average diameter on beaches 48.3, on slopes 41.9 (Fordham 1964a). Divided or double nests occasionally found, comprising two nests placed side by side as though part of one another. Secondary nests occasionally built. Eggs that roll out of nests usually ignored but if original nest damaged or broken, secondary nests built round and beneath lone eggs; first egg of nest with two eggs disappeared; 18 days after its disappearance the second egg, which was added, was found outside the original nest-scraper; 4 days later a secondary nest had been built round the added egg (Fordham 1964a).

Eggs Aust. A clutch of three eggs in NSW: ground-colour, greenish stone to stone, blotched and spotted black and brown with underlying markings of dull purple (Gwynne & Gray 1959). **Somes I.** Colour and pattern of eggs vary greatly within and between clutches; for 818 eggs: ground-colour, grey (44%), grey-green (36%), green (12%), rest: yellow-grey, brown-green, green-blue, blue, blue-grey and off-white; with various sized blotches, spots or streaks of brown (Fordham

1964a); blotches, streaks and vermiculations of light brownish-purple, brownish black, sepia, black or yellowish brown (Wilkinson 1927). Shells smooth (Fordham 1964a). **MEASUREMENTS** (mm): Summarized in Table 1. On Marion I., first-laid eggs longer and heavier than second (Williams *et al.* 1984). **WEIGHT**: Summarized in Table 1. On Somes I., wide variation within clutches and between eggs of different clutches; first egg nearly always heavier than second, which is usually heavier than third. Of 787 eggs from first clutches: first eggs, 84.2 (57–105); second eggs, 79.7 (65–93); third eggs, 72.9 (57–87). Eggs of repeat clutches generally lighter than first clutches. Weight-loss during incubation for two eggs, 38.8% and 35.8%; weight remained fairly steady for first 4 days, then fell gradually till eggs pipped (Fordham 1964a).

Clutch-size NZ Usually three eggs but two not uncommon; ranges from one to five (Stidolph 1926); in one study of over 8000 nests, only two had four eggs (J.M. Hawkins); a clutch of five eggs comprising three dark-fawn eggs and two greyish-green eggs possibly from two females laying in same nest (Vincent 1988). On Somes I., for 310 first clutches: average 2.4: C/1 x 28, C/2 x 133, C/3 x 149; for 14 repeat clutches: average 2.3: C/2 x 10, C/3 x 4 (Fordham 1964a,b). On Marion I.: average clutch-size 1.9: C/1 x 4, C/2 x 16, C/3 x 1 (Williams *et al.* 1984); 1.7 (0.47; 29) (Siegfried *et al.* 1978). In Antarctica: average clutch-size 2.56 (n=32 pairs) (Parmelee 1992). Seasonal variation in clutch-size apparent on Somes I. from Oct. to Nov., with a decrease in three-egg clutches and increase in one- and two-egg clutches. At one nest, removing all eggs as soon as they were laid resulted in nine eggs being laid before nest abandoned; interval between laying varied from 2 to 7 days (Fordham 1964a).

Laying Eggs laid at any time of day (Fordham 1964a). For 135 three-egg clutches: 60% clutches took 6–9 days to be completed; laying interval most often 48 h (33%), sometimes 72 h between first and second (24%) or second and third eggs (28%); for two-egg clutches: interval most often 72 h (49%), sometimes 48 h (24%) (Fordham 1964a). May re-lay after failure, up to twice (Fordham 1964a). Average interval between failure of first clutch and first egg of replacement clutch, 15 days (1–30; 15); interval shorter for loss of eggs than for small chicks. At one nest: nest with one egg collapsed after 19 days; 22 days later, with two new eggs, nest collapsed again; another two eggs were laid (Fordham 1964a).

Incubation Begins with last egg; rarely incubate before clutch complete. Both sexes incubate, in stints ranging from 20 min to 7 h; change-overs may occur at any time of day

(Fordham 1964b). In Antarctica: females incubate more than males; average for observation lasting 3 days, 59% for females and 40% for males; males on nest several hours before midnight, female typically during early morning; longest shift 10.7 h, shorter during middle of day (Maxson & Bernstein 1984). On settling, incubating bird shuffles eggs into place against brood-patch then usually adjusts nest-material with bill; in early stages of incubation, this may be followed by Foot-patting; bird lowers head and pulls eggs towards itself with underside of bill; sitting birds make small trampling movements with feet, which tilt body from side to side and eventually move feet close to eggs; feet usually partly under eggs. As chicks hatch, posture of incubating bird changes: it sits more tightly on nest, wings drooping and held very slightly away from body, and wings and body often lifted to accommodate movements of chicks (Fordham 1964b). **INCUBATION PERIOD**: On Somes I.: from laying of last egg to hatching of last young: 27 days (23–30; 172 clutches); 94% clutches hatched within 23–26 days (Fordham 1964b). On Marion I.: from laying to hatching of second egg: average, 28 days; hatching interval, 2.1 days (Williams *et al.* 1984). On S. Orkney Is: 25 days (Murphy). In Antarctica: 28 days (26–30) from laying to hatching of last egg (Parmelee *et al.* 1977). Two 2-egg clutches incubated for 58 and 69 days respectively before being deserted (Fordham 1964b). Hatching asynchronous; duration of hatching (pipping to emergence) ranges from 1 to 6 days, 94% hatch in 2–4 days, average 3 days; no significant difference between eggs in clutch (Fordham 1964b; Williams *et al.* 1984). Egg-shells removed from nest and dropped a metre or so away soon after hatching (Fordham 1964b).

Young Semi-precocial. Most young unable to stand at hatching; can move about outside nest after 2 or 3 days (Fordham 1964b), though said to be able to leave nest within a few hours of hatching (Williams *et al.* 1984). Primaries and scapulars appear at 9–12 days; feathers on breast from 12 days; and over whole body by 35 days; no down showing by 38–42 days (Williams *et al.* 1984). **Growth** Increase in weight shown in Table 2. On Marion I., weight of chicks at 60 days, 94% of mean adult weight. Growth of tarsus, culmen and wing given in Table 3.

Parental care, Role of sexes Both parents brood, about equally; brooded fairly constantly for 3–4 days, for 90% time at 2 days, 43% at 5 days, then left unbrooded for increasingly long intervals (Fordham 1964b; Maxson & Bernstein 1984). Young 10–12 days or older have to find own shelter in surrounding vegetation; only smallest young sheltered during hot

Table 1. Measurements and weights of eggs.

Location	Length	Breadth	Weight	
Tas.	68.8 (3.92; 62.0–75.5; 19)	47.3 (2.05; 44.5–51.0)		1
Somes I.	69.2 (59.7–82.9; 798)	47.0 (41.0–51.5)	80.1 (57–105; 787)	2
Chatham I.	71.3 (67.0–75.5; 2)	49.5 (47.0–52.0)		3
Marion I.	70.1 (3.0; 65.4–78.7; 38)	47.9 (1.2; 43.4–50.8)	86.3 (6.1; 74–98; 30)	4
	70.9 (66.9–79.6; 11)	48.9 (46.7–51.1)	80 (79–81; 3)	5
Iles Kerguelen	68.8 (64.3–74.4; 6)	49.0 (47.0–50.8)		6
	69.2 (66.5–76.0; 8)	49.4 (48.0–50.0)		7
Iles Crozet	69.3 (64.3–72.2; 5)	49.8 (47.5–52.2)		8
S. Shetland Is	74.7 (2.0; 71.5–78.0; 13)	49.7 (1.6; 48.0–52.5)		9
	71.7 (67.9–74.8; 21)	50.2 (46.2–53.2)	76.2 (70.0–81.0; 21)	10
S. Orkney I.			90 (2.7; 87–94; 8)	9

(1) Aust. NRS; (2) Fordham (1964a); (3) Oliver; (4) Williams *et al.* (1984); (5) Rand (1954); (6) Kidder (1876); (7) Paulin (1953); (8) Despin *et al.* (1972); (9) Gain (1914); (10) Jablonski (1986).

Table 2. Weight of chicks (g).

Days	S. Shetland Is ¹	Marion I. ²	Somes I. ³
1	53.1 (49–59; 19)	60.8 (4.3; 53–69; 21)	–
5	99.0 (72–120; 10)	–	–
7	–	–	125 (75–160; 7)
10	146.0 (130–170; 10)	250	–
14	–	–	281 (185–365; 7)
15	248.0 (210–270; 10)	–	–
20	413.0 (350–460; 10)	515	–
21	–	–	422 (305–510; 5)
25	571.0 (490–630; 8)	–	–
28	–	–	537 (495–620; 3)
30	972.0 (780–1100; 7)	690	–
35	912.0 (750–1100; 5)	–	–
40	–	795	–
50	–	825	–
60	–	840	–

(1) Jablonski (1986); (2) From growth-curve in Williams *et al.* (1984);
(3) From growth-curve in Fordham (1964b).

Table 3. Length (mm) of tarsus, culmen and wing (from growth-curves in Williams *et al.* 1984).

Days	10	20	30	40	60
TARSUS	40	55.5	63.5	66	–
CULMEN	27	33	38	43	–
WING	–	96	78	253	330

or wet weather or at night. Young do not form crèches. At least one parent nearly always near young until young can fly (Fordham 1964b). Both adults feed young. Fed by regurgitation; adult holds food in bill near gonys while young peck at it; red spot on gonys guides chick; after 5 or 6 weeks, young eat most food from ground. At 1 or 2 weeks, young fed on average once per hour; at 3 weeks, *c.* every 2 h. Adults defend nest against intruding animals, potential predators and other gulls (Fordham 1964a). Chicks fed until 12 weeks old (Wilkinson & Wilkinson 1952). Young <100 days old observed attempting to take molluscs. In NSW, adults not seen to feed young via regurgitation after Apr.; bonding tolerance between young and parents not seen after July (C.J. Chafer).

Fledging to maturity FLEDGING PERIOD: On Marion I.: average age of first flight, 61 days (46–73; 4); in Antarctica, average fledging period for 19 young, 45 days (Parmelee *et al.* 1977). Adults continue to feed young after fledging (Maxson & Bernstein 1984). Age of first breeding not known but probably not until third year or older (Fordham 1964b); reach maturity in three seasons (Matthews 1929).

Success On Somes I.: for 741 eggs: 490 (66%) hatched; maximum of 393 (53%) fledged; equivalent of 1.3 young fledged per pair. Of 251 eggs that failed, 127 (50.6%) addled or embryo died, 54 (21.5%) destroyed or eaten by gulls, 47 (18.7%) disappeared, 23 (8.2%) died at hatching, lost when nest collapsed or destroyed, or died when nest abandoned. At least 97 young died: 29 (30%) dead in nest, 25 (26%) disappeared at hatching or on next day, 23 (24%) uninjured outside nest, 12 (12%) killed by adult Gulls, 8 (8%) fell out of nest, died of exposure or were accidentally killed by observer (Fordham 1964b). Loss of eggs greater in areas of higher nest-density (Fordham 1964b). On S. Shetland Is: from 28 nests, 64 eggs survived to hatching (2.25/nest), 19 young survived to *c.* 7.5–8.5 weeks (0.68/nest) (Jablonski 1986). On Marion I.: from 30

eggs laid, 26 hatched, seven (possibly only four) fledged; for 26 young, 12 died within 10 days of hatching, two at 11–20 days, one at 37 days and three after 48 days; starvation main cause of death in chicks up to 40 days old (Williams *et al.* 1984); mortality of eggs, 19% (Siegfried *et al.* 1978). In Antarctica: four young fledged from nine nests; of 19 pairs that laid eggs, nine pairs fledged 11 chicks, equalling 0.6 young per laying pair and 1.2 young per successful pair; reproductive rate possibly affected by availability of food: success-rate 1.8–1.9 fledged young per pair when food abundant, 0.4–0.6 when food not abundant (Maxson & Bernstein 1984). Exposed nests on slopes and at high-tide mark destroyed by storms and spring tides; unstable nests collapse, may be blown to pieces by gales; eggs eaten by parents or predators, broken by people; wandering chicks attacked by adults and many killed, and sometimes eaten (Fordham 1964a). South Polar Skuas are major cause of loss of eggs in Antarctica (Maxson & Bernstein 1984). On S. Shetland Is, Pale-faced Sheathbills *Chionis alba* take eggs and chicks (Jablonski 1986).

PLUMAGES Prepared by D.J. James. Typical large gull, maturing gradually over about 4 years with (usually) eight recognizable plumages (including downy young) and eight moults before attaining adult plumage. Moults three times in first year and twice a year thereafter. Begin pre-juvenile moult shortly after hatching and fledge in mid-summer, when about 2 months old. Undergo partial post-juvenile moult to first non-breeding plumage, followed immediately by partial pre-breeding moult to first breeding plumage. Thereafter, undergo complete post-breeding and partial pre-breeding moults annually, usually attaining adult plumage with fourth non-breeding plumage. Plumages and bare parts change much with each moult in young immatures, but changes abate with age, and seasonal variation in adults mostly confined to brightness of bare parts. Adults undertake post-breeding (pre-basic) moults in late summer and autumn, and pre-breeding (pre-alternate) moults in early spring. Moults of immatures (and failed breeders) are earlier than homologous adult ones, but occur slightly later each year until breeding. Most first breed in adult plumage, but a few breed in third year. Sexes similar but males slightly larger. Two subspecies, one extralimital. Nominat *dominicanus* occurs HANZAB region, described below.

Following descriptions of plumages not absolute because individuals progress through plumages at different rates (some mature in 3.5 years, some in 5), 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, MV, NMNZ), field observations (D.J. James), photos (Harrison 1987; Pringle 1987; James 1995; unpubl.: M.J. Carter; D.J. James; W. & M. Wakefield) and study of Kinsky (1963).

Adult (Fourth and subsequent basic [winter] and alternate [summer]). In non-breeding plumage, all feathers equally fresh; in breeding plumage, wings and tail (retained from non-breeding) varying worn, with fresher head and body; bare parts differ slightly. **Head and neck** Nearly always pure white. Some in fourth non-breeding retain traces of grey-brown (28) speckling on head. A few appear to develop a little dusky streaking in non-breeding plumage, which is correlated with duller than usual bare parts. **Upperparts** Mantle, back and scapulars, dull black (between 82 and 89) when fresh, with

slight brown tinge when worn. Anterior four scapulars have long white tips (15–20 mm) forming conspicuous scapular crescent. Rump and uppertail-coverts, white. **Underparts, Tail** White. **Upperwing** Black, with white trailing- and leading-edges and small mirrors at tip. Marginal coverts and some leading lesser secondary coverts, white; form conspicuous white leading-edge about half width of trailing-edge. Rest of coverts, dull black like scapulars. Secondaries appear dull black, with broad white trailing-edge; feathers, grey-black (82) with white tip 30–35 mm long; inner webs have concealed white bases. Primaries, black (89) with slight brownish tinge that increases with wear; a broad white trailing-edge to inner primaries that narrows to small apical spots on outer primaries; and white mirrors on one to two outer primaries. P1–p4, grey-black (82) with long white tips (like secondaries) that extend slightly farther down edge of inner web. P5, grey-black (82) with black subterminal band (wider on outer web), a white apical spot and a white crescent-shaped tongue on inner web basal to black subterminal band (not normally visible). P6 similar but with slightly broader black band and fainter tongue, washed grey. P7, black (89) with shadowy grey (c84–85) tongue across inner web c. 45 mm from tip. Pattern and strength of tongues on p5–p7 vary individually. P8–p10, black (89) with white apical spots; p10 invariably has white mirror across both webs, 50–60 mm long, which usually separated from apical spot by black band c. 10 mm wide, or rarely joins apical spot to form long white tip; about 35% have mirror on p9, which is smaller than on p10 and may be broken into separate spots on each web or on only one web or one wing; apical spots decrease outwards: p4 15–19 mm; p6 10–15 mm; p8 7–11 mm; p9 6–9 mm; p10 2–5 mm. In breeding plumage, apical spots often worn off p9–p10 and reduced or sometimes lost on p8. Tertiaries, grey-black (82) with long white tips (15–20 mm) forming conspicuous tertial crescent, cloaking folded primaries. Kinsky (1963) classified pattern of primaries in five categories: Type 1, tongues on p5–p7; Type 2, tongues on p5–p6; Type 3, tongue on p5; with subtypes: (A) mirrors on p9–p10; and (B) mirror on p10. Type 3 does not occur in combination with subtype A. **Underwing** Primaries, grey-black (82) at base grading to black (89) distally; apical spots show as broad white trailing-edge on inner primaries and isolated spots on outer primaries. Greater primary coverts usually white but some have extensive to sparse light-grey (86) speckling on outer few. Lesser primary coverts, secondary coverts and subhumeral, white. Secondaries, dark grey (83) with broad white trailing-edge; form tapering dark subterminal bar through underwing, which narrows towards body as overlying greater coverts become longer and white tips to secondaries broader.

Downy young Down, appears hairy, mostly light silvery-grey, with faint uneven brown or buff tinge, and fine obscure grey-brown (c28) markings. Head liberally marked with elongated dark-brown (219) blotches in irregular pattern of crown-stripes; elongated blotch in centre of forehead, originating at base of bill, forks to form split medial crown-stripe; broken lateral crown-stripes curve down behind ear-coverts; often have blotchy stripe under eye. Throat has series of dark blotches that tend to coalesce towards centre. Upperparts and most of underparts, light silvery-grey, with fine grey-brown mottling, not forming a pattern. Breast and belly, cream (92) to pale grey-brown (119D), paler than rest of down. Skins with buffy ground-colour may represent individual variation, a different morph or soiling.

Juvenile Held for about 2 months after fledging (Kinsky 1963). Dark, with conspicuous neat buff fringes on scapulars

and wing-coverts. **Head and neck** Forehead, lores, crown, nape and ear-coverts, dull dark-brown (219) with narrow pale-buff (124) to cream (92) streaks along edges of feathers giving faintly streaked appearance. Chin and throat, off-white, moderately streaked grey-brown (28). Neck, dark brown (219) with broad pale (off-white to cream [92]) edges to feathers, giving heavier streaking than on head. **Upperparts** Mantle and scapulars, cold, dull dark-brown (219) with sharp, narrow cream (92) fringes, which are faintly tinged buff; fringes produce neat chequered pattern. Longest scapulars have brown-grey (45) wash to tips, like an inconspicuous scapular crescent. Feathers of back and rump, slightly paler, dark brown (121); fringes similar, but broader and less crisp. Tail-coverts, white, with irregular dark-brown (121) markings (roughly diamond- or chevron-shaped) forming bold irregular blotchy pattern. **Underparts** Ground-colour, white, evenly mottled dark brown with slight olive or grey tinge (129, 28, 119A) (almost streaked on upper breast); white usually <20% of underparts. Feathers of breast and belly, white at base, dark brown at tip and blotched in between. Feathers on upper breast have streaky, cream (92) edges. Vent tends to be slightly paler than belly but similarly patterned. Tail-coverts, more white and boldly barred than rest of underparts, with dark-brown (121, 219) chevrons, bars and shaft-streaks. Thighs and rear flanks can appear slightly barred. **Tail** Distally, black-brown (119) with narrow slightly irregular white tips; basally, irregularly barred dark brown (219) on white to light brown-grey (45) ground; barring becomes less distinct towards tips and usually little barring visible beyond tail-coverts. **Upperwing** Dull black primaries and secondaries and dark, pale-tipped outer greater coverts contrast slightly with otherwise mottled brown secondary coverts. Primaries and secondaries, black-brown (119), slightly browner on secondaries; narrow tips of p1–p4 tinged pale-brown (223D); tips of secondaries washed (tea-stained) light brown-grey (45) or pale grey-brown (119D) with narrow off-white fringe at extreme tip. Tertiaries like secondaries but pale tips slightly broader. Lesser and median secondary coverts, dark brown (219) with neat narrow cream (92) fringes, like scapulars, but slightly broader and less crisp, though leading lesser coverts uniformly dark brown. Outer greater secondary coverts, dark brown (219) with moderate to broad, faint pale-brown (223D) to light brown-grey (45) tips; tips become broader, crisper and paler inwards on greater coverts, and inner coverts have cream (92) spots distally; tract forms dark bar tapering from carpal toward body. Primary coverts and alula, black-brown (119). **Underwing** Primaries, secondaries and greater coverts, dark brown (219) with reflective grey sheen; narrow cream (92) tips to secondaries form inconspicuous trailing-edge. Rest of underwing, slightly darker and browner (c121) without reflective sheen; feathers have slightly paler brown (c121C) centres and faint bars giving wing-lining slightly mottled look.

First immature non-breeding (First basic [winter]). Similar to juvenile, and wing and tail retained from juvenile. **Head and neck** Head, white, untidily streaked grey-brown (28); streaking heavy round eye, on ear-coverts and across nape, fainter (sometimes mostly white) on forehead, lores, chin and throat, where streaks mostly confined to shafts. Dark smudge in recess in front of eye. Indistinct grey-brown (28) eye-ring. Neck, white, with untidy collar of grey-brown (c28) streaks, which are broader on hindneck than on foreneck. Almost continuously in moult, so much white visible at bases of feathers. **Upperparts** Mantle and scapulars plainer than those of juvenile. Mantle, scapulars and back, grey-brown (45–28) with dark-brown (121) subterminal band, and broad

diffuse buff (124) to cream (92) tip or fringes to feathers (fringes fade to white with wear); ground-colour slightly greyer and pattern much less distinct or chequered than in juvenile. Rump, white, with brown-grey (54) to grey-brown (28) blotches, forming chequered pattern. Uppertail-coverts retained from juvenile. **Underparts** Still heavily mottled, usually with 15–35% white. Feathers of breast, mostly white with large irregular grey-brown (28) blotches in centres. Thighs and flanks like those of juvenile, but can be boldly barred grey-brown (28) and white near tips. Undertail-coverts either retained from or similar to juvenile. **Tail** Retained from juvenile; white tips gradually wear and ground-colour becomes browner. **Upperwing** Retained from juvenile. Remiges gradually wear and become browner. Fringes of secondary coverts fade to white, more contrasting, but slightly untidy compared with those of juvenile. Dark bar on greater coverts becomes more conspicuous as pale tips and spots of greater coverts fade and become paler, and lesser and median coverts fade to lighter brown. **Underwing** As juvenile.

First immature breeding (First alternate [summer]). Similar to first immature non-breeding, from which not easily separated on plumage alone. Head, neck and underparts become progressively whiter, but much individual variation leads to overlap with first immature non-breeding. Rump and uppertail-coverts have fewer grey-brown blotches and appear white, with scattered blotches, rather than chequered; become whiter in early stages of first post-breeding moult, usually in Oct.

Second immature non-breeding (Second basic [winter]). Mantle and scapulars, slate-grey; wing-coverts, mottled brown; and head and underbody, white, liberally smudged with brown. **Head and neck** Similar to first immature non-breeding (streaking heaviest on ear-coverts, nape, crown and neck) but more varied; some as dark as first immatures, others mostly white, with little streaking; streaks tend to be slightly greyer than in first immatures. Chin always white. Throat, white or sometimes lightly streaked darker. Hindneck, white near mantle, streaked like first immature non-breeding near nape. Foreneck, like first immature non-breeding or whiter. **Upperparts** Mantle, scapulars and back, slate-grey (grey-black with dull slate-grey tone [c82]), paler towards fringes. With wear, fringes tinged brown and upperparts appear mottled slate-grey and brown. Moult of body slow, so birds with mixture of new slate-grey and old brown feathering (increasing mottled appearance of upperparts) often seen. Posterior scapulars, slate-grey at base, grading to marbled slate-grey and white tips, forming broad but untidy scapular crescent. Rump and uppertail-coverts, white, with small but varying amount of brown (119B) barring; distinctly whiter than first immatures, contrasting more with tail. **Underparts** Unevenly mottled white and grey-brown (28). Breast, sparsely streaked brown (usually only on upper breast). Belly, mostly white, with a few thin brown bars on lower belly. Some heavily streaked on head and breast, and mottled brown on lower breast (like first immatures) but most have mainly white belly, vent and flanks, with only scattered streaks. Undertail-coverts, white, barred dark brown (121), the dark bars about half the width of the interspaces. **Tail** Varies from mostly dark to mostly white. If dark, tail, black-brown (119) with narrow (<3 mm wide) white tips; central rectrices have vermiculated brown (121) bars or blotches across off-white bases (usually concealed by tail-coverts); length of patterned bases increases on outer feathers and can almost reach tip of outer webs, sometimes producing pale streaks on essentially dark tail. In some, tail

appears black, without patterning, from above, and nearly always so from below. If white, tails have narrow broken or complete but untidy dark tail-band, much like third immatures. Exceptionally, tail completely white. **Upperwing** Similar to juvenile. Primaries like juvenile except for broader rounded tips to feathers and slightly more conspicuous pale tips on p1–p4; inner primaries may be slightly paler than outer primaries but never produce obvious window or pale panel in wing. Secondaries, black-brown (119) to dark brown (219) usually with varying white tips. When present, tips form varyingly wide trailing-edge, which can be as broad as that of third-year birds. Tertiaries, slate-black (c82) (becoming browner with wear) with long white tips that are mottled and washed brown; form mottled tertial crescent that is diagnostic of second immatures. Greater primary coverts, black-brown (119) like juvenile, but with narrow light-brown (25) tips. Greater secondary coverts, uniform brown or grey-brown (c119B) with slightly paler mottled edges but not distinctly patterned. Lesser and median coverts, mottled brown and not clearly patterned, but blotchy and messy; feathers, grey-brown (28) with dark-brown (121) centres. Some or all median and a few scattered lesser coverts sometimes slate-black (c82) like scapulars. **Underwing** Remiges, dark greyish-brown, with slight glossy sheen (grey 121); outer primaries, slightly darker than rest. Greater coverts, uniform, slightly paler than remiges, brownish grey (c79). Lesser and median coverts, off-white or pale grey-brown (119D) at bases and mottled grey-brown (28) at tips; prevalence of brown tips varies between individuals, darker birds being heavily mottled, and paler birds being mostly off-white. Median primary coverts tend to be darker than rest of coverts, forming irregular dark carpal patch. Subhumeral, like lesser coverts; their dark tips form obscure diagonal bar at base of wing.

Second immature breeding (Second alternate [summer]). Similar to second immature non-breeding, but head and underparts whiter. **Head and neck** In many, white, with scattered dark blotches and streaks, heaviest on ear-coverts, and with collar of sparse dark streaks on neck. Some are darker, like second immature non-breeding; some entirely white. **Upperparts** Slate-black (c82); feathers tend to fade to brown at tips, reducing uniformity of upperparts. Rump and uppertail-coverts, white, with a few brownish streaks. Shortest uppertail-coverts usually replaced, white; sometimes shortest and usually longest coverts retained from non-breeding. **Underparts** Breast and vent, white, with varying amount of grey-brown (28) mottling (usually little). Often have darker mottled belly, formed by more grey-brown (28) tips and blotches on white feathers. Tips of longest scapulars, whiter, with less (but still some) marbling, forming clearer scapular crescent. **Tail** Retained; faded, browner, and white tip reduced or lost. **Upperwing** Remiges retained, worn. Varying number of coverts (none to most) replaced. New coverts, mostly slate-black (c82) with brown tinge (that increases with wear); wing-coverts vary, from mostly brown, through chequered black-and-brown, to mostly dull black; typically, median secondary coverts are slate-black, forming conspicuous band through coverts. **Underwing** Probably retained; coverts show little change from non-breeding.

Third immature non-breeding (Third basic [winter]). Usually similar to adult; an unknown (probably small) proportion indistinguishable from adults. **Head and neck** Sometimes white. More usually, lightly speckled and mottled grey-brown (c28) on head (especially ear-coverts and nape) and scaled or blotched same colour on neck. **Upperparts** Usually identical to adults; scapulars tend to be more often tinged

browner when worn. **Underparts** Typically white; retarded individuals may have grey-brown (c28) mottling on belly or tail-coverts or both. **Tail** Sometimes completely white; usually have dark-brown (121) to grey-brown (28) streaks beside shafts of some (mostly central) rectrices; streaks can be faint or obvious. Often have complete or incomplete subterminal band of blotches, but sharp even tail-band exceptional. **Upperwing** Similar to adult, but without mirrors and with tiny apical spots on outer primaries, so appearing slightly darker. At least sometimes have untidy trailing-edge to secondaries. Tertiaries usually have speckled rather than clean transition between white tips and black bases. Upperwing-coverts and, sometimes, remiges tend to be very slightly browner than in adult; difference subtle when fresh but enhanced by wear. Rarely, inner primaries noticeably brown. **Underwing** Mostly white. Speckled grey-brown (28) to grey (85) fringes to coverts (especially primary coverts) give scaly or dirty wash to lining.

Third immature breeding (Third alternate [summer]). Similar to third immature non-breeding. **Head and neck** Much more often white, though some retain some light mottling. **Upperwing** Retained feathers can have distinct brown tinge, producing strong contrast with fresh upperparts.

Aberrant plumages Buller (1873, 1888) reported an albino. McLintock (1959) and Kinsky (1963) described partially leucistic bird, probably in second or third year, that was 'milk white', with oblique fawn line on breast, fawn marks on upperparts and wing-coverts, and fawn tail-band; bill, cream with dark tip; eye, dark; tarsus, greyish. Eight birds with white spots on greater primary coverts reported from NZ and s. Africa (Buller 1873, 1888; Kinsky 1963; Donnelly 1966; Dillingham 1972; Brooke & Cooper 1979). An adult, in at least fourth non-breeding plumage, had a hood of dusky streaks not extending to neck (photo in Kinsky 1963). Details of exceptional coloration in immatures given by Kinsky (1963).

BARE PARTS Nominate *dominicanus*. Based on photos (Harrison 1987; Pringle 1987; James 1995; unpubl.: M.J. Carter; D.J. James; W. & M. Wakefield) and field observations (D.J. James). Bare parts change gradually between moults and more rapidly during moults, with much individual variation. **Adult non-breeding** Bill usually yellow (c55) or pale yellow, with rounded red (14, 12) subterminal spot at gonys, and often with paler yellow or cream (54) tips to mandibles. During non-breeding season, bill fades to various shades of pale yellow, pale olive-grey or pale blue-grey. Yellow lacking in a few, but probably normal. Birds with dull bills generally have little or no red at gonys; bill may be uniform or have paler spot on gonys. Some birds have dusky markings on gonys and adjacent tomiom, which are probably final trace of immaturity. Gape and mouth, bright orange. Iris, cream (92) to pale yellow; see Brooke & Cooper (1979) for analysis of geographical variation in colour of irides. Orbital ring, orange-red. Legs fade to varying degree: straw-yellow (57), greyish yellow (c54), pale olive-grey or pale blue-grey; colour usually similar to bill but duller and greyer. Claws, dark grey (c83) to black (89). **Adult breeding** Early in breeding season colours intensify, and brightest Aug.–Sept. Bill becomes bright yellow, sometimes with orange tinge, with bright-red (210, 14) spot at gonys. Orbital ring, bright red (210). Legs, bright mustard-yellow. **Downy young** When newly hatched, bill, black (89) or grey-black (82) with large cream (c92) tips to mandibles, and small white egg-tooth; egg-tooth quickly lost; pale tips gradually reduced and lost before fledging. Mouth, pink-red (10). Iris, dark brown (c219). Orbital ring, dark grey (83), surrounded by conspicuous ring of

pale-grey (86) skin. Legs, dark grey, with purple or dark-pink tinge. Claws, grey-black (83). **Juvenile** Bill, grey-black (82) to black (89). Gape, pink. Iris, dark brown (219). Orbital ring, dark grey (83). Legs, grey (84) to light grey (85) with tinge of pink or brown. Claws, grey-black (83). **First immature non-breeding** Similar to juvenile. Legs gradually lighten and develop tinges of olive or yellow. **First immature breeding** From about May, bill develops small cream (92) base to lower mandible and varying pale-yellow tip to both mandibles. Legs, usually olive-grey or blue-grey. **Second immature non-breeding** Bill, usually cream (54) to dull straw-yellow (c56) with smeared black subterminal band that may extend over much of culmen or tomiom; uncommonly, have brighter yellow base and, rarely, trace of red at gonys. Gape, cream (92). Iris, light brown (123A). Legs, usually grey-olive. **Second immature breeding** Bill, like second immature non-breeding but slightly brighter yellow, usually with smaller dusky markings; sometimes uniformly pale yellow. Iris, usually light yellow flecked light brown. Orbital ring begins to show trace of colour, yellow to orange-yellow (c18). Legs, usually pale olive or grey-olive, but vary. **Third immature non-breeding** Bare parts as adult, except bill usually paler yellow, with little or no red at gonys and, sometimes, a slight blue-grey tinge at base. Orbital ring usually orange, sometimes orange-yellow (c18). Iris often ivory but sometimes flecked darker. Legs, dull yellow. **Third immature breeding** Like adult non-breeding, except bill slightly duller, with smaller fainter spot at gonys. Orbital ring, orange-red.

MOULTS Based on Kinsky (1963), supplemented with field observations (D.J. James) and photos (Pringle 1987; James 1995; unpubl.: M.J. Carter; D.J. James; W. & M. Wakefield). Kinsky found that, for immatures, different moults overlap greatly and moult is more or less continuously active from onset of post-juvenile moult to completion of fourth post-breeding moult. **Adult post-breeding** (Fourth and subsequent pre-basic). Complete, mostly symmetrical. Begins with p1 and marginal coverts; ends with p10; spans 4 months (3.5–4.5) between Jan. and July, with time of onset (Jan.–Feb.) varying individually by up to 2 months; individuals beginning moult in Dec. probably non-breeders. Primaries moult outwards; usually two, rarely three, active at a time. Secondaries begin when primaries at about p5 or p6; moult inwards, sequentially from s1 to s17, though often with irregularities from s13 inwards. Tertiaries, outwards (some irregularities in sequence occur), beginning when secondaries at about s3 or s4. Tail, irregularly centripetal, usually symmetrical; t6 often before t5, t2 sometimes before t1; tail begins when moult of remiges advanced. **Adult pre-breeding** (Fourth and subsequent pre-alternate). Partial. Begins mid-July to Aug.; finishes by late Oct. Often begins while preceding post-breeding moult still under way. Restricted to head and body. **Post-juvenile** (First pre-basic). Partial; involves most of head, neck, upperparts and underparts (but not tail-coverts), and, rarely, some marginal coverts.

Plate 31

Black-tailed Gull *Larus crassirostris* (page 485)

- 1 Adult breeding; 2 Adult non-breeding; 3 Juvenile;
- 4 First immature non-breeding; 5 First immature breeding;
- 6 Second immature non-breeding

Sabine's Gull *Larus sabini* (page 569)

- 7 Adult breeding; 8 Adult non-breeding;
- 9 Juvenile; 10 First immature non-breeding

Begins from early Mar. to early Apr. and continues without pause into first pre-breeding moult, which itself continues till about Sept. Begins with lower neck and upper back, ends with forehead and breast. Extent of moult varies, e.g. some replace nearly all feathers of head, neck and upperparts, some only a few feathers of head and mantle. **First pre-breeding** (First pre-alternate). Partial. Continues from post-juvenile moult (q.v.) without pause, finishing about Sept. **First post-breeding** (Second pre-basic). Begins Sept.–Nov. at end of first year; finishes Feb.–Apr. Begins with feathers of upper back or with lesser coverts and rump. Primaries begin about 1 month later and take 3.5–4 months to complete. Otherwise, sequences as adult post-breeding. **Second pre-breeding** (Second pre-alternate). Partial, protracted. Begins immediately after finishing first post-breeding moult (Mar.–Apr.) in some but later in others. Sequence and extent much like first pre-breeding, except often moult many upperwing-coverts, particularly median coverts, and some renew tertials. **Second post-breeding** (Third pre-basic). Complete. Begins Oct.–Dec. and finishes late Apr. to early June; more protracted than first post-breeding. Sequences as for adult post-breeding. Begins with lesser upperwing-coverts, which moult outwards. P1 shed from mid-Nov. to early Jan. **Third pre-breeding** (Third pre-alternate). Partial. Begins shortly after finishing second post-breeding, in May or June. Possibly restricted to head, neck and underparts.

MEASUREMENTS (1–4) NZ, 110 fresh specimens and 90 skins; Bill D = depth of bill at base; Bill D(G) = depth of bill at gonys (Kinsky 1963): (1) First-year birds; (2) Second-year birds; (3) Third-year birds; (4) Adults.

	MALES	FEMALES
WING	(1) 410.8 (392–430; 24) (2) 417.0 (405–430; 13) (3) 432.0 (424–440; 4) (4) 427.4 (400–448; 57)	387.4 (320–412; 23) 394.8 (380–411; 16) 394.7 (385–403; 8) 404.5 (373–428) 55
TAIL	(1) 155.8 (139–172; 24) (2) 161.5 (149–173; 13) (3) 168.0 (159–175; 4) (4) 169.8 (150–181; 57)	148.9 (130–165; 23) 152.3 (144–162; 17) 152.9 (143–161; 8) 154.3 (130–167; 55)
BILL	(1) 50.3 (46.0–54.0; 24) (2) 51.9 (48.5–55.5; 16) (3) 53.6 (50.0–55.0; 4) (4) 53.9 (49.0–59.0; 57)	45.3 (39.0–51.5; 23) 47.2 (44.5–49.5; 16) 47.8 (46.0–49.0; 8) 49.2 (44.5–53.0; 55)

Plate 32

Silver Gull *Larus novaehollandiae* (page 517)
 Subspecies *novaehollandiae* unless stated
 1 Adult breeding, subspecies *scopulinus*; 2 Adult non-breeding;
 3 Downy young; 4 Juvenile; 5 Juvenile, subspecies *scopulinus*;
 6 First immature non-breeding; 7 First immature breeding;
 8 Second immature non-breeding

Black-billed Gull *Larus bulleri* (page 545)
 9 Adult breeding; 10 Adult non-breeding; 11 Downy young;
 12 Juvenile; 13 First immature non-breeding;
 14 First immature breeding; 15 Second immature non-breeding

Black-headed Gull *Larus ridibundus* (page 558)
 16 Adult breeding; 17 Adult non-breeding;
 18 Juvenile; 19 First immature non-breeding;
 20 First immature breeding

BILL D	(1) 18.3 (15.5–20.0; 24) (2) 18.6 (17.5–20.5; 13) (3) 19.2 (18.5–19.5; 4) (4) 20.1 (18.5–23.5; 57)	16.9 (14.0–19.0; 23) 18.4 (17.5–19.5; 16) 17.7 (17.0–18.5; 8) 17.8 (16.5–20.0; 55)
BILL D(G)	(1) 19.4 (18.0–21.5; 24) (2) 20.4 (19.0–21.5; 13) (3) 21.0 (20.0–21.5; 4) (4) 21.8 (19.5–23.5; 57)	17.8 (15.5–19.5; 23) 18.4 (17.5–19.5; 16) 19.1 (18.0–20.0; 8) 19.6 (18.0–21.5; 55)
TARSUS	(1) 64.6 (58.0–70.0; 24) (2) 66.0 (57.5–69.5; 13) (3) 65.6 (61.0–69.5; 4) (4) 66.7 (60.0–72.5; 57)	60.9 (57.5–64.5; 23) 60.8 (57.5–65.5; 16) 60.0 (57.5–63.0; 8) 60.3 (53.0–66.0; 55)
TOE C	(1) 65.2 (61.0–70.5; 24) (2) 65.5 (62.5–68.5; 13) (3) 66.6 (61.5–71.0; 4) (4) 65.6 (61.0–71.0; 57)	60.7 (53.5–66.5; 23) 60.8 (55.5–65.5; 16) 61.0 (57.5–65.5; 8) 59.1 (53.0–65.0; 55)

Except for tarsi and toes, do not reach full size before third year (Kinsky 1963).

(5) Marion I., live birds and skins; methods unknown (Brooke & Cooper 1979). (6) Subantarctic islands (Campbell, Auckland, Macquarie and Heard Is and Iles Kerguelen and Crozet), adult and third-year birds (Kinsky 1963).

	MALES	FEMALES
WING	(5) 400 (15.6; 372–423; 8) (6) 409.7 (401–411; 6)	383 (12.4; 365–395; 7) 397 (375–405; 9)
TAIL	(5) 157 (156–157; 4) (6) 166.2 (164–168; 6)	151 (142–160; 4) 157.8 (149–169; 9)
BILL	(5) 50.3 (2.4; 46.0–54.0; 8) (6) 50.8 (49.5–53.0; 6)	45.0 (1.8; 43.0–47.5; 7) 45.5 (43.5–48.0; 9)
TARSUS	(5) 66.5 (2.8; 62.0–70.0; 8) (6) 64.9 (63.5–66.5; 6)	59.8 (2.4; 56.0–62.8; 7) 60.5 (58–64; 9)

Though not tested, males larger than females and birds from NZ larger than birds from subantarctic islands (Kinsky 1963).

Kinsky (1963) presented geographical breakdown for main NZ islands and concluded that birds from Southland and Westland larger than those from NI and Canterbury. Data for first- and second-year birds from islands in (6) also in Kinsky (1963). More data in Dwight (1925; repeated in Murphy) and Falla (1937). Measurements of subspecies *vetula* from s. Africa in Brooke & Cooper (1979).

WEIGHTS (1) NZ, fresh specimens, all ages (Kinsky 1963). (2) Subantarctic islands (Macquarie, Kerguelen, Heard), all ages, label data from skins (NMNZ). (3) Marion I. (Brooke & Cooper 1979).

	MALES	FEMALES
(1)	1050 (950–1130; 13)	832 (540–970; 15)
(2)	1168 (141; 964–1388; 6)	896 (66; 790–1020; 9)
(3)	1005 (980–1040; 4)	780, 800, 870

Males heavier than females. Little difference between birds from NZ and Subantarctic.

STRUCTURE Wing, long, pointed, though slightly more rounded than wing of Pacific Gull. Eleven primaries: p10 or p9 usually equal longest; p8 11–19 mm shorter, p7 34–44, p6 62–74, p5 86–101, p4 104–126, p3 133–151, p2 162–177, p1 179–195; p11 minute. Twenty-one to 23 secondaries, including 5–6

tertials (Kinsky 1963); tips of longest tertials fall between p4 and p6 on folded wing; p10 not visible when wing folded. Tail, square; 12 rectrices. Bill, straight, heavy, slightly laterally compressed, with prominent gonydeal angle; mandibles terminate at c. 45° with gentle curve to culmen. Nostril, slit-like, a third to half-way along bill. Tibia, mostly bare. Tarsus, laterally compressed; scutellate in single row on front, reticulate elsewhere. Front toes fully webbed; outer toe 90–99% of middle, inner 71–78%; hind, 12–16%; raised. Middle toe and claw much heavier than others.

AGEING Plumage, bare parts, moult and date all aid ageing (though dates given here are only a rough guide). Feathers of wing and tail show less individual variation within any plumage, so are better for ageing than feathers of head and body. Typically, have nine separable pennaceous plumages. In each cycle (year) there is one complete moult introducing a single generation of non-breeding feathers, and one partial moult introducing new generation of feathers on head and body, which combines with retained wing and tail to form breeding plumage (except that first immature non-breeding and breeding attained through partial moults, so juvenile wing and tail retained through two partial moults). Non-breeding and breeding plumages (within a cycle) are harder to separate than are year-classes because (1) feathers of wing and tail do not help to separate them; (2) there are few differences between non-breeding and breeding plumages; and (3) in adults and third-year birds, progress of partial moults is difficult to follow. Thus the best approach is to first identify the year-class, then ascertain whether the partial pre-breeding moult has occurred; clues to latter are: (1) contrast, or lack of contrast, between wear of feathers of wing and tail compared with those of head and body; (2) moult; (3) date; and (4) in some cases, plumages and bare parts. A small proportion of birds may be wrongly classified by the following summary because individual variation is great. Some birds show characters consistent with more than one plumage so accurate classification will only come from evaluating as many characters as possible. Some birds cannot be safely aged. **First-year plumages** Remiges, black-brown without apical spots; tips of primaries more pointed, especially when worn; tail, essentially all dark; head and body, heavily mottled and streaked; no scapular or tertial crescents; bill generally dark. **JUVENILE:** Jan.–Mar. All plumage fresh; upperparts and wing-coverts, neatly scaled or chequered; head, underparts and underwing very heavily mottled; rump essentially brown. **FIRST IMMATURE NON-BREEDING:** Apr. to June or July. Upperparts not so distinctly chequered, duller brown; rump, chequered; head shows more white between streaks; flight-feathers slightly worn (especially primaries). **FIRST IMMATURE BREEDING:** Spring. Head, more white than brown, but with much variation; rump, white, with scattered blotches; primaries and wing-coverts, frayed and bedraggled, with pointed primary-tips visible in flight; primary-moult producing distinction between rounded new primaries and pointed old ones diagnostic of transition from first immature breeding to second immature non-breeding; pale base to bill. **Second-year plumages** Intermediate between brown and black-and-white plumages. Scapulars, blackish (but not quite uniform), contrasting with brown or black-and-brown chequered coverts; scapular and tertial crescents have blackish marbling; tail has broad to narrow tail-band; wing-lining, heavily mottled brown; head, rump and underparts have some dusky markings but much whiter than first-year plumages; bill, mostly pale yellow, nearly always with black smudges. Iris, straw-yellow. **NON-**

BREEDING: Summer and autumn. Uniformly fresh to slightly worn. **BREEDING:** Autumn and winter. Contrast in wear between scapulars and wing-coverts strong; often have contrast in wear between new black coverts and old brown coverts. **Third-year plumages** Similar to adult. Primaries, black but without mirrors and apical spots; white tail often has narrow dark subterminal band; have bold white scapular and tertial crescents; often have brown tinge to some upperwing-coverts but never any wholly brown coverts; wing-lining usually lightly suffused brown; most have sparse dark streaks on head or neck; bare parts like duller non-breeding adults; some have black subterminal smudge on bill. Look carefully for small signs of immaturity. **NON-BREEDING:** Autumn and winter. **BREEDING:** Spring and summer. Contrast in wear between wing and scapulars; other characters differ only on average. **Adult plumages** Primaries have white apical spots, clearly visible when perched and flying; have broad white trailing-edge to wing; bold white scapular and tertial crescents; and head, body, wing-lining and tail, pure white. **NON-BREEDING:** Autumn and winter. **BREEDING:** Spring and summer. Apical spots worn; coverts, worn, can be browner than scapulars; bill always bright yellow, with bold red spot; colour of legs intensifies to bright mustard in Aug.–Sept.

SEXING Males larger than females, especially in bill, but overlap in all measurements. Breeding pairs can be reliably sexed on measurements or by observation if side by side (Kinsky 1963). Brooke & Cooper (1979) used NZ data on weight and bill-length from Kinsky (1963) to sex live birds on Marion I.: birds weighing >975 g and with Bill >50 mm said to be male; if smaller, female. Nugent (1982) produced a discriminant function for NZ birds using total head-length and bill-depth (taken at shallowest point, about half-way between loreal point and nostril): $0 = (0.126 \times \text{THL}) + (0.289 \times \text{depth}) - 19.707$; females negative, males positive; 156 (99%) of 158 birds used to derive the function and 25 (96%) of 26 independent birds were correctly classified.

GEOGRAPHICAL VARIATION No detailed studies. Kinsky (1963) summarized early taxonomic history. Populations do not separate clearly into subspecies on basis of measurements (Dwight 1925; Brooke & Cooper 1979; Murphy). Brooke & Cooper (1979) recognized subspecies *vetula* of s. Africa because, in breeding adults, irides densely speckled dark brown on pale yellow or whitish ground and appear dark brown from beyond 1 m. NZ birds and subspecies *vetula* very close in size (see Measurements in Brooke & Cooper 1979), and both are larger than birds from Subantarctic in linear measurements but not weight. Latitudinal and longitudinal analyses of measurements might reveal clines. Kinsky's (1963) data on differences in size within NZ are surprising for a species whose range and abundance have probably increased greatly after the arrival of people.

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6, 7 Adult non-breeding; 8, 9 Juvenile; 10 Second immature non-breeding

Pacific Gull *Larus pacificus* (page 471)

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1 Adult non-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

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