

Order CHARADRIIFORMES

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

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

| | |
|------------------|------------------------------------------------------------------------------------------|
| Thinocoridae | seedsnipes; four species, S. America. |
| Pedionomidae | Plains-wanderer; monotypic, Aust. |
| Scolopacidae | sandpipers, snipes and allies; c. 85 species, cosmopolitan. |
| Rostratulidae | painted snipes; two species, s. America and Old World. |
| Jacanidae | jacanas; seven species, pantropical. |
| Chionididae | sheathbills; two species, Antarctica and subantarctic islands. |
| Burhinidae | thick-knees, stone-curlews; nine species, widespread in Old World and two in Neotropics. |
| Haematopodidae | oystercatchers; c. 11 species, worldwide in tropics and temperate regions. |
| Recurvirostridae | avocets and stilts; about seven species, worldwide in tropical and temperate regions. |
| Ibidiorhynchidae | Ibisbill; monotypic, central Asia. |
| Charadriidae | plovers and lapwings; c. 60 species, cosmopolitan. |
| Pluvianellidae | Magellanic Plover; monotypic, S. America. |
| Dromadidae | Crab Plover; monotypic, Arabian region. |
| Glareolidae | pratinoles, 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 (Thinocoridae, Pedionomidae, Scolopacidae, Rostratulidae, Jacanidae) 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 Jacanidae. Feathers with small thin afterfeathers. Normally two moults annually: complete post-

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

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

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Family LARIDAE skuas, jaegers, gulls and terns

A large assemblage of small to very large charadriiform seabirds. We recognize four subfamilies within the Laridae following Mayr & Amadon (1951), AOU (1983).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 plumages terms specific to gulls). Underparts and tail usually white, with some exceptions: e.g. pink tinge to underparts of several species, black subterminal bands or tips to tails of some. In breeding plumage, head and neck either white or with large dark hood; in non-breeding plumages, hoods much reduced and many species develop brown streaking, especially on neck. Bare parts, brightly coloured. Iris, white to black-brown, surrounded by fleshy orbital ring. Bill, usually red, yellow or black, often with contrasting subterminal markings or tips; many large species have yellow bill with red spot on gonys which is tapped by chicks to elicit feeding from parent. Legs, usually pink, red, yellow or black. Adults moult twice annually: (1) a complete post-breeding (pre-basic) moult, generally beginning during or just after breeding (but before in *Pagophila*); and (2) a partial pre-breeding (pre-alternate)

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

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

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

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

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

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

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

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Plate 34

Silver Gull *Larus novaehollandiae* (Nominate race except where stated) (page 517)

1, 2 Adult non-breeding; 3 First immature non-breeding

Black-billed Gull *Larus bulleri* (page 545)

4, 5 Adult non-breeding; 6 First immature non-breeding

Black-headed Gull *Larus ridibundus* (page 558)

7, 8 Adult non-breeding; 9 First immature non-breeding

Laughing Gull *Larus atricilla* (page 561)

10, 11 Adult non-breeding; 12 First immature non-breeding;

13 Second immature non-breeding

Franklin's Gull *Larus pipixcan* (page 565)

14, 15 Adult non-breeding; 16, 17 First immature non-breeding; 18 First immature breeding

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

19, 20 Adult non-breeding; 21, 22 First immature non-breeding; 23 First immature breeding

Larus bulleri Black-billed Gull

COLOUR PLATES FACING PAGES 513 & 545

Larus bulleri Hutton, 1871, *Cat. Birds NZ*: 41 — New Zealand.

Named in honour of Sir Henry Lawry Buller (1838–1906) who dominated ornithology in New Zealand during the second half of the nineteenth century and who had earlier (1869) described this gull using the preoccupied name *melanorhynus* (Greek compound meaning 'black-billed').

OTHER ENGLISH NAMES Buller's Gull.

MONOTYPIC

FIELD IDENTIFICATION Length 35–38 cm; wingspan 81–96 cm; weight 230 g. Small slender gull, with diagnostic long slender bill; small head with sloping forehead; long narrow wings that extend well beyond tip of tail to give rather

attenuated rear-end when perched; and rather short legs. Very similar in size and shape to Silver (Red-billed) Gull *Larus novaehollandiae*, but with more delicate appearance. Adults silvery-grey above, with distinctive white upperwing-pattern. Sexes alike. Slight seasonal variation in colour and pattern of bare parts (see Bare Parts). Juvenile and immatures separable.

Description Adult breeding Head, neck, rump, tail and underbody, white, occasionally with faint pink flush below. Saddle and tertials, pale silvery-grey. Pattern of upperwing distinctive: pale silvery-grey as saddle, with bold white wedge along leading-edge of outerwing (broadening from carpal to wing-tip) and narrow black trailing-edge to outer primaries, with neat white tips to outer primaries (that are often reduced or lost with wear). From head-on, leading-edge looks white. At rest, long narrow white lower edge to folded wing. Underwing: lining, pale grey, grading to white on leading-edge; secondaries and inner primaries, paler, off-white and partially translucent, grading to mostly black on outer primaries, bordered by strongly translucent narrow white leading-edge that broadens toward wing-tip. Bill, black. Iris, white. Orbital ring, black, sometimes with dark-red tinge. Legs and feet, black at start of breeding season (tinged red in some); become increasingly redder through breeding season.

Adult non-breeding Differ from adult breeding by: orbital ring, orange-red to dark red. Legs and feet, black, with varying red tinge. **Juvenile** Differs from adult by: dark-grey wash over crown, spot on rear ear-coverts and small smudge in front of eye. Lower hindneck, mantle and sides of neck, uniform grey, or mottled with grey or grey-brown. Scapulars, back and tertials, pale silvery grey, spotted with dark grey. Rump and tail, white, sometimes with indistinct brown terminal smudge on central rectrices. Upperwing: secondary coverts mostly pale silvery-grey, with indistinct narrow dark carpal bar; outerwing similar to adult, but with small dark-brown patch at alula, and dark streaks on outer few greater primary coverts and primaries; dark trailing-edge of primaries joins narrow black secondary bar, with white trailing-edge to secondaries and inner primaries; outer primaries have small white tips. At rest, white lower edge to folded wing as adult, but not reaching tip. Underwing as adult, except dark inner primaries and secondary bar show through. Bill, pink to dull orange-pink, with grey-black tip. Iris, dark brown. Orbital ring, grey-black to black. Legs and feet, pink to dull orange-pink. **First immature non-breeding** Differ from juvenile by: saddle, uniform pale silvery-grey; and head and neck, white, except for indistinct grey smudge in front of eye and, in some, faint grey spot on ear-coverts. Dark areas of coverts, tertials and remiges become browner with wear and fading, and pale fringes and tips reduced. Bill varies: generally brighter pink with darker dull-black tip. Legs and feet brighter pink; some have blackish joints and webs. **First immature breeding** As first immature non-breeding; differ by: Do not have prominent dark smudges or wash on head and neck. Dark areas in wings more worn and faded, paler brown, with pale fringes and tips much reduced or lost. Typically, tertials, new, pale silvery-grey as saddle, and carpal bar even fainter or lost. Bill varies: much as first immature non-breeding to wholly black. Iris, dark brown in some or paler brown. Orbital ring, dark. Legs and feet vary, from pink as first immature non-breeding to marked with dusky joints and webs. **Second immature non-breeding** Many probably inseparable from adult; some separable by colour and pattern of bare parts: bill, dull red, with large black tip; iris varies, from light brown to grey-white; legs and feet vary, from pale red to dull red.

Similar species Can be confused with **Silver Gull**; see

that text for details. **Black-headed Gull** *Larus ridibundus* has similar wing-pattern in all plumages and is vagrant to HANZAB region, but not recorded in NZ.

Abundant gull of NZ inland, frequenting farmland and larger lakes and rivers of SI during breeding season, moving to sheltered coasts and estuaries of NI and SI in winter. Rarely seen far out to sea, though stragglers have reached Stewart I. and The Snares. Gregarious at all times, usually in smaller flocks than Silver Gull, though flocks of hundreds occur at some coastal sites in winter. Feed in open country, on lakes and rivers and in wide variety of sheltered coastal habitats, especially estuaries; also commonly in farmland, following plough; hawk for insects on lakes and rivers in association with Black-fronted Terns *Sterna albostratus*. Forage in city parks, gardens and playing fields and sometimes eat scraps. Noisy, conspicuous and quarrelsome; generally less confiding than Silver Gull. Gait and flight similar to those of Silver Gull, though wings slightly longer, narrower and more pointed, and flight can be more buoyant and graceful. At rest, show longer, finer wing-points than Silver Gull, giving more attenuated rear-end: usually six primary-tips visible beyond tip of longest tertial, with tip of p6 falling level with or just beyond tip of tail. Generally less noisy than Silver Gull; calls similar but higher-pitched and more penetrating; usual calls include anxious *kek kek*, loud *kaark* when defending nest, and aggressive *kear* and *kwow*; begging juveniles utter softer *psee* notes.

HABITAT Breed mostly on upper reaches of major river systems, sometimes in estuaries or on edges of lakes. When not breeding, mainly coastal, though some remain at or near breeding sites throughout year. Some breeding at high altitudes, e.g. 600–900 asl (Beer 1966; Child 1975; Pierce 1983).

In SI, breed in wide braided river beds on dynamic bars, spits, islands and beaches of consolidated shingle or gravel. On Shotover R., optimal breeding habitat includes wide flat dynamic banks of shingle covered with smooth flat stones (75–300 mm diameter) with little silt and few projecting rounded stones and always much scattered driftwood; occasionally nest on bare stones, but avoid large shingles, sandy banks or vegetated shingle banks (Soper 1959, 1963). Elsewhere, recorded breeding on sandbanks in rivers (Oliver), among low vegetation (including grass and weeds, such as broom *Cytisus scoparius* and thistles), and on bare stones away from driftwood (Reid & Reid 1965; Beer 1966). Also breed on islets and at edges of inland lakes and associated pools; occasionally reservoirs. In coastal areas, breed in river estuaries, lagoons, grassy swamps, harbours and sewage ponds; rarely on rocky headlands or in mangroves; recorded breeding near boggy depressions in rolling tussock-grass country on schist plateau (Cunningham & Wodzicki 1948; Reid & Reid 1965; Beer 1966; Foreman 1973; Anon. 1977; Drake 1980; Pierce 1980; Oliver; CSN 22, 23). In NI, breed on edges of inland lakes or in variety of coastal or near-coastal habitats: shingle banks within braided river bed (similar to habitat of SI) (Drake 1980); in holes, dips and crevices on flat silica spit and associated islets and rocks projecting into water of thermal lakes (Black 1955; Daniel 1963; Reid & Reid 1965); shell bank in sheltered coastal embayments (Gleeson *et al.* 1972); bare sand round coastal estuarine lagoon (Cunningham & Wodzicki 1948); and sandy beaches near estuaries (G.A. Taylor). Recorded nesting on groynes inside harbour (Merton 1955).

Outside breeding period, mainly along sheltered coasts, in bays, inlets and harbours, lagoons, estuaries and beaches. Congregate in small estuaries rather than on nearby beaches

(Powlesland & Robertson 1987). Some remain round inland lakes (G.A. Taylor). Occur in open country, such as agricultural land, on wet pasture and particularly newly ploughed paddocks. Occasionally, non-breeding birds recorded at high altitudes, up to 1700 m asl, round subalpine lakes, streambanks and swampy depressions. Often in modified habitats: urban areas, city streets, parks, gardens, and playing fields; airfields, rubbish tips, sewage farms; anywhere refuse or scraps available. Sometimes congregate round freezing works and, formerly, whaling stations (Sibson 1941–42; Stidolph 1949; Black 1955; Dawson 1958; Boud & Cunningham 1959; Child 1975; Oliver; CSN).

Feed on ground, in water and in air. At wetlands, feed from, or just below, surface of water, either while swimming or by low plunge-dives (Boud & Cunningham 1959; Oliver). Once recorded running into shallows of stream, chasing food (Oliver). Also forage on mudflats in lakes, river deltas and lagoons, and on banks and beds of rivers (Dawson 1958; Boud & Cunningham 1959; Child 1975; Pierce 1980, 1983; Owen & Sell 1985; CSN 19 Suppl.). Often feed on wet grassy agricultural land or recreation areas; follow tractor-drawn plough or harrow (Dunedin Naturalists' Field Club 1947; Dawson 1958; Gurr 1967; Oliver; CSN 19 Suppl.); often fed by people in city streets and parks (Dawson 1958; Gurr 1967; Oliver). Recorded feeding at night round artificially lit harbour (Dawson 1958). Occasionally feed on insects in air (Oliver). Round thermal lakes, drink rainwater that has collected in fissures in rocks (Daniel 1963).

Roost at edge of wetlands and lakes (e.g. on grass verges or shell banks), in rafts in shallows, or on islets or promontories in wetlands. On coasts, prefer estuaries to beaches (Black 1955; Sibson 1966; Heather & Jones 1979; Latham 1979; Pierce 1980; Evans 1982d; Powlesland & Robertson 1987; CSN). Also roost on rough marshy pasture near coastal lagoons (Cunningham & Wodzicki 1948) and, during winter, on wet pastures inland (A. Habraken).

Mining of shingle in Buller R. forced breeding colony to move (Owen & Sell 1985).

DISTRIBUTION AND POPULATION Endemic to NZ. Account based on NZ Atlas and CSN.

NI Scattered but widespread round coasts and on Volcanic Plateau, mainly S of Auckland Isthmus. **NORTHLAND:** few, scattered records, from Dargaville, Wairoa R. (n. Kaipara Harbour), Pouto and Rat I., Kaipara Harbour. **AUCKLAND,** s. **AUCKLAND:** mostly from Manukau Harbour, E to Firth of Thames and NE to Coromandel Harbour; recorded on Kawau I. **BAY OF PLENTY:** widespread between Maketu and C. Runaway; also Mercury I. and Tairua and Tauranga Harbours. **E. COAST:** isolated record from near East C., and scattered records from Tolaga Bay, S to Wairoa. **HAWKE'S BAY:** widespread, from Mohaka R., S to Porangahau, and inland lakes, such as L. Poukawa and L. Hatuma. **WAIARAPA:** few records, mainly round Palliser Bay; also L. Wairarapa, Masterton and Riversdale Beach. **WELLINGTON:** widespread between Wellington Harbour and Wanganui R. **TARANAKI:** few records, between Rahotu and Waitara R. Scattered round Waikato coast from Mokau to Raglan Harbour. **VOLCANIC PLATEAU:** Widespread round lakes, especially in Rotorua district and L. Taupo. **SI** Widespread in coastal regions of Nelson and Marlborough, from Farewell Spit to Kaikoura, extending inland along Wairau R. to L. Rotoiti. Farther S, widespread in all districts E of Southern Alps. Sparsely distributed in Fiordland, extending N to Jackson Bay; farther N on West Coast, widespread from Jackson Bay to

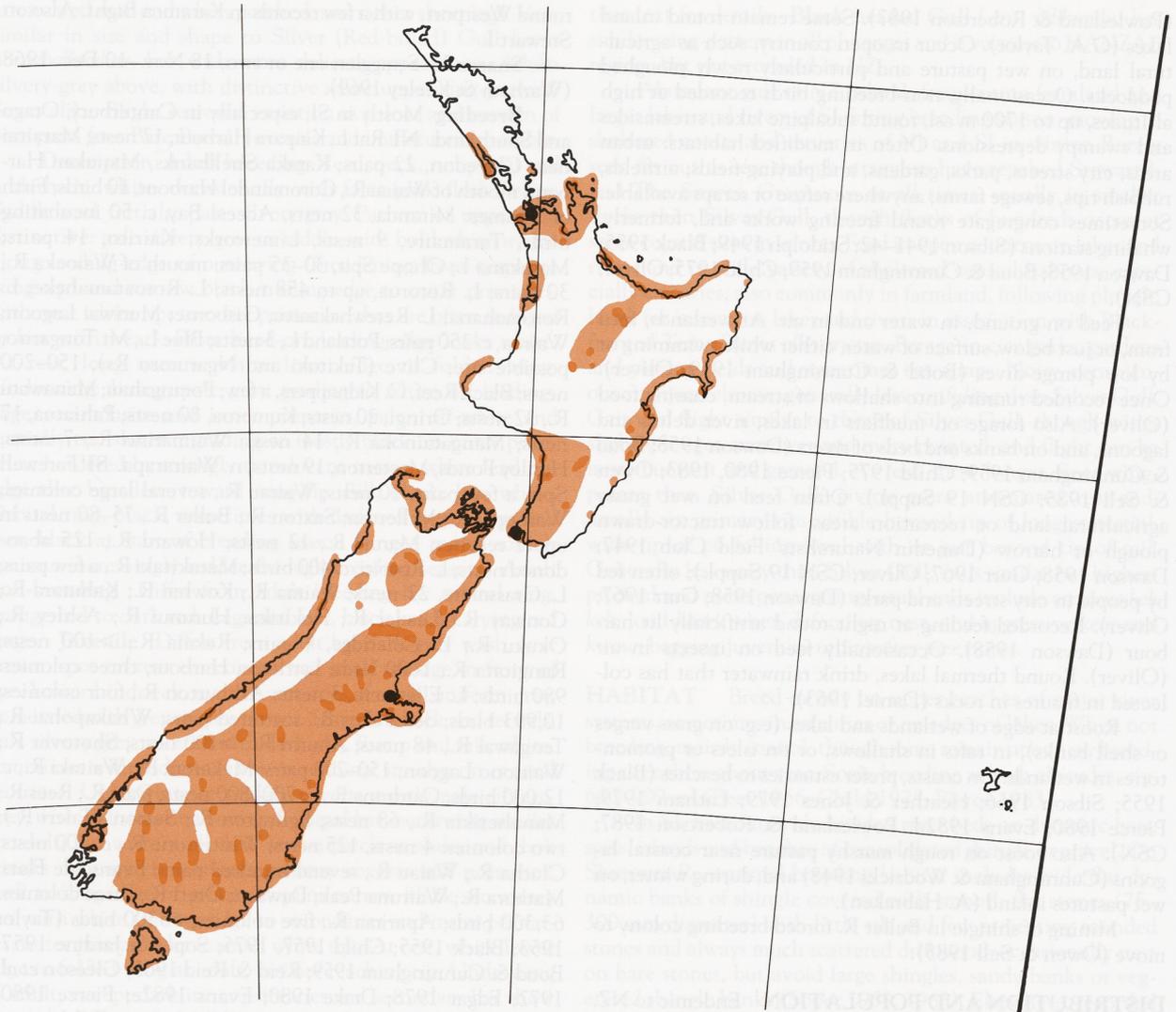
round Westport, with a few records in Karamea Bight. Also on Stewart I.

Snares Is Straggler; one or two, 18 Nov.–10 Dec. 1968 (Warham & Keeley 1969).

Breeding Mostly in SI, especially in Canterbury, Otago and Southland. **NI** Rat I., Kaipara Harbour, 12 nests; Mataitai near Clevedon, 22 pairs; Karaka Shellbanks, Manukau Harbour; mouth of Waiiau R., Coromandel Harbour, 10 birds; Firth of Thames: Miranda, 32 nests, Access Bay, c. 50 incubating birds, Taramaire, 9 nests, Limeworks, Kairito, 14 pairs; Matakana I.; Ohope Spit, 30–35 pairs; mouth of Waiioeka R., 30 pairs; L. Rotorua, up to 458 nests; L. Rotoatamaheke; L. Rotomahana; L. Rerehakaaitu; Gisborne; Muriwai Lagoon; Wairoa, c. 250 pairs; Portland I., 3 nests; Blue L., Mt Tongariro, possible site; Clive (Tukituki and Ngaruroro Rs), 150–200 nests; Black Reef, C. Kidnappers, a few; Porangahau; Manawatu R., 32 nests; Oringi, 20 nests; Kumeroa, 80 nests; Pahiatua, 17 nests; Mangatainoka R., 14 nests; Waimarino R., 7 nests; Henley Ponds, Masterton, 19 nests; n. Wairarapa. **SI** Farewell Spit, a few pairs, 10 nests; Wairau R., several large colonies; Waihopai R.; Millerton; Saxton R.; Buller R., 75–80 nests in upper reaches; Maruia R., 12 nests; Howard R., 125 abandoned nests; L. Rotoiti, c. 400 birds; Matakaitaki R., a few pairs; L. Grassmere, 22 nests; Waima R.; Kowhai R.; Kahutara R.; Conway R.; Leader R.; Hokitika; Hurunui R.; Ashley R.; Okuku R.; L. Coleridge, 4 pairs; Rakaia R., >100 nests; Rangitara R., 1000 birds; Lyttleton Harbour, three colonies: 980 birds; L. Ellesmere, 3 nests; Ashburton R., four colonies: 10,993 birds; delta Cass R., scattered pairs; Whakapohai R.; Tengawai R., 48 nests; Ahuriri R., >100 nests; Shotover R.; Wainono Lagoon, 150–200 pairs; Makarora R.; Waitaki R., c. 12,000 birds; Cardrona R., c. 700–800 nests; Dart R.; Rees R.; Manuherikia R., 68 nests; Eglington R.; Sutton (Taieri R.), two colonies: 4 nests, 125 nests; Whitestone R., c. 200 nests; Clutha R.; Waiiau R., several hundred pairs; Evansdale Flats; Matura R.; Wairuna Peak; Dawson; Oreti R., three colonies: 63,300 birds; Aparima R., five colonies, >5300 birds (Taylor 1953; Black 1955; Child 1957, 1975; Soper & Jardine 1957; Boud & Cunningham 1959; Reid & Reid 1965; Gleeson *et al.* 1972; Edgar 1978; Drake 1980; Evans 1982e; Pierce 1980, 1983, 1984; O'Donnell & Moore 1983; Morrison & Morrison 1985; Owen & Sell 1985; Hawkins 1988; Foreman 1991; CSN; NZCL; A. Habraken).

Populations Total estimated at 50,000 to 100,000 breeding pairs (G.A. Taylor), though earlier estimated as considerably more (Robertson & Bell 1984). Breeding range has expanded N in twentieth century. Formerly visitor to NI; first recorded breeding L. Rotorua, May 1932; at Porangahau, Jan. 1945; Ngaruroro R. and Gisborne, Jan. 1954; and Taramaire, Firth of Thames, Dec. 1968 (Cunningham & Wodzicki 1948; Reid & Reid 1965; Gleeson *et al.* 1972; CSN 2). Numbers have also increased throughout range, e.g. Taramaire (Gleeson *et al.* 1972), L. Rotorua (Reid & Reid 1965) and Moa Flat (CSN 8), possibly because new sources of food available (Dawson 1958; Oliver). However, numbers round s. L. Rotorua 'greatly reduced', in 1969, possibly through pressure from Silver and Kelp Gulls *Larus dominicanus* (CSN 19 Suppl.)

Some colonies (e.g. L. Rotorua) formerly subject to considerable disturbance from people, both deliberate and accidental (Black 1955; Daniel 1963; CSN 22, 30). Dogs, Stoats *Mustela erminea* and feral cats kill chicks and trample eggs (Black 1955; Evans 1982e; CSN 22). In 1930s, Gulls shot in Hagley Park because they were thought to have eaten trout fry in Victoria L. (Dawson 1958). In urban areas, often feed on



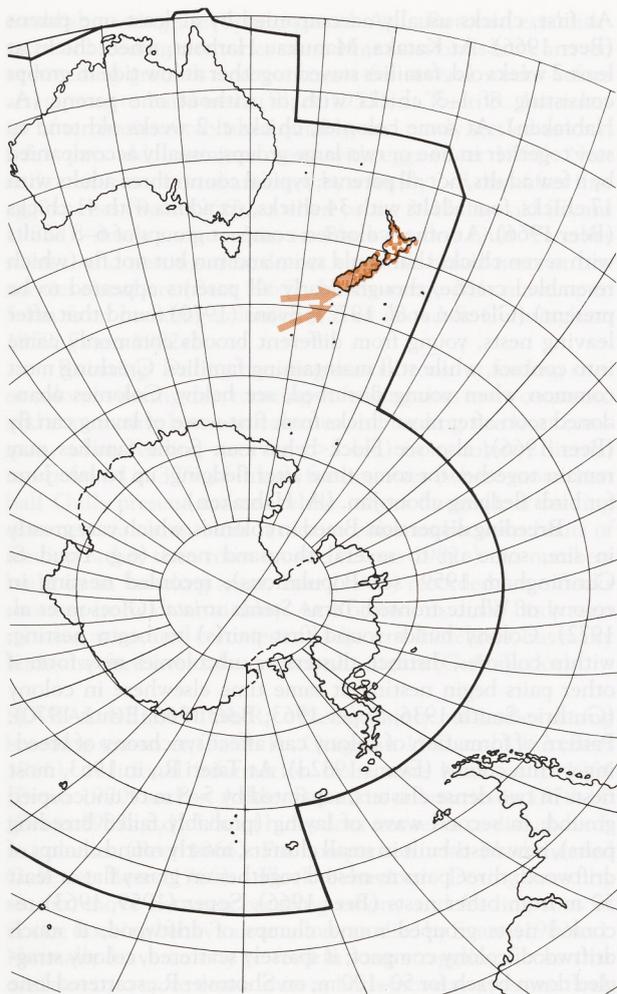
scraps, and may congregate round offal-producing industries such as freezing works and, formerly, whaling stations (Dawson 1958). Killed on roads, sometimes in high numbers (CSN 22). Once recorded 'brooding one very small chick and a bright yellow electric [light] bulb' (Kinsky 1960). Formerly eaten by Maori (Sibson 1992).

MOVEMENTS Poorly known; partly dispersive and partly sedentary. Many move from inland breeding sites to non-breeding sites on coast, others remain near colonies throughout year. No evidence of annual migration between same breeding and non-breeding sites. After dispersing to coast for winter, some SI birds move N, crossing Cook Str. Movements between breeding and non-breeding areas best known for colony at Rotorua: some stay near colony, some move N, and some move E to coast (Powlesland & Robertson 1987), possibly also to Miranda and Bay of Plenty, NI (Reid & Reid 1965) though no evidence of latter from 1982–84 banding study (G.A. Taylor). Some local movements apparently dispersive, e.g. highest numbers on bed of Cass R. on days when food abundant (Pierce 1983).

Departure After breeding finishes or colony deserted, some departures rapid, e.g. at Middlemarch, Otago, most adults

and flying young leave colony on same day. Near Otago, leave breeding sites mid-Dec.; at same time, numbers at coast increase with arrival of flocks of adults and newly fledged young (Beer 1966). At L. Rotorua, most leave breeding grounds, mid-Apr. to end May, with greatest fall in numbers after mid-May; by end May, few remain (Black 1955). At Karaka Shellbanks, s. Manukau Harbour, of 231 chicks colour-marked 1 Jan.–5 Feb. 1995, first was recorded away from colony on 16 Feb. 1995 and first bird recorded at Miranda, 25 Feb. 1995 (A. Habraken). Influxes occur at coastal sites: large numbers arrived at Karitane, SI, first week of Feb. 1991 (CSN 39); in s. NI, first for season at Pukerua Bay in Apr. (CSN 19); maximum numbers at Waikanae Estuary Apr. or May (CSN 31); return to Foxton, after seasonal absence, in Feb. (CSN 19); numbers at Firth of Thames, NI, increase in Apr. (Sibson 1941–42). In 1972, colony at Wairoa, NI, deserted by 18 Nov.; within a few days birds had dispersed through coastal area from Wairoa to Mahia Pen. where stayed for summer (Foreman 1973). Breeding finishes Dec.–Jan. Desert some colony sites after flooding (Stead 1932); other desertions, particularly early in breeding season, may be because food supply is not stable (Evans 1982d).

Non-breeding At some breeding sites, few remain (e.g.



L. Rotorua, Porangahau) (Cunningham & Wodzicki 1948; Reid & Reid 1965). On SI, most move to coast, where some then stay for non-breeding period, e.g. most Otago birds spend this period near coast (Beer 1966), but also widespread in small numbers in many inland areas, such as on rivers of MacKenzie Basin (CSN 36). Many birds from SI spend winter on NI, e.g. w. coast of Manawatu–Wellington and at L. Wairarapa (Drake 1980). In NI, hundreds flock at Miranda, Firth of Thames; smaller numbers occur Bay of Plenty (Falla *et al.* 1981); in Wellington Harbour, mainly recorded Feb.–June (Robertson 1992); colour-banding of chicks indicates that at least some birds at Miranda come from colony at Karaka in Manukau Harbour (A. Habraken). Some dispersion: at L. Rotorua (breeding site), birds occur during non-breeding season but population not stable, with flocks sometimes suddenly arriving or leaving (Black 1955; Reid & Reid 1965).

Return Leave Miranda, Firth of Thames, late Sept. to early Nov., though some (mostly immatures) stayed near Miranda, or at Taramaire (Gleeson *et al.* 1972); no evidence that birds from Miranda come to Rotorua (G.A. Taylor). At L. Rotorua, first of breeding population arrive Aug., numbers increasing into Oct. and early Nov. (Black 1955). At Manukau Harbour, arrive just before breeding (A. Habraken). Round Otago, still plentiful on coast, Aug. and Sept.; numbers round breeding sites did not appear to increase till early to mid-Oct.,

2–3 weeks before breeding sites occupied and laying started; at Middlemarch, Otago, numbers increased second half Sept. (Beer 1966). In central Otago, start to arrive as early as last week in July (Child 1983). Start to congregate on Shotover R., Aug. (Soper 1963).

Breeding Fidelity to colonies poorly known; breeding recorded both at, and away from, natal colony (see Banding). Said to remain faithful to stretch of river bed (Soper 1963); flooding often makes colony sites unsuitable for breeding for two or more consecutive seasons and birds breed elsewhere; at Middlemarch, one colony formed c. 13 km from site of previous season (Beer 1966); flooding at Rotorua prevented large-scale breeding in 1962–63 season (Reid & Reid 1965). Also colonize new areas (e.g. Oreti R., Southland, Sansom 1950). At some sites, breed irregularly (e.g. in Taupo district, Bull 1983). Sometimes breed at sites where occurrence erratic (e.g. Cass R. Valley, Pierce 1983) and irregularly breed at main non-breeding sites (e.g. Firth of Thames, Drake 1980). Leave and move between breeding and foraging sites in flocks (Evans 1982c). Foraging sites up to c. 12 km from breeding colonies on Ashley, Hurunui and Conway Rs (Evans 1982e); mainly forage away from river colonies, particularly after rain (Boud & Cunningham 1959).

Many birds occur away from breeding colonies during breeding period; many of these apparently young, e.g. in Mar. counts of Otaki–Ohaui coast, 97% were subadults, suggesting at least that 1-year-old birds do not move from non-breeding areas to breeding colonies (Powlesland & Robertson 1987). Proportion of summer population remaining in winter varies between years at some sites, e.g. at Firth of Thames: 1987–88, 77.6% (CSN 36), 1986–87, 81.2% (CSN 35), 1984–85, 83.3% (CSN 33), 1985–86, 54.1% (CSN 34), 1983–84, 63.3% (CSN 32), 1982–83, 34.4% (CSN 31), 1981–82, 30.0% (CSN 30).

Banding, Colour-marking Bird in first year sighted at natal colony, and second-year birds seen breeding at natal colony (Dawson 1954). One banded as chick Ashley R., Canterbury, in 1950, seen breeding at Waipara R. (Dawson 1954). One banded Ashley R. found Manawatu R. (Oliver). Bird banded Waihopai R., near Blenheim, 25 Oct. 1966, seen Foxton, 11 Apr. 1970 (CSN 19). Few recoveries of birds banded as chicks (e.g. Black 1955). Birds banded as chicks at Rotorua disperse to local lakes, e.g. L. Rotoehu and L. Taupo. At Rotorua, adults banded at colony at Sulphur Bay later seen nesting at colony at L. Rerewhakaaitu (G.A. Taylor). Bird found breeding Karaka, Manukau Harbour, 1 Jan. 1995, was banded at L. Rotorua on 31 Jan. 1984 as a chick, where it had been misidentified as a Silver Gull; possibly other birds banded at Rotorua at this time were also misidentified (A. Habraken).

FOOD Omnivorous. Worms, insects (adults and larvae), crustaceans, fish and occasionally vegetable matter. **Behaviour** Diurnal, though at L. Rotorua, feed on lake on moonlit nights (G.A. Taylor). Glean on river beds, coasts and shores of lakes, and in pasture, depending on conditions. Highly gregarious; often follow farm machinery, taking worms and other small invertebrates (Evans 1982b; Allen 1984; CSN 32). Forage 4.7 km (0.4–11.9; 46) from colony. Favour recently tilled fields, preferring those closest to colony, unless more distant sites have more food. Rarely use same site for more than 3 days (Evans 1982b). Activity of other birds a cue to selection of foraging site (Evans 1982a). Hawk for emerging mayflies and other insects, taking them from surface of water (Boud & Cunningham 1959), from air above water, or from over forest (Evans 1982b). Sometimes foot-tremble to disturb food

(Dawson 1966; CSN 26; A. Habraken). Also courtship-feed (Evans 1970).

Adults On **Aparima R., SI** (20 stomachs; Boud & Cunningham 1959): Vegetable matter. Animals: ANNELIDS: oligochaetes; INSECTS: Ephemeroptera imagos; Megaloptera: Corydalidae: *Archichauliodes* larv.; Coleoptera: Elateridae larv.; Scarabaeidae: *Costelytra zealandica* larv.; Trichoptera: Sericostomatidae larv.: *Olinga*, *Pycnocentria*. Off **Otago Pen.** (5 stomachs; McClatchie *et al.* 1989): Animals: CRUSTACEANS: euphausiids: *Nyctiphanes australis* 98.3; crabs: Galatheididae: *Munida gregaria* 1.7.

Other records ANNELIDS (Evans 1982b); CRUSTACEANS: amphipods (Pierce 1980); INSECTS (Stead 1932; Evans 1982b); Ephemeroptera: Leptophlebiidae: *Deleatidium* larv. and subimagines (Pierce 1983); Coleoptera: Scarabaeidae: *Costelytra zealandica* larv.; Lepidoptera: Hepialidae larv. (Allen 1984); FISH (Evans 1982b): Salmonidae: trout fry (Stead 1932); Retropinnidae: *Retropinna anisodon* (McMillan 1961). Food scraps (Dawson 1958).

Young Fed by regurgitation. On **Ashley R., SI** (23 regurgitations and dropped items; Dawson 1958): Plants 4.3. Animals: ANNELIDS: oligochaetes 30.4% freq.; MOLLUSCS: bivalves: Mesodesmatidae: *Paphies* 4.3; CRUSTACEANS: amphipods: Hyalidae: *Talorchestia* 4.3; crabs: Hymenosomatidae: *Hymenosoma* 4.3; INSECTS: Coleoptera ads 4.3; Elateridae: larv. 8.7, *Monocrepidius exsul* 4.3; Scarabaeidae: *Costelytra zealandica* ads 8.7, larv. 17.3; Coccinellidae: *Adalia bipunctata* 4.3; Lepidoptera: Hepialidae: *Oxycanus* larv. 13.0; Noctuidae: *Heliothis* larv. 4.3; FISH 4.3: Galaxiidae: *Galaxias* 4.3; *G. attenuatus* 4.3; Pleuronectidae: *Rhombosolea* 8.7. At **Manukau Harbour, NI** (regurgitations; A. Habraken): MOLLUSCS: polychaetes; FISH: Carangidae: *Trachurus*; Pleuronectidae: *Rhombosolea*. **Other records** ANNELIDS (Boud & Cunningham 1959); FISH: Retropinnidae: *Retropinna retropinna* larv. (Black 1955).

Intake Off Otago Pen., five stomachs contained mean of 9 ± 20 mg dry weight of *Munida* and 515 ± 363 mg dry weight of *Nyctiphanes* (McClatchie *et al.* 1989).

SOCIAL ORGANIZATION Major study on Taieri R., Otago (Beer 1966). Gregarious; breed colonially and typically feed in flocks. During winter, flocks move to coast (e.g. Black 1955; Beer 1966); at Firth of Thames, main winter flock up to 850 birds (Gleeson *et al.* 1972). At start of breeding season, numbers build up at breeding grounds, noticeably 2–3 weeks before choosing colony sites; flocks of several hundred recorded roosting in fields at midday (Beer 1966). During breeding season, Black (1955) found large numbers of non-breeding birds at breeding grounds, and a number of birds within colony that did not nest but stood about in small groups. Small parties of immatures with a few non-breeding adults stay at wintering sites during breeding season (Gleeson *et al.* 1972). After breeding, numbers at coast increase markedly as flocks of adults and newly fledged young arrive (Beer 1966). At any time of year at breeding grounds at L. Rotorua, irruptions can occur (Black 1955) but no details of social organization associated with these. Further details of formation and sizes of flocks in Flock behaviour.

Bonds Not studied; appear to be monogamous. Said to first breed when 2 years old (Stead 1932; Dawson 1954). Pair-formation noted in June (A. Habraken); apparently advanced when birds still on coast, many of them moving about in twos; on arrival at breeding grounds pair-formation more advanced than in Black-headed Gulls at this time (Beer 1966). **Parental care** Both sexes incubate and care for young (see Breeding).

At first, chicks usually accompanied by at least one parent (Beer 1966). At Karaka, Manukau Harbour, when chicks at least 2 weeks old, families stayed together at low tide in groups consisting of 1–3 chicks with or without one parent (A. Habraken). At some colonies, chicks c. 2 weeks old tend to stay together in one or two large groups; usually accompanied by a few adults, not all parents; typical count: three adults with 17 chicks, four adults with 34 chicks, six adults with 41 chicks (Beer 1966). At other colonies: compact groups of 6–8 adults with seven chicks that could swim and run but not fly (which resembled crèche, though nearly all parents appeared to be present) (Gleeson *et al.* 1972); Evans (1970) found that after leaving nests, young from different broods commonly came into contact, while still maintaining families. Crèching most common when young disturbed, see below. Colonies abandoned soon after most chicks from first wave of laying can fly (Beer 1966); also see Flock behaviour. Some families may remain together for some time after fledging, up to late June for birds fledging about Jan. (A. Habraken).

Breeding dispersion Breed in colonies, which vary greatly in size; some up to several thousand nests (e.g. Boud & Cunningham 1959; see Populations); recorded nesting in colony of White-fronted Terns *Sterna striata* (Gleeson *et al.* 1972). Colony builds round first pair(s) to begin nesting; within colonies, distinct clusters or subcolonies may form if other pairs begin nesting at same time elsewhere in colony (Guthrie-Smith 1936; Soper 1963; Beer 1966; Evans 1970). Pattern of formation of colony can affect synchrony of breeding within colony (Evans 1982d). At Taieri R., in 1963, most nests in two dense clusters, separated by 5–8 m of unoccupied ground; in second wave of laying (probably failed breeding pairs), new nests built in small clusters, mostly round clumps of driftwood; three pairs re-nested together on grassy flat at least 50 m from other nests (Beer 1966). Soper (1959, 1963) recorded nests grouped round clumps of driftwood; if much driftwood, colony compact; if sparsely scattered, colony straggled down beach for 50–100 m; on Shotover R., scattered lone nests sometimes found on bare stones, but always in centre of colony. On Conway R. in 1979, three distinct subcolonies (1 x 954 nests or broods; 1 x 144 nests; 1 x 107 nests) 50+ m apart, the oldest and largest partly subdivided into three clusters (Evans 1982d). At Taieri R., 1963, distances between nests 49 cm (11.5; 27–83; 70) (Beer 1966); in 1964, 49 cm (35–75) (Evans 1970). On Shotover R., nests grouped round driftwood usually c. 0.5 m apart in any cluster (Soper 1959). On L. Rotorua, colony 'closely packed', e.g. at least 25 occupied nests on one rock c. 3.5 x 4.5 m (Black 1955). In colonies, Gulls little more than pecking distance from each other and nests often touch, leaving little room for taking off and landing. As colonies grow, density of subcolonies more or less constant; density of separated small clusters about as high as main groups. Nests at centres of groups vacated first, leaving rings of occupied nests, thickness of the ring diminishing from inside as more nests vacated (Beer 1966). **Territories** Pairs form before establishing nesting territories. Before nesting, defence of territories not as obvious as in some other species of gulls (e.g. important in pair-formation of Black-headed Gulls); males sometimes defend ill-defined areas round themselves before moving to breeding colonies, e.g. after vigorously excluding all others from small areas for 5 min or so, males usually wander off and ignore area; some aggressive behaviour at this time does not seem to be related to landmarks or areas (see Agonistic behaviour) (Beer 1966). Defend small nesting territories against intruders, though generally not neighbours; those trying to

establish nesting sites appear paired. At L. Rotorua, establishment of breeding territories starts after most birds have arrived at breeding grounds and continues for several weeks before attempting to build nests (Beer 1955); at Taieri R., boundaries of territories established quickly, and newly settled colony, a few days old, contained nests with eggs (Beer 1966). Nest and territories often abandoned by a family 2–3 days after first egg hatches (Beer 1966), or when young 3–12 days old (Evans 1982d), much sooner than in Black-headed Gull. Families roam round nesting area; do not establish brood-nests or territories elsewhere (Beer 1966). **Home-range** May move up to 5 km from breeding colonies to feed (Boud & Cunningham 1959; Evans 1982e).

Roosting During breeding season, roost at feeding sites or colonies during day; roosting at feeding sites more common, and commuting between colonies and feeding site least common, when feeding sites far (>5 km) from colony; diurnal roosts found at 37% of inland feeding sites (where more than half Gulls present roosted while others foraged); if feeding sites near colonies, birds return to colonies between bouts of feeding rather than roost on site (Evans 1982e). As numbers build up in breeding areas, Beer (1966) recorded large flocks roosting in fields at midday. At Rotorua, at dusk, birds seen roosting at vacated colonies and adjacent shorelines, but many birds also feed over lake on moonlit nights (G.A. Taylor).

SOCIAL BEHAVIOUR Based mainly on studies during breeding season on Taieri R., Otago, in 1962 and 1963 (Beer 1966); additional information from same location in 1964 (Evans 1970) and on Ashley R. and its tributaries in 1979–80 (Evans 1982a,c,d). Use of hides does not seem to disturb birds in colonies (Beer 1966). For comparison with Black-headed Gull, see Beer (1966). **Flock behaviour** During breeding season, move between breeding colony and feeding sites in flocks; flocking behaviour at colony studied by Evans (1982a,c). Normally leave colony to feed in long straggling flocks that coalesce into more dense units as birds move away; some flock leaders advertise departure by giving call that attracts other foragers (followers) into flock; leaders call more often than followers, and calling leaders recruit followers more often than silent leaders; intervals between departure of flocks range from several seconds to several minutes; flocks usually <20 (range 2–130 birds). Flocks leaving foraging sites larger than those leaving colony, partly because more upflights occur at foraging sites, which result in many birds flying away as dense flock (see Evans 1982c). Within flocks, birds also call when: flying to or from feeding sites; on arrival at roosts, colonies, or foraging sites; and when flying over rivers before establishment of colony (Evans 1982a; Beer 1966). Site of breeding colony may change from year to year; before breeding, one flock recorded settling at breeding site of previous season for c. 1 h then bred elsewhere. Behaviour of birds at a site before it was chosen as colony breeding site: flock settled for c. 1 h on site; next day group of ten, all apparently paired, arrived, displayed and called to one another on ground (some displays similar to Greeting Ceremony as described by Tinbergen 1959); after 10 min, six flew off and rest split into pairs; one bird then flew, swooping and soaring, at other pair, returned to its partner and performed Greeting Ceremony; all flew off 35 min after arriving; no birds appeared to settle at this site until c. 5 days later; after a further 2 days, c. 400 Gulls present, three nests with eggs, and at least another 150 nests started (Beer 1966). Breeding within colony synchronized (see Breeding); sometimes marked asynchrony between colonies. Better synchrony

within than between subcolonies (Evans 1982d). During last 3 weeks before colonies deserted, PANIC FLIGHTS seem to occur often: periodically all calling in colony stops, and all Gulls (adults, including incubating birds and those without nests, and flying young) take off and fly in tight, silent flock round breeding site once or several times; resume calling as they land, but often hush again and repeat flight within a few seconds. At one colony, nearly all birds deserted on same day; probably do so at other colonies (Beer 1966). Some colonies deserted shortly after start of breeding; observed desertions occurred in daytime, and were accompanied by upflights and much calling, and high circling of flocks, similar to that described above (Stead 1932; Evans 1982d).

Agonistic behaviour Before moving to breeding areas, male appears to defend area round itself by display and attacks; sometimes aggression not obviously related to fixed area. At breeding colony, away from nest-sites, birds without nest-sites can also display aggression that seems unrelated to fixed areas. A few days after site of colony chosen, nesting birds call, display and jab at intruders; on edge of nest-area, Gulls that seem to be establishing nest-sites often involved in conflict. Establishment of territories: typically, pair walks through edge of colony, displaying or fighting with other similar pairs or with owners of established nesting sites; seeking pair retreats readily from such encounters, especially from established pairs; pair continues until they find site where remain unchallenged for some time; then perform courtship displays, Food-begging, courtship feeding and, sometimes, copulations; may soon begin building nest and are likely to defend site against other wandering pairs; in some cases, after <10 min of undisturbed occupation of sites, during which courtship feeding occurred, pairs appeared to possess sites (Beer 1966). Adults will attack wandering chicks; birds standing near nests more aggressive than incubating birds; some of these are off-duty breeding birds, but most probably non-breeders. Much aggression after young leave nests accompanied by one or both parents; sometimes pair without young contest parents, apparently over possession of young; more commonly young attacked by adults and parents come to their aid (Beer 1966); see Relations within family groups.

Agonistic Behaviour, except Choking, similar to that of Black-headed Gulls (Beer 1966); in OBLIQUE and LONG CALL, Black-billed Gull arches neck more (concave downwards) and sometimes directs open mouth slightly downwards; in HEAD-FLAGGING, often holds head and neck in ANXIETY UPRIGHT (bill up, neck thin) and usually waves bill slightly from side to side; Anxiety Upright occurs more often, particularly in Greeting Ceremonies, than in displays of Black-headed Gulls. **CHOKING**: With bill pointing down, bird tilts body slightly forward, usually 10–30° from horizontal but up to 90°; usually holds wings slightly out from body; flexes legs, sometimes so that breast rests on ground; neck relaxed, or extended at angle to body; if neck at right angles to body, head sits at right angles to neck so bill points to ground and about parallel with axis of body; if neck at oblique angle to body, head may be at right angles to neck, with bill often pointing vertically down, or head may be tilted back on neck so that bill points at oblique angle to ground or almost parallel with ground. When Choking, bird occasionally treads feet and may change direction it faces. Does not discernibly jerk head, lower tongue, or make rhythmic coughing call; ruffling of ventral feathers, spreading of tail, or contraction of cloaca not seen; makes soft crooning sound through slightly open bill (not Choking Call of other species of gulls). Choking occurs with short charges and re-

treats, e.g. as nears opponent, attacking bird slows and tends to pull head back from opponent; stops, probably turns side-on to opponent, and adopts bent-down posture, which opponent also likely to adopt; if attacked bird retreats before or after struck, often flees only 1 m or less, then turns, probably side-on to opponent, adopts posture, and again opponent probably does likewise. Clashes involving Choking performed by apparently paired birds accompanied by mates. Position of Choking in agonistic sequences similar to hostile Choking in Black-headed Gulls and Laughing Gulls *L. atricilla* (Beer 1966). Choking can also be non-aggressive, e.g. in courtship feeding (see below). **Fights** Usually consist of one bird, with bill pointed obliquely downwards, rushing at and striking another, which immediately retreats; to strike, bird pecks or leaps onto other bird, pecking, beating with partly folded wing, and perhaps scratching with violently pedalling legs; attacked bird may beat back with one wing, but usually withdraws quickly. Contact maintained for 1 s or so; prolonged fights rare; birds not recorded locked together as in other species of gull (Beer 1966). Two birds, apparently territorial pair, recorded being aggressive to Silver Gulls (Sibson 1941–42). **Alarm** For behaviour at breeding colony, see Parental anti-predator behaviour. In Dec., at L. Te Anau, report of Gull being grasped by Swamp Harrier *Circus approximans*, and then escaping when another Gull harassed Harrier; another two Gulls arrived before Harrier flew away (Cooper 1991).

Sexual behaviour In Aug. and Sept., when still in non-breeding areas, courtship and agonistic behaviour as intense as any time later in breeding season. Before moving to breeding areas, behaviour between members of apparent pairs includes: supporting each other in disputes; courtship behaviour, e.g. Greeting Ceremonies (see below), or Food-begging with some regurgitation; male Head-bobbing (pre-copulatory behaviour); and mounting, probably with some complete copulations. On edges of colonies, away from nesting area, similar behaviour seen among Gulls without nests. Early in breeding season at colonies, Greeting Ceremonies (often abbreviated), courtship feeding, and copulations common between nesting birds. Choking, in exactly same form as for aggression, occurs between mates without any associated attack and escape behaviour; often appears to be related to selection of nest-site: if one of pair Chokes on particular site, it is usually joined by mate who may also posture and call; such spots often where nest-building begins or has already begun. Choking by male may also lead to Food-begging and courtship feeding (Beer 1966). **Courtship feeding** Food passed from male to female. Offering bird precedes or accompanies feeding with Mew Calls; sometimes regurgitation intention movements performed with Mew Call, but no food transferred. Both feeding and regurgitation intention movements may lead to actual or attempted copulation (Evans 1970). **Greeting** Beer (1966) refers to courting birds performing GREETING CEREMONY or MEETING CEREMONY (e.g. Tinbergen 1959). At change-over at nest, relieving bird may Choke if incubating bird does not leave immediately; outgoing bird may Choke if it has been slow to give up nest to mate; displaying bird usually stands on edge of nest and places head close to head of sitting partner (Beer 1966). Also during change-over, Mew Calls usually only given by incoming bird, but sometimes by sitting bird; occasionally courtship feeding occurs; sometimes arriving mate deposits nest-material at nest (Evans 1970). **Copulation** HEAD-BOBBING noted as pre-copulatory behaviour (Beer 1966). Copulation (Black 1955) occurred continuously from when colony first settled, apparently to laying of full clutch, and spasmodically thereafter. When

mounting, male hovered over female, dropped lightly onto her back and continued to flap his wings until coition completed. Always occurred on land, never on water; often with incubating female on nest.

Relations within family groups Parents coerced chicks to water to swim; in water, chick gave piping whistle as parent, 1–2 m ahead, encouraged it to swim (Black 1955). Parent (one only by this time) similarly trained young to fly: flew for c. 20 m and settled on water; young, after much flapping, flew to it. To attract young to be fed, either parent gives postures (probably low-intensity Choking) and calls as those performed by male as prelude to courtship feeding (Beer 1966; Evans 1970). To feed chick, parent regurgitates onto ground, then picks up food and places it in open bill of chick; when chick older, feeds itself from regurgitated food, to which sometimes beaten by neighbouring chicks (Black 1955). Parent typically gave series of Mew Calls before or while feeding chick; during feeding bouts, gave Mew Calls either with bill empty or with food held in its tip (Evans 1970). Individual recognition between parent and offspring appears to develop by time young leave nest, but as early as 2–3 days after hatching; studies by Evans (1970) suggest that in first day after hatching, young respond indiscriminately to Mew Calls of parents or of other adults, but as it gets older, parental calls become more effective in eliciting response; repeated Mew Calling by parents while feeding young doubtless facilitates early development of parental recognition by young. Nesting adults sometimes adopt young (Beer 1966). **Anti-predator responses of young** Chicks, c. 2 weeks old, run in all directions when people in colony (Soper 1963). If chick separated from parents and attacked by other Gulls, usually runs about wildly; often scrambles under attacker, which may be stimulated to brood it for a short time. When just over 2 weeks old, can be aggressive enough to intimidate adults; at this age, when colony alarmed, chicks will rush into water and swim. When in crèches, entire crèche takes to water: chicks swim together in tightly packed raft and attendant adults swim with them or hover overhead (Beer 1966). **Parental anti-predator responses** Other Gulls will eat eggs in unattended nests (Beer 1966). When Swamp Harriers fly over colony, mass upflights usually occur, but mobbing by large numbers of Gulls not seen (Evans 1982d). However, Black (1955) noted that any large bird (e.g. Swamp Harrier, Kelp Gull) that approached colony containing young was immediately chased by group of Gulls. When people approach colony, individuals fly out and hover (Beer 1966) or circle overhead, irrespective of breeding stage (Soper 1963). First Gulls to fly out said to be sentinels, birds that had apparently been temporarily loafing round colony; when intruder comes closer, main colony takes flight and, when intruder leaves, a few sentinels continue to escort it away after colony has settled. Black (1955) noted that disturbed birds rose and hovered over nest, dropping vertically onto nest when danger past. At least one parent usually accompanies chicks after hatching (Beer 1966); when people approach, parents shepherd chicks of appropriate ages into water and away from shore; adults may fly overhead as chicks swim to safety (Black 1955; Gleeson *et al.* 1972). Dive-bombing by adult recorded when young of colony able to fly (Gleeson *et al.* 1972).

VOICE Some calls well known from studies by Beer (1966) and Evans (1970); sonagrams in latter. Calls, like other aspects of behaviour, show adaptations to minimize time at breeding sites, which are usually vulnerable to flooding; examples are absence of Choke Call, probably because there is little

disputation over territorial boundaries, and early recognition of parents by young (Beer 1966; Evans 1970). Loud calls common when leaving roost or colony; when flying to or from feeding site; on arrival at roost, colony or foraging site; and when in flocks flying over river, before establishment of colony (Beer 1966; Evans 1982a). Silent when flying to food revealed by other foraging birds, but give loud excited cries on arrival (Stead 1932). Continuous babble of sound from colony (Stead 1932). During early courtship, massed flights common, with continuous calling; occur much less often at night, with only occasional calls (Stead 1932). In 3 weeks before desertion of colony, periodic cessation of all calling, after which all birds that can fly do so, in tight silent flock, with calling resuming after landing (Beer 1966). Mew Calls differ considerably between adults, providing probable basis for recognition of parents by young (Evans 1970).

Adult MEW CALL: A soft staccato crooning *chrrrrroooooo* or *chrrrrrrrrrr* (Beer 1966; Evans 1970); described as somewhat toneless rasping cry, softened during courtship (Stead 1932). Called Mew Call, because similar in function to Mew of other gulls, though sound not a mewling (Evans 1970). During courtship feeding, always precedes or accompanies offering of food by male to female; during change-over at nest, usually given only by relieving bird, though sometimes by relieved bird or by both; after hatching, Mew Call and food usually given to young instead of mate, though sometimes still call to mate; when feeding chicks, adult usually gives one or more repetitive series of Mew Calls, with bill empty or with food held in tip; also used when leading chicks across or away from territory (Evans 1970). Also used (in place of Choke Call of other gulls) in agonistic display (Beer 1966; Evans 1970). Little or no difference between Mew Calls of an individual, even when used for different functions; considerable differences between individuals (Evans 1970). In different species of gulls, position of bill when uttering Mew Call differs from wide open to almost closed; in Black-billed, calls of an individual with and without food indistinguishable, and made with bill almost closed whether or not food held in it, presumably an adaptation to permit individually recognizable calls in a species in which the Mew Call is made simultaneously with offer of food to mate or offspring (Evans 1970). **CONTACT CALL:** Loud single note; the first bird (leader) to leave a colony often gives this call, attracting other birds (followers) into a foraging flock; leaders call more often than followers, and calling leaders recruit followers more often than silent leaders (Evans 1982a). Playback experiments have shown Contact Calls attract other Gulls (Evans 1982a). **Other calls** Beer (1966) refers to Long Call display but does not describe associated call. Harsh *ka-a* from birds in possession of a 'fishing stand' to birds looking for one; cry harshly to drive off trespassing birds (Stead 1932).

Young At 1 day old, nearly all chicks respond indiscriminately to Mew Calls of all adults; proportion of young that respond selectively to Mew Calls of parents increases significantly from 1 to 4 days (Evans 1970). Chick c. 14 days old gave thin piping whistle when being coaxed to water by parents (Black 1955).

BREEDING Well known; studied at L. Rotorua, NI (Black 1955; Reid & Reid 1965) and Taieri R. (Beer 1965, 1966) and Canterbury Plains, SI (Evans 1982d). Nest in large dense colonies; lone pairs twice recorded nesting in colony of White-fronted Terns (Gleeson *et al.* 1972; Evans 1982d).

Season Broadly, Sept.–Oct. to Dec.–Jan., but onset of

breeding varies from year to year. Most birds arrive at colonies and lay within 1 week (Beer 1966). Select site, mid-Oct., first eggs laid by end Oct., most laying in first half of Nov. (Oliver). **NI** Eggs, Oct.–Dec. (Drake 1980); eggs and young, mid-Jan. (Merton 1955). At Manukau Harbour, eggs, Nov. to late Jan. (A. Habraken). At L. Rotorua, building starts mid-Oct., with 5–10+ days between completion of nest and laying (Black 1955); in 1961, laying began 28–29 Sept., with >70% laid between 5 and 19 Oct., and last clutches 9–14 Nov.; left colonies, mid-Apr. to late May (Reid & Reid 1965); nest 2–3 weeks later than Silver Gulls (Black 1955). **SI** Eggs, mid-Nov.; young, early Dec. (Dawson 1954); laying begins, early Oct.; most hatched or hatching towards end of Nov.; second wave of building begins towards end of Nov., probably by pairs replacing failed nests (Beer 1966). Sites deserted mid-Dec., abandoned soon after most chicks from first wave of laying have fledged (Beer 1966). On Canterbury Plains: onset of breeding roughly early Sept. to early Dec.; start breeding when abundant food available close to suitable nesting site, though prone to desert site if food supply dwindles sufficiently within next few days (Evans 1982d).

Site Inland, on river beds and banks; on grassy edges, sandy spits, low reefs of silica, small islets and rocks of lakes; also swamps and sewage ponds. On coast, on shingle or sandbanks, sand-spits, shell banks and, sometimes, rocky headlands; also on groyne inside harbour (Sansom 1950; Merton 1955; Child 1957; Reid & Reid 1965; Moon 1979; Drake 1980; Oliver; G.A. Taylor). On NI, usually breed on coast (Drake 1980). In centre of river bed, preferably on an island, in flat area at least 46 x 91 m, composed of flat stones 7.6–30.5 cm across, with little silt or round projecting stones, and with much scattered driftwood; will not use sand or area with grass or lichen (Soper 1959). At L. Rotorua, make use of holes, dips and crevices on reef (Black 1955). For formation of colony, see Breeding dispersion; breeding synchronous within subcolonies, asynchronous between subcolonies (Evans 1970, 1982d). Child (1957) noted nests grouped around clumps of leafy tobacco weed or among pile of drift debris, with nests placed 30–90 cm apart; Soper (1959) found nests grouped round clumps of driftwood, usually 30–60 cm apart; scattered lone nests on flat stones, always in centre of colony. Beer (1966) found distribution of nests not related to distribution of driftwood. Do not seem to use same site in successive years (Soper 1959). Colonies sometimes deserted early in breeding cycle; six of 16 colonies within 3–15 days after onset of breeding, with a few nests containing eggs; incomplete desertion at four colonies left from one to 45 nests with eggs, attended by adults (Evans 1982d). Nest with White-fronted Terns, Kelp Gulls, Silver Gulls and Black-winged Stilts *Himantopus himantopus* (Cunningham & Wodzicki 1948; Black 1955; Merton 1955; Gleeson *et al.* 1972; Drake 1980; G.A. Taylor); Pied Oystercatchers *Haematopus longirostris*, Black-winged Stilts, Double-banded Plovers *Charadrius bicinctus* and Black-fronted Terns recorded nesting nearby (Child 1957).

Nest, Materials Nests generally well built; made of straw, dry grass, roots, small sticks, feathers and leaves; lined with grass (Black 1955; Child 1957; Oliver). **MEASUREMENTS:** 5.1–10.2 cm high (Black 1955); up to 22.9 cm in swamps (Oliver). Role of sexes in building not known. Material carried to nest; a few bents or rootlets placed in depressions, more material used when nesting on a flat surface (Black 1955). Meagre structure built before laying, with building continuing after clutch complete. Mate will carefully drop material from 30 to 60 cm onto back of sitting bird, which grips it in bill and

tucks it beneath itself (Guthrie-Smith 1936). Collect material in bill and walk or fly to nest, dropping material at edge of nest; built into nest by bird sitting on nest, picking up material in bill and placing it on either side of body. All collecting performed at change-over, by incoming bird or bird just relieved (Beer 1965). Shape nest by resting on breast, kicking or pushing back with feet, alternately, and wagging body from side to side (Beer 1961, 1963). Most building movements during incubation performed just before or after settling; lower proportion of building movements per hour during incubation for clutches of three eggs than clutches of one, two or four (see Beer 1965). During second wave of nesting at a colony, some new pairs lay in nests recently vacated (Evans 1982d).

Eggs Ovoid; pale olive-green, pale grey or even pale blue, with dark-brown and light-brown blotches (Oliver). Colour of eggs within a clutch may vary (Dawson & Brathwaite 1963). **MEASUREMENTS:** 50.1 (1.83; 46.7–52.8; 29) x 36.7 (1.02; 33.7–39.0) (Cunningham & Wodzicki 1948). Average 50.9 x 37.0 (n=11); one abnormal egg, 29.0 x 24.1 (Child 1957).

Clutch-size Usually two; less often one, three or four (Merton 1955). Average 1.85: C/1 x 52, C/2 x 185, C/3 x 13, C/4 x 1 (Child 1957). At L. Rotorua, C/1 x 33%, C/2 x 165%, C/3 x 22%; C/1 possibly result from laying by old females or loss of eggs (Black 1955); average 2.37: C/1 x 12%, C/2 x 40%, C/3 x 47%, C/4 x 1% (Reid & Reid 1965). At Taieri R., average 1.84: C/1 x 260, C/2 x 565, C/3 x 97, C/4 x 6 (Beer 1965).

Laying Synchronous within colony, asynchronous between colonies and between years (Evans 1982d); most lay within 1 week of occupation (Beer 1966); greater synchrony within rather than between subcolonies (Evans 1982d). Interval between successive eggs probably 1.5–2 days (Beer 1966).

Incubation Often begins with laying of first egg (Oliver). Both sexes incubate, more or less equally; one parent sits throughout night; during day, change-over occurs every 2 h or so on average; stints less interrupted in nests with C/3 than for other sizes (Beer 1965). During a stint of incubation, sitting bird usually rises and settles at least once, often several times. Settling consists of a sequence of movements: begins with Gull standing in nest behind eggs; bird lifts ventral feathers to expose brood patches, then drops forward, resting breast on one side of nest, with legs still partly extended; bird may then sit in nest with body horizontal, stand up or **WAGGLE:** with chest low, bird treads or pushes backwards with legs, swinging rear-end from side to side in phase with leg movements, pivoting on breast; Wagging ends by standing or flexing legs and lowering rear to sit in nest. Bird may then sit without more movement or add **QUIVERING:** a rapid shaking or shivering of body often accompanied by slight side-to-side rocking movements. Settling may consist of dropping breast with or without Wagging (incomplete settling), or dropping, wagging and quivering (complete settling) (Beer 1965). Between stints, bird may walk up to 3 m from nest to defecate, move round on nest or move eggs about in nest with bill (Beer 1965). Parents appear not to recognize own eggs: incubate foreign eggs added to nest and will incubate eggs in nest of another bird if that nest placed at its own site (Beer 1965). **INCUBATION PERIOD:** c. 20 days (Stead 1932); 22–24 days (Black 1955); 22±1 day (Reid & Reid 1965). Unhatched eggs abandoned within 4 days of hatching of last egg (Beer 1966).

Young Semi-precocial. Grow rapidly and very active after 2 weeks (Black 1955); capable of walking or even running within 24 h of hatching; adults and young leave nest and

territory within 2–3 days of hatching of first egg, becoming nomadic near nest (Stead 1932; Beer 1966). At 18 nests, no chicks had left nest at 3 days old, 17% had left at 4 days old and 50% at 5 days (Evans 1970). At L. Rotorua, adults led young into water and onto nearby sandbar till fledging (Black 1955).

Parental care, Role of sexes Young brooded for first few days after hatching, more during cooler weather, which can delay young leaving nest (Evans 1970). During first few days after hatching, one or both parents accompany young; chicks push beneath parent and are brooded when not moving around (Beer 1966). After 2 weeks, chicks of colony tend to stay together in one or two large groups, usually accompanied by a few adult birds (Beer 1966), though, at Karaka, Manukau Harbour, seem to stay as family at low tide (A. Habraken). At first, chicks fed by parent regurgitating onto ground, picking up food and placing it in bill of chick; when older, chicks pick from ground (Black 1955). **FLEDGING PERIOD:** Able to fly when 26 days old (Stead 1932); flying at 5 weeks (Reid & Reid 1965).

Fledging to maturity Able to breed when 2 years old (Stead 1932; Dawson 1954).

Success At L. Rotorua: from 1197 eggs, 1080 (90.2%) hatched, c. 520 young fledged (43.4%); estimated mortality: at 1–7 days, 20%; 8–14 days, 12%; 15–21 days, 12%; 22–28, 12%; 29–35, 12% (Reid & Reid 1965). In one season, eggs and newly hatched young, most likely from second wave of laying, disappeared within 2 days of abandonment of colony (Beer 1966). Eggs washed away by flooding of rivers and tides (Gleeson *et al.* 1972; Drake 1980; A. Habraken); people destroy colonies; Stoats, cats, dogs, Swamp Harriers and Kelp Gulls take eggs or chicks (Black 1955; Merton 1955). Hot volcanic pools claim considerable number of chicks (Reid & Reid 1965). Some Gulls fail to hatch eggs because they prematurely switch from incubation to brooding after adopting a stray chick (Beer 1966).

PLUMAGES Prepared by D.J. James. Begin post-natal moult at unknown age, and fledge at c. 26 days. Undergo partial post-juvenile moult to first immature non-breeding (first basic) plumage, followed by partial pre-breeding (pre-alternate) moult to first immature breeding (first alternate) plumage, with little change in appearance. Thereafter, moult twice annually: a complete post-breeding (pre-basic) moult and a partial pre-breeding (pre-alternate) moult, produce alternating non-breeding and breeding plumages without seasonal change in appearance. Second-year birds separable from older birds by bare parts and, sometimes, pattern of wing-tip. First breed at 2 years old or older (Dawson 1954). Sexes similar, though males slightly larger. No geographical variation.

Adult (Third and subsequent basic [winter] and alternate [summer]). **Head and neck** White. Underdown, light grey (c85), which, during moult, can give impression of slight grey tinge to head. **Upperparts** Mantle, back and scapulars, pale to light grey (closer to 86 than 85); no scapular crescent. Rump and uppertail-coverts, white. **Underparts** White. A few in breeding plumage in Oct. have roseate tinge on breast and belly. **Tail** White. **Upperwing** Mostly grey, with largely white outer four primaries forming white panel along leading-edge of outerwing (from head-on, leading-edge uninterrupted from base of wing almost to tip); narrow black edges of outer primaries forming inconspicuous black stripes along white panel (visible when wing well spread); black subterminal bands on outer primaries forming distinctive dark bar near trailing-

edge of outerwing; and white apical spots from about p6 outwards. Secondaries, tertiaries, humerals, secondary coverts, inner six greater primary coverts and inner lesser primary coverts, light grey (c85), slightly darker than upperparts; when fresh, narrow tips of secondaries slightly paler than bases, but soon lost with wear; no tertial crescent. Seventh greater primary covert, white basally grading to pale grey (86) at tip. Outer three greater primary coverts, outer lesser primary coverts, alula and marginal coverts, white. P1–p3, light grey (c85) with brownish-grey (80–79) shafts; p4, similar but usually with narrow smudgy dark brownish-grey (c79) distal inner edge (1–4 mm wide, 20–30 mm wide and ending 12–17 mm from tip). Middle primaries have pale-grey tongue at base, white apical spot, black subterminal band and blackish inner edge, the area of black increasing outwards. P5, light grey (c85) with broad smudgy grey-black (82) inner edge, broadening distally and merging into sharp grey-black subterminal bar 7–10 mm wide across both webs; large apical spot 9–11 mm long, usually light grey (86), sometimes white, occasionally divided by black along shaft or absent from outer web. P6 has white apical spot 5–10 mm long; sharp black subterminal band 15–20 mm long across both webs, often pinched or extruded at shaft; light-grey (c85) base (tongue) rounded distally, grading to paler grey (sometimes whitish) proximal to subterminal band; and broad grey-black (82) inner edge becomes broader distally and merges into subterminal band. P7 has small white apical spot (4–9 mm long) and longer (21–26 mm) black subterminal band, pinched along shaft (hourglass-shaped); pale-grey tongue rounded distally, grades from light grey (85–86) at base to pale grey (86) half-way along feather and abruptly to white proximal to subterminal band. P8 has white apical spot c. 7 mm long; black subterminal band 23–30 mm long, extending as narrow line along outer edge; tongue mostly white, grading to pale grey (86) near base; grey-black inner edge at least half width of inner web. P9 mostly white with square-cut black subterminal band and small white apical spot (12–17 mm); grey-black inner edge, usually just over half width of inner web, straight or sometimes irregularly bulging; short narrow black outer edge about half-way along, usually isolated but sometimes connected with subterminal band. P10 mostly white, only sometimes with black subterminal band <15 mm long; white apical spot less than 5 mm long when present; narrow inconspicuous black outer edge 1–3 mm wide along basal three-quarters does not change impression of white leading-edge to outerwing in flight; grey-black (82) inner edge much broader and thickened in middle, constricting white tongue. Some variation in amount of black and white on outer primaries probably not related to geographical variation or sex: variation as great in four males and four females from Ashley R., Canterbury (NMNZ) as in all 50 or so adult skins examined; more likely to be result of slight tendency of adults to reduce black in wing-tip each year, as in Black-headed Gull (Allaine & Lebreton 1990). **Underwing** Secondaries, pale to light grey (86–85). Coverts, mostly pale grey; leading lesser coverts, white. Inner primaries, grey (85–84). Outer primaries appear mostly grey-black (82), varying striped pale grey (c86) depending on spread of wing: p10 and distal half of p9, white except for grey-black (82) subterminal bands; base of p9 and most of p8–p6 dominated by grey-black inner edges with pale-grey tongues forming stripes that are more visible the more wing is spread. Blackish subterminal band and white apical spots clearly visible on outer five primaries, though blackish band tends to merge with slightly paler grey-black bases.

Downy young Individual variation moderate, with as

much variation within colonies as between them. Ground-colour of head, upperparts and wing-pads varies from yellow-brown or ginger-brown (c123B) to cream (92) or off-white, liberally and irregularly blotched black-brown (119). Blotches very sharp on forehead, ear-coverts, chin and throat; less sharp on crown and hindneck; mottled on upperparts; occasionally, blotches clearer on upperparts than crown. Sides of neck, not mottled, emphasizing narrow vertebral stripe of blotches along hindneck. Prominent light-grey (c85) eye-ring. Narrow stripe on underparts, unmarked, not mottled or blotched, same colour as ground-colour of upperparts. Best distinguished from Silver Gull on bare parts.

Juvenile Differs from adult in: bare parts (see below); brown to grey-brown wash on crown and hindneck; soft brown spotting on upperparts and wing-coverts; dark secondary bar; and pattern of wing-tip. Prominence of brown markings varies considerably between individuals. **Head and neck** In some, head practically pure white except for prominent grey-brown (28) ear-spot and narrow dark-grey (83) streaks at front of eye (pre-ocular spot), usually forming conspicuous grey crescent, though can be small and inconspicuous. Some have rounded diffuse light-brown cap often bordered by whitish nape and ear-coverts; feathers of crown, white smeared with light brown (c27). Some have narrow or broad light-brown (239) to grey-brown (28) tips to feathers of hindneck (with very fine white fringe that wears off before fledging). Others have light-brown wash over nape and hindneck extending to ear-coverts and side of neck as partial collar. **Upperparts** Mantle, white, heavily but diffusely mottled brown-grey, grey-brown (28) or light brown (239); feathers have white bases grading to brownish tips, with very narrow white fringe at tips (which wear off before or soon after fledging); on darkest birds, white bases concealed and mantle looks uniform. Scapulars, pale grey (c86 like adult) with irregular and diffuse grey-brown (c28) subterminal spot or blotch and broad cream fringe; blotches have slight tinge of rufous when fresh (quickly lost); fringes broader towards rear. Back, pale grey (c86). Rump and uppertail-coverts, white. Sometimes give impression of more clearly spotted upperparts than typical of Silver Gull, though variation in pattern apparently great and poorly understood. **Underparts** White. **Tail** White; rarely, have brown terminal marks on some central rectrices. **Upperwing** Marginal coverts, white; ground-colour of remaining coverts, light grey (c85), slightly darker than scapulars; leading rows of lesser secondary coverts, uniform light grey. Median and rear three rows of lesser coverts, light grey (c85) with grey-brown (c28) subterminal band and pale-cream (pale 92) fringe at tip; pattern similar to scapulars but dark marks smaller; form, at best, very faint carpal bar. Greater secondary coverts, light grey (86–85) with narrow indistinct pale-cream tips (broader on inner feathers). Primary coverts, like those of adult but outer greater coverts can have large dark-brown (121) smudges at bases. Alula, white, with dark-brown (121) subterminal band on inner webs. Humerals, uniform pale grey (86). Tertiaries and tertial coverts, light grey (86–85), usually with prominent irregular grey-brown (28) subterminal blotches; sometimes uniform. Secondaries, pale grey (c86) with rounded elongate dark-brown (121) subterminal spots across middle of feathers, forming prominent dark secondary bar; spots largest in mid-secondaries, where extend from outer edge to half-way across inner web and c. 25 mm long; on s1 only extend half-way across outer web and c. 15 mm long; on s13 confined to narrow streak on inner web beside shaft; s14 usually uniform grey. Primaries similar to those of adult, differing mainly by grey-

brown subterminal bands across inner primaries and conspicuous black band across middle of outer primaries. P1–p5, pale grey (nearer 86 than 85) with narrow grey-brown (c28, 119A) subterminal band across feathers (sometimes not reaching edges, especially on p1). In general, outer five primaries only differ from adult in width of black borders to tongues; area of black tends to be broader than area of white on inner edge (rarely so in adults) so primaries appear striped black and white (not mostly white); some similar to adult. On p9 and p10, outer edge mostly black except for apical spot, and black inner edge often extends to shaft at about middle of feather, separating white bases from tips in pattern that can recall adult Silver Gull, but always shows more white than any Silver Gull. **Underwing** All coverts and subhumeral, pale grey (c86). Secondaries and inner primaries, glossy pale grey (86) with inconspicuous dusky subterminal spots to secondaries that stand out as shadowy areas when back-lit. Outer seven primaries, mostly grey-black (82) with prominent white mirror on outer two and varying (though usually inconspicuous) pale grey (c86) stripes (formed by tongues) on middle primaries.

First immature non-breeding (First basic [winter]). Similar to adult, with worn retained juvenile wing and tail. **Head and neck** Usually as adult. Some possibly have faint dusky markings round front of eye and inconspicuous grey wash on hindneck. **Upperparts** As adult; some may retain a few juvenile feathers. **Upperwing** By early or late winter, spots on coverts wear and fade so that coverts appear pale grey with only very slight brown tinge or faint smudges; carpal bar inconspicuous. Apical spots wear off outer primaries and folded primaries appear dark (adults conspicuously spotted in winter). Juvenile secondaries and tertials retain bold subterminal marks.

First immature breeding (First alternate [summer]). Similar to first immature non-breeding, retaining most of juvenile wing and tail. **Head, Neck, Upperparts, Underparts** As adult. **Tail** White. May replace some or most rectrices. **Upperwing** As first immature non-breeding but more worn. Coverts have no juvenile spotting, though often appear dirty and show slight contrast in wear with scapulars. Primaries have no apical spots and are very worn, with black areas faded to dirty dark-brown. Usually retain secondaries and sometimes retain tertials, though may replace a few inner secondaries and often replace tertials with uniform light-grey ones.

Second immature non-breeding and breeding (Second basic [winter] and alternate [summer]). As adult but some separable on bare parts. Most have pattern of outer two primaries like adult; small proportion appear to have pattern intermediate between that of juvenile and adult, with wide black edges and smaller pale tongues on outer primaries; rarely have outer primaries like juvenile.

Hybrid plumages Black-billed Gull x Silver Gull hybrids occasionally reported at Rotorua colony, where both breed sympatrically. Two adult skins, an F1 hybrid and an F2 hybrid (back-crossed to Silver) (NMNZ) had: Upperparts and upperwing, light grey, closer in colour to Silver than to Black-billed Gull. The F1 had wing-tip similar to Black-billed Gull but with slightly broader black bands across middle of outer two primaries. The F2 had pattern of wing-tip intermediate, but more similar to Silver than to Black-billed Gull. See also Bare Parts and Structure.

BARE PARTS Based on photos (Harrison 1987; Moon 1979, 1992; Moon & Lockley 1982; NZRD; unpubl. M.J. Carter; B. Chudleigh; A. Habraken; D.J. James) and label data (AIM, NMNZ), except as stated. Important in ageing, but rate

of change with age and seasonal variation poorly known because individual variation apparently great. **Adult non-breeding** Bill, black; dark red (c110) inside gape and mouth (conspicuous when bill open). Iris, white. Orbital ring, orange-red (labels), red (108A) to dark red (110) (photos); NZRD states orbital ring black from Feb. to June. Legs and feet, black or more often black tinged with dark red, particularly inside tarsus and on top of toes; usually dull dark-red but sometimes bright (but see Adult breeding). **Adult breeding** Very similar to adult non-breeding, but colours intensify slightly. Inside of gape and mouth, bright red (c12–14). Orbital ring, black, sometimes with dark red tinge (G.A. Taylor). Legs and feet, often completely black, but some with red-black or red legs seen in all or most months as a result of individual variation in seasonality and intensity of colours. Apparently, leg-colour more closely tied to breeding cycle than to plumage cycle (A. Habraken): at onset of breeding and during incubation legs black, tinged dark red in some; between hatching and fledging of chicks legs turn red (sometimes spreading from joints) and intensify to bright red about time of fledging; red sometimes held until at least late June (when post-breeding moult long completed); change to red possibly stimulated by presence of begging chicks and juveniles. **Downy young** Bill, pink-brown or pink-grey, slightly smudged with dark grey; gape, light pink. Iris, dark brown. Orbital ring, black. Legs and feet, dark pinkish-grey (Cunningham 1953; Reid & Reid 1965; photos). **Juvenile** Bill, dull pink (c5) to dull orange-pink, with small smudgy dull-black or dusky tip developing before fledging. Iris, dark brown. Orbital ring, black to grey-black (89–82). Legs, dull pink (c5) to dull orange-pink. **First immature non-breeding** Soon after fledging, bill becomes bi-coloured: basal three-quarters, dull pink to orange-pink, with reasonably sharply demarcated black tip not extending far back along tomlia; most retain bi-coloured bill till at least Aug., others develop black mottling or smudging at base by June (see First immature breeding). Iris, dark brown. Orbital ring, black to grey-black. Legs and feet, dull orange-pink. **First immature breeding** Bill not usually bi-coloured; base, duller orange-pink, with increasing black mottling or smudging; some (probably rarely) have completely black bill before fully in second immature non-breeding plumage (photo; NZRD). Iris, brown to grey or greyish white, usually slightly paler than pupil. Orbital ring, black. Legs and feet, dull orange-pink with varying black mottling or smudging, especially round joints. **Second immature non-breeding** Variation unknown. Bill, dark red, heavily mottled black on basal half to two-thirds, with black tip. Iris, light brown to grey or greyish white. Legs and feet, pale or dull red (dull 13). Advanced individuals probably like adult non-breeding. **Second immature breeding** Not certainly known to differ from adults, though possibly retain some immature characters.

Hybrids (With Silver Gull). Adults (NMNZ): F1 hybrid: bill, very dark red; iris, white; orbital ring, orange; tarsus, reddish brown. F2 hybrid: bill, dark red with blackish patches; iris, white; tarsus, brick-red.

MOULTS Based on examination of c. 70 skins with date (AIM, AM, CM, NMNZ). **Adult post-breeding** (Pre-basic). Complete. Begins with p1, late Dec. to early Jan., after chicks fledge; finishes Mar.–Apr.; takes 3–3.5 months to complete. Non-breeders and failed breeders moult slightly earlier. Primaries moult outwards; usually two, rarely three, at a time. Secondaries begin when p3–p5 moulted; moult inwards from s1 to about s14; up to three active. Tertials (s15–s19) moult inwards in separate wave that begins soon after s1 moulted;

sometimes, wave at tertials begins with s13 or s14. Tail, outwards; timing and regularity of sequence unknown. **Adult pre-breeding** (Pre-alternate). Partial moult of head and body. About late July to early Sept. All four skins collected Aug. and one of two in each of July and Sept. were moulting. **Pre-juvenile** No information. Said to fledge at c. 26 days (NZRD). **Post-juvenile** (First pre-basic). Partial. Involves head and body, but not wing or tail. Begins soon after fledging, in Feb. or Mar. Replace all scapulars, mantle and back, unknown amount of head, tail-coverts and underparts. **First immature pre-breeding** (First pre-alternate). No skins in moult. By Nov. most have renewed head and body and tertials, and, sometimes, some inner secondaries and some of tail; may also replace some secondary coverts. Do not appear to replace many secondaries as in Silver Gull (q.v.) and Indian Black-headed Gull *L. brunicephalus* (van den Berg *et al.* 1991). In photos from Sept. (M.J. Carter; B. Chudleigh) one has replaced tertials and two have not. Probably takes place Sept.–Oct., though Dwight (1925) suggested Oct. or later. **First immature post-breeding** (Second pre-basic). First complete moult. Begins about Nov. and finishes late Feb. to early Mar. with population reasonably well synchronized; individuals probably take c. 3 months. Sequences similar to adult post-breeding. **Second immature pre-breeding** (Second pre-alternate). Partial; poorly known but similar to adult pre-breeding.

MEASUREMENTS Skins; Bill G = depth of bill at gonys (AIM, AM, CM, NMNZ): (1) Adults (third non-breeding or older); (2) Second-year birds (second immature non-breeding or breeding); (3) First-year birds (juveniles, first immature non-breeding and breeding).

| | MALES | FEMALES | |
|--------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------|
| WING | (1) 296.8 (6.7; 288–310; 18) (2) 285 (3) 290.6 (6.2; 282–302; 8) | 286.6 (7.4; 274–298; 16) 282, 286 280.5 (3.7; 278–286; 4) | ** * |
| TAIL | (1) 108.1 (4.6; 102–120; 18) (2) 100.2 (2.6; 98–104; 4) (3) 103.7 (2.4; 101–109; 8) | 103.2 (4.6; 97–112; 20) 100.4 (3.2; 95–104; 7) 98.8 (3.2; 96–104; 5) | ** * |
| BILL | (1) 38.3 (2.1; 33.0–41.8; 16) (2) 39.2 (2.3; 36.6–42.0; 4) (3) 38.1 (1.5; 36.0–40.1; 8) | 35.9 (1.6; 31.4–38.0; 21) 35.0 (1.9; 31.5–37.2; 7) 34.5 (1.0; 32.6–35.3; 6) | ** ** |
| BILL G | (1) 8.7 (0.2; 8.1–9.1; 15) (2) 8.0, 8.4, 8.8 (3) 8.3 (0.2; 8.0–8.8; 8) | 8.1 (0.4; 7.5–8.8; 18) 7.9 (0.3; 7.4–8.4; 7) 7.6 (0.4; 6.8–8.0; 6) | ** ** |
| TARSUS | (1) 41.2 (1.9; 38.0–45.7; 18) (2) 42.6 (0.9; 41.3–43.5; 4) (3) 40.6 (1.8; 38.3–42.7; 8) | 39.5 (1.4; 36.8–42.2; 21) 39.2 (0.5; 38.6–40.2; 7) 39.7 (1.4; 37.5–42.0; 6) | ** ns |
| TOE | (1) 31.4 (1.2; 30.0–34.4; 18) (2) 30.7, 31.0, 32.0 (3) 30.9 (0.8; 30.0–31.9; 5) | 30.7 (2.4; 28.4–39.8; 19) 30.0 (0.3; 29.5–30.5; 5) 29.9 (1.1; 28.5–31.3; 6) | ns ns |

Marked differences in sexes in adults and first-year birds in all measurements except toe. Adults slightly but significantly larger than first-year birds in Wing ($P < 0.05$, males only), Tail ($P < 0.01$, males only) and Bill ($P < 0.01$, both sexes). Dimorphism sufficient for sexing by discriminant function, but none yet published. Insufficient data to examine geographical variation.

WEIGHTS Museum labels (AIM, NMNZ): (1) Adults; (2) Second-year birds; (3) First-year birds.

| | MALES | FEMALES | |
|-----|------------------------|------------------------|----|
| (1) | 243 (29.7; 195–277; 7) | 218 (49.8; 109–260; 9) | ns |
| (2) | 110, 230 | 189 (46.3; 113–236; 5) | ns |
| (3) | – 200, 215, 217 | | |

Males probably larger than females but few data. Large variation possibly because some data not reliable.

STRUCTURE Wing, slightly longer, more slender and pointed than that of Silver Gull. Eleven primaries: p10 longest, p9 0–6 mm shorter, p8 8–18, p7 30–38, p6 52–58, p5 72–82, p4 91–105, p3 110–124, p2 125–139, p1 142–154; p11 minute. Tips of primaries rounded in adults, more pointed in juveniles, but differences slight. Nineteen secondaries, including five tertials; tips of longest tertials fall between p4 and p6 on folded wing. Tail, square, though often appears rounded when spread; 12 rectrices, with tips square in adults and rounded in juveniles. Head proportionately smaller and with more sloping forehead than in Silver Gull. Bill, rather long, straight, narrow (laterally compressed) and shallow (slightly longer and deeper in males than females); tip, rather pointed because downcurve of culmen gradual, gonys well back from tip and gonydeal angle small. Nostril, narrow slit in shallow groove; narrowest of all gulls (Dwight 1925). Skins of F1 and F2 hybrid Black-billed Gull x Silver Gull (NMNZ) have flat lower edge to gonys, and nostrils similar to those of Silver Gull. Tarsus, slightly laterally compressed; scutellate on front of tarsus and top of toes, reticulate elsewhere. Outer toe 89–97% of middle, inner 76–83%, hind 19–24%, raised. Toes, fully webbed, slightly incised.

AGEING Use of bare parts to distinguish adult non-breeding and breeding needs further study because situation complex and poorly known; moult, contrast between worn and fresh plumage, and time of year are best distinctions. Above characters and bare parts distinguish first immature non-breeding and breeding; replacement of any juvenile feathers of wing or tail indicates first immature pre-breeding moult at least begun. Most second immature non-breeding distinguished by combination of adult-like plumage and immature bare parts (pattern of bill evident in skins, but not colour); some also have wing-pattern intermediate between juvenile and adult. More information needed on bare parts in second immature breeding.

GEOGRAPHICAL VARIATION None.

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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



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Silver Gull *Larus novaehollandiae* (Nominate race except where stated) (page 517)

1, 2 Adult non-breeding; 3 First immature non-breeding

Black-billed Gull *Larus bulleri* (page 545)

4, 5 Adult non-breeding; 6 First immature non-breeding

Black-headed Gull *Larus ridibundus* (page 558)

7, 8 Adult non-breeding; 9 First immature non-breeding

Laughing Gull *Larus atricilla* (page 561)

10, 11 Adult non-breeding; 12 First immature non-breeding; 13 Second immature non-breeding

Franklin's Gull *Larus pipixcan* (page 565)

14, 15 Adult non-breeding; 16, 17 First immature non-breeding; 18 First immature breeding

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

19, 20 Adult non-breeding; 21, 22 First immature non-breeding; 23 First immature breeding