Order CHARADRIIFORMES

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

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

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

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

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

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

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

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

REFERENCES

Christian, P.D., *et al.* 1992. *Aust. J. Zool.* 40: 291–302.

Fjeldså, J. 1976. *Vidensk. Medd. dansk. Natur. Foren.* 139: 179–243.

—— 1977. *Guide to the Young of European Precocial Birds.* Scarv Nature Productions, Tisvildeleje.

Glenny, F.H. 1955. *Proc. US natn. Mus.* 103 (3346): 525–621.

Jehl, J.L., Jr. 1968. *Mem. San Diego Soc. nat. Hist.* 3.

Mayr, E., & D. Amadon. 1951. *Am. Mus. Novit.* 1496.

Mickevich, M.F., & L.R. Parenti. 1980. *Syst. Zool.* 29: 108–113.

Olson, S.L., & A. Feduccia. 1981. *Smithson. Contrib. Zool.* 323: 1–24.

——, & D.W. Steadman. 1981. *Smithson. Contrib. Zool.* 337: 1–25.

Sibley, C.G., & J.E. Ahlquist. 1990. *Phylogeny and Classification of Birds of the World.* Yale Univ. Press, New Haven.

——, & B.L. Monroe. 1990. *Distribution and Taxonomy of the Birds of the World.* Yale Univ. Press; New Haven.

——, *et al.* 1988. *Auk* 105: 409–423.

Strauch, J.G., Jr. 1978. *Trans. zool. Soc. Lond.* 34: 263–345.

Family LARIDAE   skuas, jaegers, gulls and terns

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

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

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

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

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

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

---

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

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

Plate 23

Oriental Pratincole *Glareola maldivarum* (page 366)
1 Adult breeding;   **2** Adult non-breeding;   **3** Juvenile;
4, 5 Adult

Australian Pratincole *Stiltia isabella* (page 373)
6 Adult;   **7** Downy young;   **8** Juvenile;
9 First immature non-breeding;
10, 11 Adult

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

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

See subfamily accounts for summaries of social organization and breeding.

REFERENCES

AOU. 1983. *Check-list of North American Birds*. Am. Orn. Union, Lawrence, Kansas.
Campbell, B., & E. Lack. 1985. *A Dictionary of Birds*. Poyser, Calton, England.
Christian, P.D., *et al.* 1992. *Aust. J. Zool.* 40: 225–33.
Christidis, L., & W.E. Boles. 1994. *RAOU Monogr.* 2.
Chu, P.C. 1995. *Condor* 97: 174–96.
Fjeldså, J. 1977. *Guide to the Young of European Precocial Birds*. Skarv Nature Publs, Strandgården, Tisvildileje.
Hackett, S.J. 1989. *Condor* 91: 73–90.
Judin, K.A. 1965. *Fauna USSR, Aves. Ser. 1, 2*, ns 91. Acad. Sci., Moscow & Leningrad.
Mayr, E., & D. Amadon. 1951. *Am. Mus. Novit.* 1496.

Mickevich, M.F., & L.R. Parenti. 1980. *Syst. Zool.* 29: 108–13.
Moynihan, M. 1959. *Am. Mus. Novit.* 1928.
Schnell, G.D. 1970a. *Syst. Zool.* 19: 35–57.
—— 1970b. *Syst. Zool.* 19: 264–302.
Sibley, C.G., & J.E. Ahlquist. 1990. *Phylogeny and Classification of Birds*. Yale University Press, New Haven.
——, & B.L. Monroe Jr. 1990. *Distribution and Taxonomy of Birds of the World*. Yale University Press, New Haven.
——, *et al.* 1988. *Auk* 105: 409–23.
Strauch Jr, J.G. 1978. *Trans. zool. Soc. Lond.* 34: 263–345.
Wetmore, A. 1960. *Smithson. Misc. Coll.* 139 (II): 1–37.
Zusi, R.L. 1962. *Publ. Nuttall orn. Club* 3.

Subfamily **LARINAE** gulls

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

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

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

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

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

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

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

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

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

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

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

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

REFERENCES

Barth, E.K. 1968. Nytt. Mag. Zool 15 (Suppl. 1).
Campbell, B., & E. Lack. 1985. A Dictionary of Birds. Poyser, Calton, England.
Christidis, L., & W.E. Boles. 1994. RAOU Monogr. 2.
Devillers, P. 1977. Gerfaut 67: 171–200
—— 1982. Gerfaut 72: 1–41.
Dwight, J. 1925. Bull. Am. Mus. nat. Hist. 52: 63–401.
Fjeldså, J. 1977. Guide to the Young of European Precocial Birds. Skarv Nature Publs, Strandgården, Tisvildileje.
Grant, P.J. 1986. Gulls: A Guide to Identification. Second edn; Poyser, Calton, England.
Ingolfsson, A. 1969. Auk 86: 732–7.
Johnstone, R.E. 1982. Rec. West Aust. Mus. 10: 133–65.
Kinsky, F.C. 1963. Rec. Dominion Mus 4: 149–219.
Mierauskas, P., et al. 1991. Acta Orn. Litu 4: 3–26.

Moynihan, M. 1959. Am. Mus. Novit. 1928.
—— 1962. Behav. Suppl. 8: 1–365.
Nicholls, C.A. 1974. Aust. J. Zool. 22: 71–89.
Nicolau-Guillaumet, P. 1977. Alauda 45: 53–73.
Sibley, C.G., & B.L. Monroe Jr. 1990. Distribution and Taxonomy of Birds of the World. Yale University Press, Yale, New Haven.
Smith, N.G. 1966. AOU orn. Monogr. 4.
Snell, R.R. 1989. Colonial Waterbirds 12: 12–23.
Stresemann, E., & V. Stresemann. 1966. J. Orn., Lpz. 107 (Sonderheft).
Tinbergen, N. 1953. The Herring Gull's World. Collins, Lond.
—— 1959. Behaviour 15: 1–70.
White, C.M.N. 1965. A Revised Checklist of African Non-passerine Birds. Lusaka.
Wolters, H.E. 1975. Die Vogelarten der Erde. 1. Hamburg.

Larus novaehollandiae   **Silver Gull**

Larus Novæ-Hollandiæ Stephens, 1826, in Shaw's *Gen. Zool.* 13 (1): 196 — New South Wales.

The specific name is a modern coinage for New Holland (*Nova Hollandia*), the name by which western Australia was known to Europeans for two centuries after its discovery and which gradually attached itself to the whole continent.

OTHER ENGLISH NAMES Red-billed Gull (NZ); Red-legged, Mackerel, Kitty and Jameson's Gull or Sea-Pigeon; Seagull; Jackie.

POLYTYPIC Nominate *novaehollandiae* Aust. (including Tas.); subspecies *scopulinus* Forster, 1844, NZ and Chatham, Snares, Auckland and Campbell Is. Extralimitally, subspecies *forsteri* (Mathews, 1912), New Caledonia and sw. Pacific Ocean.

FIELD IDENTIFICATION   Length 36–44 cm; wingspan 91–96 cm; weight 265–315 g. Familiar small gull, with slim body, short slender bill, sloping forehead, narrow wings, and short to medium-length legs. Very similar in size and general shape to Black-billed Gull *Larus bulleri* of NZ but slightly bulkier, with shorter, stouter bill, less sloping forehead and more rounded head, and slightly shorter wings, giving less attenuated rear-end at rest. Adult readily identified by bright

red bill and legs, and distinctive pattern of upperwing. Sexes alike. Slight seasonal variation in colour and pattern of bare parts. Juvenile and immatures separable.

Description Adult breeding Head, neck, rump, tail and underbody, white, occasionally with faint pink wash on breast and flanks. Saddle, pale grey. Upperwing distinctive: pale grey, with prominent white wedge along leading-edge, extending from carpal onto bases of outer primaries, and black wing-tip (extending narrowly along trailing-edge of outer primaries) with prominent white mirrors on outer two or three primaries; also have indistinct white trailing-edge to secondaries and inner primaries and small white tips to outer primaries (often reduced or lost with wear). Extent of black and white at wing-tip varies much (see Plumages). Below, axillaries and leading secondary coverts, white, grading to pale grey on rest of lining; secondaries and inner primaries, off-white and partly translucent, grading to grey-black wing-tip with translucent white mirrors. Bill, orbital ring, legs and feet, bright red. Iris, white. **Adult non-breeding** As adult breeding except: red of bare parts can be slightly duller, and bill usually has diffuse dull-black subterminal marks; white tips of outer primaries fresh. **Juvenile** Differ from adult by: varying faint brown smudge in front of eye and brown wash over crown, nape and ear-coverts (soon lost with wear) and pale-grey wash on lower hindneck and sides of neck; some have diffuse narrow brown half-collar (soon lost with wear). Saddle, tertials and secondary coverts, pale grey, mottled dark-brown on mantle, and with prominent, coarsely patterned dark-brown markings on scapulars, tertials and most coverts. In flight, upperwing appears strongly patterned: secondary coverts, pale grey, with broad dark-brown carpal bar; outerwing similar to adult, but with brown tips to primary coverts and smaller white mirrors, so that black wing-tip appears larger (sometimes have dark-brown patch at alula); black near tips of inner primaries joins with blackish secondary bar, bordered by narrow white trailing-edge. Rump and tail, white, with, in Aust., narrow dark-brown subterminal band or spots on tail (rarely so in NZ). Underwing as adult except dark secondary bar and dark of inner primaries show through, and narrow white trailing-edge and white mirrors translucent. Bill, dull black, with brown at base; some have varying pink tinge. Iris, dark brown to black. Orbital ring, dull black. Legs and feet, pink-grey to pink-brown. **First immature non-breeding** As juvenile except: head and neck, white. Saddle, pale grey; brown areas on wings and tail, worn and faded paler, with white scaling of coverts and tips of remiges and tail reduced. Bill, paler brown (rarely, pale pink) with black tip and cutting edges to mandibles. Legs and feet, paler brown. **First immature breeding** As first immature non-breeding except: dark areas of wings and tail more worn and faded, with pale scaling and tips much reduced or lost; many or all secondary coverts and tertials, new, pale grey; and some or all rectrices, new, white as adult. Exceptionally, most or all secondaries, new, pale grey as adult, leaving worn and faded juvenile outerwing. Bill varies: as first immature non-breeding, to brownish orange or red, always with black tip and cutting edges. Iris starts to turn pale, light brown to grey-white. Orbital ring varies, dull black to dull orange. Legs and feet match bill. **Second immature non-breeding** As adult except bare parts duller: bill varies: duller orange-red with black tip and cutting edges, to slightly duller orange-red with dusky subterminal band. Iris typically duller, grey-white or off-white. Orbital ring varies, dull black to orange-red. Legs and feet match bill, slightly duller and more orange-red than adult; often have dark-grey webs.

Similar species In NZ, often confused with **Black-billed Gull**, which is very similar in size but has slightly slimmer, more attenuated shape, with: (1) longer, finer, more pointed bill; (2) slightly longer neck and smaller head, with flatter forehead and higher crown-peak just behind eye; (3) slightly longer wings that extend farther beyond tip of tail at rest to give more attenuated rear-end; wings also appear more pointed at tips. ADULTS easily distinguished by: (1) black bill and black or dark reddish-black legs and feet; (2) slightly paler, more silvery-grey upperparts in direct comparison; (3) different upperwing-pattern, with prominent white wedge along leading-edge of outerwing and narrow black trailing-edge to outer primaries; (4) unbroken white leading-edge to wing from head-on (interrupted by black at wing-tip on Silver); (5) different underwing-pattern: black wing-tip bordered by narrow white leading-edge continuous with long white ends of outer two primaries. Juveniles and immatures at rest most often confused. JUVENILES: Black-billed differs by: (1) prominent dark-grey patch in front of eye, wash over crown and spot on ear-coverts (on Silver Gull, markings fainter and browner, often absent); (2) upperparts: slightly paler, silvery grey, with spotted appearance to saddle and uniformly dark-grey lower hindneck and mantle; (3) secondary coverts appear mostly pale grey, with only narrow dark cubital bar, often hidden by scapulars (in Silver Gull, secondary coverts much more strongly patterned, matching general pattern of upperparts); (4) bill, pale pink with dusky tip; legs and feet, pale pink; (5) very different upperwing-pattern, with prominent white wedge along leading-edge; narrower black secondary bar and band of black on inner primaries, with broader area of white behind; and paler narrower and much less prominent carpal bar across secondary coverts; (6) tail, white, with only indistinct smudgy brown tips to central few; (7) tip of underwing differs much as for adults. FIRST IMMATURE NON-BREEDING: best distinguished by structure and bare parts: bill, legs and feet, pale pink, with contrasting black tip to bill, and dusky joints and webs to legs and feet (Silver Gull has much darker brown base to bill and brown legs and feet without dark joints); also differs by: (1) indistinct grey smudge in front of eye and, on some, grey spot on ear-coverts and pale-grey wash on hindneck; (2) same differences in wing-coverts as for juvenile; and, in flight, same differences in wing- and tail-patterns as for juvenile.

Common, tame, and familiar small gull of coasts and inland. Gregarious, often feeding or roosting in large flocks of hundreds or thousands. Inhabit wide variety of coastal habitats and inland wetlands; also on farmland, where follow plough. Noisy and conspicuous. Opportunistic scavenger, well adapted to urban living, scavenging for food wherever it can be found; frequent playing fields, parks and gardens, airfields, car parks, rubbish dumps, sewage farms and saltfields; commute to large communal roosts in evening. Follow ships and fishing vessels, sometimes well out to sea, but normally remain in sheltered inshore waters. Flight actions varied; compared to larger gulls, more buoyant, with lighter wing-beats and greater agility when manoeuvring. Normal flight unhurried and direct, with easy shallow wing-beats interspersed with glides; more fluttering when picking food from surface of water. When relaxed, carriage usually semi-upright; more upright when alert, with head held up on long neck. Gait free, with brisk walk and fast run. Noisy; commonest call loud harsh grating squeal *kwarr* or *kwe-aarrr*; also frantic rapid yelping notes.

HABITAT   In Aust.: coasts, ocean beaches, sheltered embayments, harbours, inlets and estuaries; on land, in urban

and developed areas; lakes, terrestrial wetlands and agricultural regions; also regularly at some sites in highlands or arid interior. At sea, usually inshore; occasionally in neritic zone; rarely .16 km from coast. In NZ, mostly coastal; far less often inland (Norris 1967; Milledge 1977).

Of 1421 records of Gulls off se. Aust.: 34% over continental shelf, 64% over continental slope and 2% over open oceanic water (Aust. Seabird Atlas); if records in May (when many were observed over continental slope off Sydney) excluded, 94% records over continental shelf-waters (Aust. Seabird Atlas). Off Wollongong, NSW, during winter, may occur well beyond continental shelf, but in Sept.–Apr., generally <10 km from shore (Brandis et al. 1991; Wood 1991). On several voyages off NSW, only one record >4.8 km from shore (Norris 1967). In WA, not seen beyond continental shelf (Dunlop et al. 1988b). In Cook Str., rarely recorded >8 km from shore (Bartle 1974).

Occur on sandy, coralline or rocky coastal beaches and on nearby reefs, rock platforms, mudflats, banks and shoals; also frequent near-coastal wetlands, such as estuaries, lagoons, saltmarsh, dune-lakes and saltworks (e.g. Pegler 1983). Farther inland, inhabit permanent wetlands, such as lakes, weirs and reservoirs; also floodplains, swamps and billabongs; and farmland, especially under cultivation. In arid interior, also occur round permanent waters, such as L. Moondarra and Menindee Ls (Horton 1975); and fresh and saline, generally shallow, ephemeral wetlands (Morgan 1931; Badman 1979, 1989; Gibson 1986; Dawson 1989; NSW Bird Rep. 1989). Attracted to floodwaters (Badman 1989); sometimes seen far from water in deserts after light rain (Badman 1979).

Recorded at high altitudes, round subalpine tarns and marshy lakes (Sharland 1956; Fielding 1983). At Great L., on Tas. Central Plateau, bred upon islands; when Lake froze, Gulls retreated to partly frozen creeks nearby, returning to Lake when thaw began (Fielding 1983). One individual recorded alighting on snow of ski-field (Schulz 1991).

When breeding, prefer islands: either offshore islands, of rock, coral, shingle or sand (including cays, rock stacks, reefs and banks), or in lakes, saltponds or floodwaters, and including piles of soil, rocks, rubbish, or tree-stumps surrounded by water, and artificial sites, such as piles, boats and jetties (Gurr & Kinsky 1965; *Corella Seabird Is Ser.*). On mainland, nest on headlands, rocky outcrops, cliffs, spits, promontories and beaches. On terrestrial wetlands, usually nest on islands, islets, and occasionally tree-stumps; sometimes on embankments at edge of wetland (Hobbs 1961; Wheeler & Watson 1963). In NZ, breed on silica spits, islets and rocky margins of inland geothermal lakes on Volcanic Plateau, once within 1 m of 'steaming sulphur-encrusted fumarole' (Phillips & Lindsay 1947; Falla 1949; Reid & Reid 1965; Gurr 1967). In NZ, breeding colonies usually near ocean features that bring plankton to sea-surface, such as troughs and upwellings (Mills 1969). Recorded nesting with Black-billed Gulls on Charwell R., 14.5 km from sea and 600–900 m asl (Cowie 1977). Often nest on artificial structures (see Breeding). Nests can be almost at high-water mark. Nest in open, on sand, gravel, shingle or rock; or among vegetation, mainly clumps of grass, low shrubs or mats of succulents, including introduced weeds (MacGillivray 1928; Wheeler & Watson 1963; van Tets 1977; *Corella Seabird Is Ser.*); occasionally beneath dense shrubs (Storr 1964; Meathrel 1990; CSN 9) or grass; more rarely, among trees, such as *Pisonia* and *Pandanus* (Walker & Hulsman 1993). On Campbell and South East Is, nest in caves and rock clefts, in shallow coastal caves or under large boulders (Wright

1963; Nilsson et al. 1994). Colonies of Silver Gulls can change habitats on breeding islands. On Five Is, NSW, Kikuyu Grass *Pennisetum clandestinum* thought to have been introduced by Gulls as nesting material and, after being fertilized by their droppings, has almost entirely covered Big I., with thick runners forming an almost impenetrable barrier to burrowing seabirds (Smith 1992). On granite islands off coast of Gippsland, guano-tolerant plants such as *Disphyma crassifolium*, *Carpobrotus rossii* and *Lepidium foliosum* have become dominant (Gillham 1962). On Mud Is, the eradication of rabbits has allowed dense regrowth of shrubs and weeds, creating more habitat suitable for Gulls (Menkhorst et al. 1988). Populations breeding on islands in swamp decreased when islands revegetated with trees and shrubs; highest breeding densities recorded beneath shrubs, lowest densities in bare areas beneath trees (Kentish 1994).

On land, feed from ground. Attracted to sites of human refuse on land and at sea, especially rubbish tips; also sewage outlets, shipping, fishing fleets and processing plants, fish markets and groups of people in urban situations (e.g. Storr & Johnstone 1988). Most often seen foraging in rubbish tips and anywhere scraps may be found, including city streets, schools, shopping centres, parks, picnic and sporting grounds, factories and processing plants (Gibson 1979; Storr & Johnstone 1988); commonly fed by people. Feed in agricultural land, foraging behind ploughs and occasionally grass-slashers (Bull 1941–42; Hodgkins 1949; Hobbs 1961; Wheeler & Watson 1963; Gurr 1967; Taylor 1987); sometimes forage in short-grassed areas, such as parks, sports grounds, airfields and paddocks, especially if water-logged; also seen foraging in recently burnt grass (Favaloro 1948; Wheeler & Watson 1963; Storr 1964; van Tets 1969a,b; Smith & Carlile 1992a). When feeding on intertidal beaches, forage on sand or in clumps of beachcast seaweed (Gurr 1954; Sharland 1956; Storr & Johnstone 1988). Sometimes forage in shallow water (≤5 cm deep); sometimes in moist sand after waves recede, on wet mudflats or reefs exposed at low tide; or in shallow lagoons, pools and floodwaters (Symon 1938; Learmonth 1958; Wheeler & Watson 1963; Loyn 1975; Woodall 1986; Walker 1988). Forage at sea, close inshore and round breakers, following schools of fish (Keast 1943; D'Ombrain 1954; Learmonth 1958; Wodzicki 1962; Wheeler & Watson 1963; Bartle 1974; Walker 1988; Smith et al. 1991); sometimes feed farther out to sea, especially if following boats (Hindwood 1955; Wheeler & Watson 1963; Milledge 1977; Storr & Johnstone 1988; Brandis et al. 1991; Wood 1991). In deeper water, take food from, or a few centimetres below, surface of water, either while swimming or flying close to water (Wheeler & Watson 1963; Storr 1964; Woodall 1986; Wood 1991); rarely, dive to depths of c. 30 cm (Wheeler & Watson 1963). In NZ, often favour lee shores for foraging (Mills 1969). May feed at seabird colonies on islands or reefs (Wheeler & Watson 1963; Storr & Johnstone 1988; Walker 1988; Oliver). Occasionally recorded feeding aerially, usually on swarming insects, or insects attracted to lights (Watt 1951; Gurr 1954; Russell 1957; Hobbs 1961; Wheeler & Watson 1963; Storr 1964; Green 1966; Baird & Nix 1979; Leishman 1982; Ashton 1985; Storr & Johnstone 1988; Tarburton 1991; Oliver), occasionally soaring to 100 m. Also catch, in mid-air, scraps thrown to them (Wood 1991). Rarely, alight in bushes to feed (Tindale 1938; Hemmings 1988). On Snares Is, feed beneath dense canopy of *Olearia* forest, near penguin colonies (Warham 1967). During adverse weather, may feed in unlikely places: during a hot spell, seen foraging with domestic fowl, and during gales, forced to forage inland among spinifex (Wheeler & Watson 1963).

Roost and loaf on sandy intertidal beaches, mudflats, exposed banks of sand and mud, spits, wave-cut rock platforms and rocky islets (D'Ombrain 1954; van Tets 1969b; Pegler 1983; Peter 1990; Smith & Carlile 1992a); round margins of wetlands or floodwaters, either on dry ground or in shallow water up to 5 cm deep or on floating mat of waterweed (Favaloro 1948; Storr 1964; Clarke 1966; van Tets 1969b; Ross 1978; Pegler 1983); also edges of man-made waterbodies, such as dams, and settling, drainage or saltponds (Wheeler & Watson 1963; van Tets 1969a; ACT Atlas); occasionally in mangroves (Smith & Carlile 1992a); on open ground such as lawns and urban malls (ACT Atlas). Often on artificial structures, such as piers and jetties, oyster racks, pipelines, pylons, telegraph and light poles, boats, swimming enclosures and buildings (Wheeler & Watson 1963; Smith & Carlile 1992a; G.C. Smith). On Snares Is, seen perched in trees (Warham 1967).

Flooding (for hydro-electricity) or burning of breeding islands have caused Gulls to desert colonies (Wheeler & Watson 1963; Fielding 1983). In an attempt to reduce the incidence of bird-strikes, habitats round airports have been modified to make them less attractive to Gulls (van Tets 1969b). Gulls once observed using a thermal air-current emanating from a steel foundry to gain height (de Rebeira 1973).

DISTRIBUTION AND POPULATION Widespread Aust. and NZ, most outlying islands of NZ (not Antipodes Is; Warham & Bell 1979) and New Caledonia (Delacour 1966). Occasional visitor to Norfolk and Lord Howe Is and s. New Guinea, mostly round n. Torres Str. and w. Gulf of Papua; once at Port Moresby (Coates 1985). Vagrant to Vanuatu (Bregulla 1992). Reports from Marquesas and Society Is in nineteenth century, possibly in error (Pratt et al. 1987). Several escaped from Honolulu Zoo in 1924, but did not survive (Long 1981).

Aust. Qld Widespread along entire coast, and most offshore islands, extending N to Bramble Cay in n. Torres Str.; also inland throughout e. and central regions, W to centres such as Georgetown, Richmond, Longreach and Charleville. Scattered records farther W, especially in Cooper Ck Drainage Basin (Qld Bird Reps; Aust. Atlas). **NSW, Vic., Tas.** Throughout and on offshore islands; mainly on coasts, but also widespread in many inland districts (Thomas 1979; NSW Bird Reps; Tas. Bird Reps; Vic. Atlas; Aust. Atlas); also in w. Tasman Sea and Bass Str. (Aust. Seabird Atlas). **SA** Widespread along entire coast, and throughout most of e. half, E of line from Streaky Bay to Arckaringa HS. Only Aust. Atlas record in NW is from the NW Aboriginal Reserve (Aust. Atlas). **WA** Entire coast. Throughout SW, including many inland areas; sparsely scattered records in Goldfields region, bounded to the E by Kalgoorlie and Leonora, and to the N by L. Violet and Meekatharra. In Pilbara, recorded inland at Newman and round Telfer Gold Mine, and occasionally inland, well upstream in rivers of the Kimberley. In Western Deserts Region, N of 30°S, recorded at L. Gregory, King's Knob, Pass of the Abencerrages and Gunnadorah Stn (Storr 1985, 1987; Jaensch et al. 1988; Corella Seabird Is Ser.; Aust. Atlas). **NT** Throughout coastal Top End and w. Gulf of Carpentaria. Aust. Atlas shows scattered records in most regions, from Victoria R. region, E to n. Barkly Tableland, and S to Simpson Desert and L. Amadeus (Aust. Atlas).

NZ NI Widespread most of Auckland Isthmus and Coromandel Pen.; elsewhere, throughout all coastal regions, but more sparsely from mouth of Rangetikei R., N to Opunake. Recorded inland at Ls Rotorua and Taupo; elsewhere, recorded sporadically at scattered inland locations. **SI** Most widespread in Nelson and Marlborough, but recorded throughout most coastal regions of Canterbury, Otago and Southland; on West Coast, most records from between Milford Sound and mouth of Cook R., and N from Hokitika, with scattered records elsewhere along coast. Several isolated inland records in Canterbury and Otago (NZ Atlas; CSN).

Norfolk I. Irregular visitor. A few present for a few years till 1967 (Hermes et al. 1986), including: single, Apr. 1961 (Wakelin 1968); single, 2 Oct. 1962 (Anon. 1963); and four, Mar. 1965 (Wakelin 1968). Subsequent records: single, Feb. 1973 (de Ravin 1975); 2–3, Mar. 1978 (Moore 1981); c. 11, 1979 or 1980 (Hermes et al. 1986); five, 9 Sept. 1982 (Moore 1985); single (Philip I.), 1983; two, 6 Mar.–5 July 1983; single (Philip I.), 1985; 1–3, Mar.–21 June 1985 (Hermes et al. 1986). One pair said to have bred on Philip I., late 1967 (Turner et al. 1968).

Lord Howe I. (Singles unless stated.) Unknown number before 1939 (Hindwood 1940); Apr. 1939 (Hindwood 1940); Sept.–Oct. 1940; specimen, Nov. 1945 (Hindwood & Cunningham 1950); 1954 (McKean & Hindwood 1965); 25 Nov. 1971, 18 Jan. 1972 (NSW Bird Reps 1971, 1972); unknown number, after 1975 (Hutton 1991); 12 Nov. 1992 (NSW Bird Rep. 1992).

Kermadec Is Several unconfirmed records (Wright 1963; Sorensen 1964; Merton 1970).

Chatham Is Breeding (Fleming 1939a; Nilsson et al. 1994).

Snares, Auckland and Campbell Is Breeding.

Bounty Is Status not known (Darby 1970; Robertson & van Tets 1982).

Breeding Aust. Wheeler & Watson (1963) summarized colonies and listed 151 sites. Of 222 islands surveyed in Corella Seabird Is Ser., Silver Gulls recorded breeding on 109. Breed Wellesley Is, se. Gulf of Carpentaria (Walker 1992) and widespread ne. coast and adjacent islands, from Torres Str. to Low Isles. Widespread on coast from Holbourne I., Qld, to Tas. and W to Eyre Pen., SA. In Great Aust. Bight, only recorded at e. and w. ends. Widespread on coast from Arch. of the Recherche to Bernier I., Shark Bay; also on several islands off Pilbara coast. Recorded in NT at Round Haul I. and Melville Bay (Storr 1977) and, possibly, Sir Edward Pellew Is (Schodde 1976). Common on subcoastal plains of many regions and many colonies in Murray–Darling Basin and L. Eyre Drainage Basin, and at other inland sites, including L. Moondarra, L. Bancannia and Wagga Wagga Stn (Corella Seabird Is Ser.; Aust. NRS; Aust. Atlas). Some breeding colonies containing ≥1000 nests or pairs (pairs unless stated) include: NSW: Big I., 43,000–50,000 (Smith & Carlile 1992a); Montagu I., 700–800 in 1988–90, though 5000–10,000 in 1973 (Fullagar 1973; P. Straw); Moon I., 3000 (P. Straw; contra NSW Bird Rep. 1988); Bass I., 2000 (Lane 1979); Mourquong Evaporation Basin, 1000 (NSW Bird Rep. 1990); Martin I., 1000 (Lane 1979). VIC: Mud Is, 40,000–50,000 (Menkhorst et al. 1988). TAS.: Egg I., near Devonport, 5000–8000 birds (Skira & Wapstra 1990); Christmas I., King I., c. 1000 (McGarvie & Templeton 1974); Inglis R., Wynyard, 'thousands' (Tas. Bird Rep.). SA: Troubridge I., c. 10,000 (Lashmar 1987); L. Eyre N., 4477 nests (Kingsford & Porter 1992); L. Torrens, c. 1200 nests (Bellchambers & Carpenter 1990); Trevarrow I., c. 1000 nests (SA Bird Rep. 1964). WA: Penguin I.: 4000–5000 (Meathrel 1990), 2500–3500 (Dunlop et al. 1988a); Green I., Oyster Harbour, 4000–5000 (Abbott 1978); Carnac I., 3000–4000 (Wooller & Dunlop 1979; Dunlop & Storr 1981); Rottnest I., c. 1000 (Storr 1976). In Qld and NT, no colonies of more than
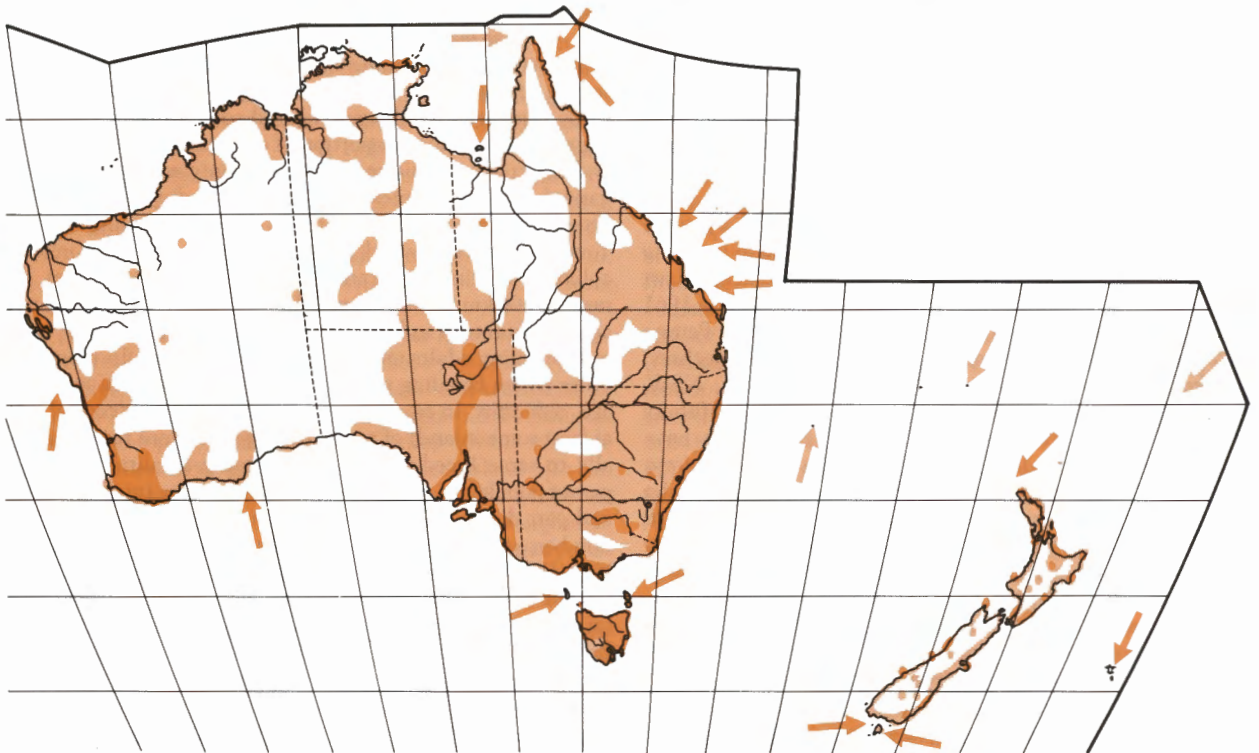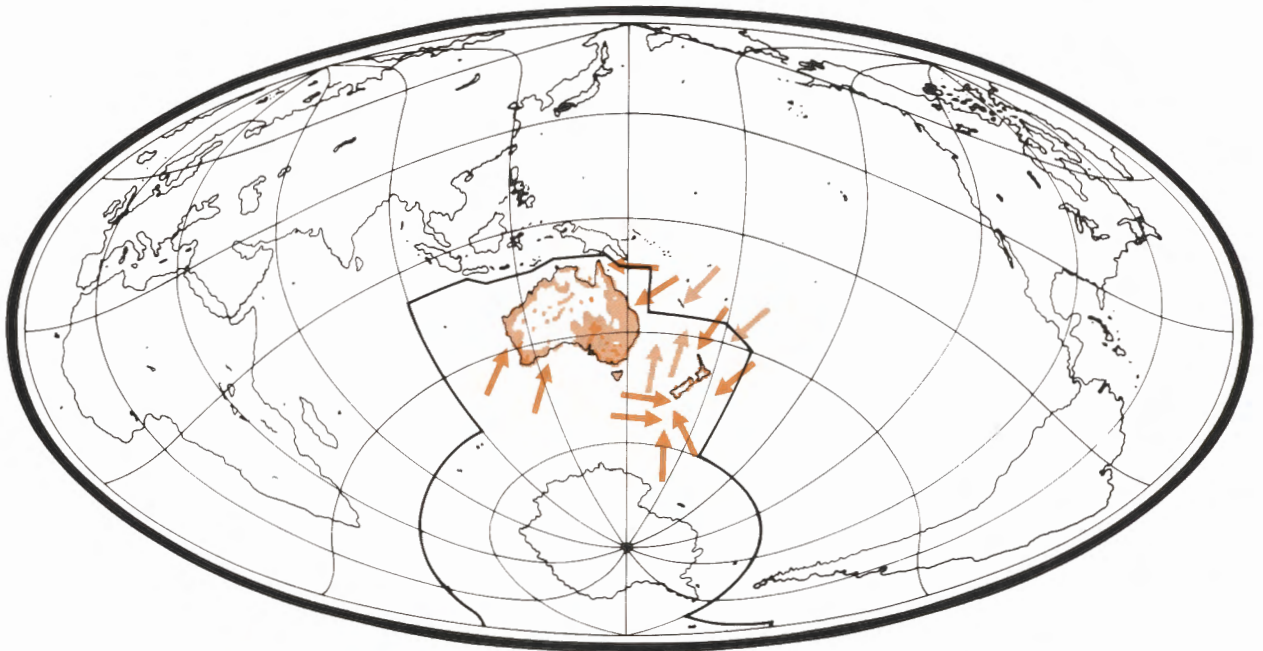
1000; largest colonies in Qld are on Capricorn and Bunker Grps, including Wreck I. (≥110 pairs), Masthead I. (≥60 pairs), and Tryon I. (≥60 pairs) with the largest of more n. colonies generally <50 pairs (King 1993). **NZ** Gurr & Kinsky (1965) summarized known colonies and listed 166 sites. **NI** Mostly along coasts and nearshore islands, from Three Kings Is to se. Bay of Plenty, mainly on e. coast of Auckland Isthmus; scattered sites on East Coast and Hawke's Bay, at Motuoroi I., Moutara Pt, Portland I. and Porangahau. Widespread coasts of Wairarapa and Wellington, between Mataikora and Kapiti I.

Recorded breeding inland at Kohukohu, L. Rotorua and Arikikapakapa (Reid & Reid 1965; Cowan 1967; CSN 9). **SI** Breed Farewell Spit, Tasman Bay and Marlborough Sounds, S to L. Grassmere; coast of Kaikoura; Banks and Otago Pens; Bluff Pt; scattered in Southland, Invercargill, islands of Foveaux Str., including Centre, Solander and Stewart Is and Preservation Inlet and Blanket Bay; sparsely scattered sites on West Coast (Gurr & Kinsky 1965; CSN). Some sites in NZ that have had ≥500 nests or pairs (from Gurr & Kinsky 1965, and pairs unless stated) are: Burgess I., 6500; now only c. 450

(Hemmings 1988); Three Kings Is, c. 6000; Kaikoura Pen., c. 6000; Nugget Pt, c. 2000; Nelson Boulder Bank, c. 1200 nests (CSN 35); Gull Rock, Goose Bay, ≥7000; Taiharuru Rock, 600–700; Kapiti I., 550; Tokohaki Trig, 550 (Powlesland & Robertson 1987); Tiwhapaua Trig, 550 (Powlesland & Robertson 1987); Poor Knights Is, ≥550; Stephens I., ≥500; Bird I., ≥500; The Brothers, ≥500; Forsythe I., 500 nests (CSN 8); Cuvier I., 500 (Reed 1976); Kuaotunu, c. 500.

Populations Larger colonies listed above. Indices of relative abundance from annual aerial surveys (transect counts) of wetlands in c. 12% of land area of e. Aust., Oct. 1983–92 (Braithwaite et al. 1985a,b, 1986, 1987; Kingsford et al. 1988, 1989, 1990, 1991, 1992, 1993, 1994) were: 20,390; 49,359; 8911; 7074; 4991; 9977; 9561; 19,795; 7686; 5785; 3804. In sw. WA, 1981–85, recorded on 58 of 197 wetlands surveyed (Jaensch et al. 1988).

Obtain much food from human sources (see Food) and increases in human population have led to a substantial increase in range and numbers of Gulls, especially round urban centres. For example, in 1940 on Big I., near Wollongong, only a few pairs nested; by 1962, numbers had increased to 17,800 pairs; between 43,000 and 50,000 pairs now breed there (Keast 1943; Gibson 1976; Smith & Carlile 1992a) and this number appears to be stable (P. Straw). Similarly on Mud Is, Vic., when nesting first recorded in 1959, five pairs bred; by 1986, 40,000–50,000 pairs bred there (Menkhorst et al. 1988). Many other breeding colonies near urban centres have exhibited similar trends. Numbers at some Qld resorts (such as on Capricorn and Bunker Grps and Lizard I.) have also increased markedly (Walker 1988, 1991; Smith 1991a). Numbers at some remote islands have increased after the establishment of factories processing fish and turtles (Walker 1988; Skira & Wapstra 1990). On Pelsaert I., Houtman Abrolhos, WA, numbers have remained stable (Fuller & Burbidge 1992). At some colonies, populations decreased: a marked decline in breeding population on Kapiti I. has caused numbers on adjacent coast between Ohau and Otaki Rs to fall from 10.6 birds/km in 1961 to 3.5/km in 1986 (Powlesland & Robertson 1987); at Petone in Wellington Harbour, numbers also appear to have declined (Secker 1954a,b; Robertson 1992); on Montagu I., NSW, marked decline possibly a result of crash in commercial fishery (P. Straw & A. Townsend). On Farewell Spit, Gulls have virtually stopped breeding since Australasian Gannets *Morus serrator* colonized site (Hawkins 1988); at Nelson Boulder Bank, numbers increased from 67 pairs in 1943–44 to c. 2000 pairs in 1972–73, then fell to 900 pairs by 1980, possibly because numbers of Kelp Gulls *Larus dominicanus* increased (Owen & Sell 1985). Numbers on Wright and Egg Is, Tas., reduced from 2000 pairs in 1966 to <600 pairs in 1970, after reduction program for air-traffic safety (van Tets 1977).

Have benefitted greatly from establishment of rubbish tips and other waste-disposal sites; at Five Is, NSW, 82% of food derived from human sources, mainly from rubbish-tips (Smith et al. 1991). Scavenge wherever scraps, offal or refuse available. Benefit from fishing industries, congregating round fish-processing factories (Skira & Wapstra 1990), following fishing boats and fishing parties (e.g. Abbott 1976; Stranger 1992), and eat offal discarded by fishermen (Harrison 1970). May become tangled in fishing-line (Lane 1979) or other twine (Wheeler & Watson 1963). In some areas, increased numbers have become a problem. Round airports, a hazard to aircraft, with 158+ bird-strikes recorded at Sydney Airport between 1981 and 1989. May also be a road hazard in some areas. Water supplies can be contaminated by excreta; they are

also agents for human enteric diseases. Efforts to control numbers of Gulls include: covering previously exposed household refuse; poisoning with alpha-chloralose (on Egg I., Tas., 7272 dead birds collected after four such culls); destruction of eggs; scaring devices; hallucinogens; and adversely modifying environments (van Tets 1969b; van Tets et al. 1969; Skira & Wapstra 1990; Smith 1992; Smith & Carlile 1993b). At colonies, chicks and eggs eaten by introduced predators, such as foxes, rats and Stoats *Mustela erminea*, with some colonies destroyed by predation (Wheeler & Watson 1963; Reid & Reid 1965; Morris 1976). Said not to nest on North West I., Capricorn Grp, because cats present (Walker 1988). People sometimes steal eggs or kill chicks and eggs (Favaloro 1948; Reid & Reid 1965; Cooper 1975); occasionally shot (NSW Bird Rep. 1982). Sometimes eaten by Maori (Sibson 1992).

MOVEMENTS Movements vary: partly migratory, partly dispersive, partly resident and partly sedentary; young apparently more mobile than adults (see Carrick 1972). Three subspecies, two breeding HANZAB region: nominate *novaehollandiae* breeds Aust. and recorded Tasman Sea and Norfolk I.; may be this subspecies common in Torres Str., and visitor to PNG. Subspecies *scopulinus* breeds NZ and reported from Norfolk I. (Wheeler & Watson 1963; Falla et al. 1981; Draffan et al. 1983; Coates 1985; Schodde et al. 1988; Aust. Seabird Atlas.).

Birds at many colonies have regular seasonal patterns of movements, though some breeding occurs irregularly in response to favourable conditions (Wheeler & Watson 1963). Birds disperse from all regularly used colonies between breeding seasons. Usually, proportion of sedentary and mobile birds and direction and distance of movements stable within, but varies between, colonies. Generally, partly dispersive, with all ages occurring throughout range in non-breeding season. Younger birds recovered farther from colonies, e.g. in Tas. colonies, maximum distance of adult recovery 280 km, cf. nearly 1600 km for immature (Thomas 1967). Most immatures apparently return to breed at natal colony, when 2 or 3 years old. Breeding adults mostly faithful to colonies. In most colonies where breeding regular, some birds, mostly of breeding age, sedentary. In se. Aust., many breeding birds (coastal and at least some inland) of well-studied populations return annually to same breeding and non-breeding localities. Usually, part of population of inland colonies sedentary (mostly adults) and part dispersive at all seasons; at some inland sites, large numbers of birds present throughout year, e.g. L. Boga, nw. Vic. (Favaloro 1948). Movement strategies apparently related to habitat, with few sites in se. Aust. with habitat suitable both for breeding and non-breeding (Murray & Carrick 1964; see Banding).

Extent of dispersal varies between colonies (e.g. Murray & Carrick 1964) and between regions, e.g. in WA, more of population sedentary than elsewhere in Aust., with banding records and geographical variation indicating local movement up to only c. 200 km along coast (Johnstone 1982). Main direction of dispersal also varies between colonies, e.g. most young of two main breeding islands in NSW disperse to N, whereas young from Port Phillip Bay, Vic., disperse in all directions (Murray & Carrick 1964). Timing of arrival and departure from colonies, and breeding season varies between colonies and between years (see below).

Can make long local movements between feeding and roosting sites (see van Tets 1969a), e.g. sometimes make round trip between Sydney and Wollongong within 1 day (Smith &

Carlile 1992b). Fly by day and night (Keast 1943); birds moving around Port Phillip Bay, Vic., recorded flying *c.* 40 km/h (Sheedy 1989); fly long distances over open water, e.g. *c.* 45 km (Walker 1988), and occasionally recorded well offshore (D.W. Eades; T. Montague); commonly move between islands (e.g. King *et al.* 1992) and between islands and mainland coasts (e.g. Walker 1989); recorded using regular flyways (Smith & Carlile 1992b). Maximum local movements at dawn and dusk, and before and after low tides (van Tets 1969a; Hulsman 1977b).

Departure In se. and e. Aust., birds in populations that breed spring–summer leave colonies when breeding complete, e.g. at Altona, Vic., adults and young mainly leave Nov. (Wheeler & Watson 1963); on Montagu I., NSW, most young leave by end Jan. (Fullagar 1973). Corresponding influx to non-breeding areas, e.g. at Mascot, NSW, adults return with young in second half Nov. (van Tets 1968). Breed during dry season in n. Aust.; at Darwin, NT (which is non-breeding area), numbers low in June, then increase to Oct. (McKean 1981). On islands off sw. WA (breeding protracted, from autumn to spring) little dispersal of adults during summer months after breeding (see Dunlop 1986). At some inland sites, breeding stops when habitat dries (e.g. at Naracoorte, SA, Wheeler & Watson 1963). In NZ (spring and summer breeding) leave breeding colonies in summer, e.g. leave colonies on Kaikoura Pen. by mid-Jan. (Mills 1973), though some leave later (e.g. Moncrieff 1928). N. movement from big breeding colonies at Kaikoura and Nelson Haven, SI, coincides with sudden increase in numbers in non-breeding areas in Wellington, NI, in Mar.; and, sometimes, along w. coast (Powlesland & Robertson 1987; Robertson 1992). Approximate time of arrival at Napier from breeding areas, late Feb., with high numbers recorded Apr. (CSN 38, 39); in Auckland district, arrive non-breeding areas, Feb.–Apr. (Bull 1941–42). In NZ, some apparently move inland for non-breeding period, e.g. influx to L. Rotorua, by end May, assumed to be birds from coast (Black 1955).

Non-breeding Many adults stay near breeding colonies in non-breeding season, inland and on coast; on Carnac I., sw. Aust., high proportion (88%; n=40) of band-recoveries of adults (1977–80) within 40 km, mostly from nearby Swan R. estuary (Dunlop & Storr 1981; see Dunlop 1986). At some island colonies, most apparently remain near island all year, e.g. on South Fisherman I., WA (Johnstone 1978). However, move away from some breeding sites, e.g. at Burgess I., Mokohinau, NZ, Penguin I., SA (Fleming 1946; Ottaway *et al.* 1988) with few remaining at some colonies (e.g. Big I., NSW, Smith *et al.* 1992a). Numbers at non-breeding sites highest during this period: on Heron I. (non-breeding site) numbers highest during winter and lowest during summer (Walker 1988); at Darwin, NT (non-breeding) numbers highest in Oct. (McKean 1981). Numbers in non-breeding sites may vary between years (e.g. Officer 1958). In se. Aust., immatures and adults from different breeding sites mix in non-breeding range (Murray & Carrick 1964). At least some breeding adults move to same non-breeding sites in successive years, and sightings of marked birds in se. Aust. indicate some adults stay at one non-breeding site for non-breeding period (Carrick & Murray 1970).

Movements and abundance often affected by changes in availability of food. Inland, birds more abundant and localized where food supply constant, and recorded leaving inland area when dry conditions reduced availability of food; populations move in response to temporary shortage or abundance of food, and influxes sometimes recorded in areas where food abundant

(Favaloro 1948; Wheeler & Watson 1963; Storr 1964; Carrick 1972).

In some inland areas, occurrence irregular, influenced by weather, e.g. recorded arriving at temporary floodwaters formed by heavy rainfall during previous night (Hobbs 1961). Weather also apparently influences extent of movement to and from interior: in WA, generally coastal, but recorded inland after cyclones or gales (Carter 1904; Masters & Milhinch 1974; Johnstone 1982), and some breeding >200 km inland in wet year (Fuller 1963); inland, can be abundant during flood years (Wheeler & Watson 1963) but fewer recorded during dry periods (e.g. Berney 1907). Observed moving up Georgina R. from Gulf of Carpentaria when inland wet, and back along river towards Gulf of Carpentaria when inland dry (Wheeler & Watson 1963). Also, can move away from coast in rough weather (Gilbert 1939; Bull 1941–42; CSN 37). Near Melbourne, Vic., hundreds commute daily between coasts and islands up to 25–50 km inland (Aust. Atlas; Vic. Atlas). In Capricorn and Bunker Grps, movement between islands influenced by presence of people (Walker 1988).

Return Populations that breed spring–summer, generally leave non-breeding areas winter or early spring and arrive breeding colonies winter and spring. **Aust.** At Mascot, NSW, most leave for breeding grounds in second half of July (van Tets 1968). Arrive Big I., NSW, June or July (Smith & Carlile 1992a); on Montagu I., NSW, from end Aug. (Fullagar 1973); start arriving near Altona colony, Vic., May, most in July (Wheeler & Watson 1963). Numbers off Wollongong, NSW, highest May–Aug., before breeding (Wood 1991). In Sydney, proportion of immatures greatest July–Oct. when adults left area to breed; maximum proportion of juveniles, Oct.–Jan.; in Wollongong, proportion of immatures low, July–Sept., as adults moved into area to breed, with maximum proportion of juveniles, Dec. and Jan. (Smith & Carlile 1992b). In WA, where breeding season protracted (recorded all months of year, see Breeding), re-occupy breeding colonies on Carnac I. in Mar., on Lancelin I. in June (Wooller & Dunlop 1979; J.N. Dunlop), and as late as Oct. in some new colonies on Rottnest I. (Dunlop 1986). In NT, where breeding occurs during dry season, numbers decrease at non-breeding sites in Darwin area, Mar.–Apr. to June as birds moved away to breed (McKean 1981). **NZ** At Manukau, NZ, few remain by Aug. (Bull 1941–42); apparently usually leave Napier by early Sept. (CSN 39); few present Wellington Harbour after Aug. (Robertson 1992). Arrive Kaikoura, mid-July (Mills 1973); arrive Mt Aspiring, Sept. (Moncrieff 1928). In n. NZ, possible pre-breeding assembly in Sept. and n. movement in Oct., with birds assumed to be bound for colony on Three Kings Is (Michie 1949; CSN 36).

Breeding Non-breeding areas either vacated or numbers decrease (e.g. at North West C., WA, Carter 1904); at non-breeding sites numbers lowest when Gulls breeding, e.g. Aug. to early Oct., Hunter R., NSW; July–Feb. at Porangahau East, NZ; June in Darwin, NT (Gosper 1981; McKean 1981; CSN 38). At foraging sites used by breeding birds, maximum numbers in breeding season, e.g. Sept.–Dec. at Whytes Gully, NSW (Smith & Carlile 1993a). At suitable sites, breed in one area for many years; at other sites, breeding irregular (Wheeler & Watson 1963; S.G. Lane 1975). At some inland sites, breed when conditions suitable, e.g. L. Eyre. Recorded breeding at nearby lakes when original colony was flooded for some years (Wheeler & Watson 1963; Murray & Carrick 1964). Overall, high fidelity of birds to site of colony. At Kaikoura, searches of colony revealed <1% of birds emigrate and little immigration

from other colonies (Mills 1973). However, fidelity to colonies varies greatly between areas and said to be lower at colonies in varying environments, i.e. those that are physically unstable, and at marginal breeding areas in unreliable feeding habitats (Ottaway *et al.* 1988). Lower fidelity also observed at Big I., NSW, possibly because much intraspecific competition for food (Smith *et al.* 1992a). Colonies may also shift between islands in successive years (Keast 1943) and new breeding colonies sometimes established (e.g. at Altona, Vic., Wheeler & Watson 1963).

Dispersal of young Disperse in first year (though many stay near site of natal colony), then, in subsequent years, gradually move closer to natal colony. Few 1-year-olds recorded at colonies (e.g. Gurr 1953; Ottaway *et al.* 1988). Some do not return to colonies for first few years, and appear not to make seasonal movements till adult, e.g. in NSW, second- and third-year birds remain away from colonies in breeding and non-breeding seasons, but fourth-year birds and older move seasonally between breeding colonies and non-breeding areas (Murray & Carrick 1964). Some immatures return to colonies earlier; recorded returning to natal site in non-breeding season, even moving back and forth along coast in first 2 years (Carrick & Murray 1970).

Dispersal of young in se. Aust. well known. At Port Phillip Bay, Vic., though most adults and young stay within *c.* 80 km, first-year birds disperse rapidly, with recoveries from Jan. at coastal and inland sites in Vic., SA, NSW and Tas.; normally do not remain widely dispersed for >2 years, though several third-year birds recovered in Qld before returning to near natal site (Murray & Carrick 1964; Johnstone 1982; ABBBS 1966, 1989a,b). Young from Five Is and Montagu I. cross to mainland from Dec., then disperse, mainly to N, by Feb. or Mar.; in autumn and winter, recorded to Qld, and also inland NSW, Vic. and Tas. Average distance N in first summer, 400 km (up to 800 km); few move S, up to 370 km. After first winter, no recoveries farther than 400 km, with most recoveries and observations within 80 km of colony; one recovered inland NT, though movements nearly entirely coastal (Murray & Carrick 1964; Johnstone 1982). In SA, some young apparently sedentary at coastal colonies near suitable habitat; others disperse up to *c.* 320 km around Spencer Gulf and Gulf St Vincent; distant dispersal in first 2 years mainly to E, but also to inland SA and n. coast of NSW (Murray & Carrick 1964). In Tas., birds banded as chicks slowly dispersed from colonies, then moved closer to natal colony before next breeding season; up to fourth winter, 40–50% of young recovered within 40 km of natal colony (based on 323 recoveries throughout years but uneven distribution between age-classes) (Thomas 1967); others move to SA, Vic. and NSW. By fourth year, all recoveries except one (on n. side of Bass Str.) were in Tas., some near natal colony (Murray & Carrick 1964). Young from inland colonies in NSW, Vic. and SA disperse in all directions to inland and coast; 3-year-old birds recovered at natal site and breeding (or during breeding season) in Port Phillip Bay, Vic., and Qld. At inland colonies in s. Vic., some fledgelings stay round inland lakes, while others disperse, up to 1600 km from colonies, most move to Port Phillip Bay and some then move farther; others return to natal colonies and apparently make annual movements between breeding and non-breeding locations (Murray & Carrick 1964).

In WA, young do not disperse as far as in e. Aust. Young banded on islands off Perth moved up to *c.* 220 km; three young observed on Rottnest I. for 5 months (Carrick *et al.* 1957; Storr 1976). Dispersal from Qld colonies poorly known;

chicks banded Capricorn and Bunker Grps recorded Heron I., where food abundant, within months of banding (Walker 1988). Nestling banded One Tree I., 5 Jan. 1980, found dead on mainland 800 km NW, late Dec. 1980 (ABBBS 1982). After breeding, most disperse from Kaikoura Pen., NZ, and usually found within 380 km (Mills 1989). Juveniles begin to arrive on Hen and Chicken Is, after mid-Dec. (Skegg 1964).

Banding, Colour-marking Substantial. Longest recorded movement of bird banded as chick: 3256 km; longest recorded movement of bird banded as juvenile, 2186 km; longest recorded movement of bird banded as adult 2144 km (ABBBS). Recoveries indicate that many birds from some colonies (e.g. in Port Phillip Bay, Vic.) sedentary; some recovered, sighted and bred close to natal area (Murray & Carrick 1964).

Fidelity to natal colony varies between areas. On Kaikoura Pen., NZ, average 42% of birds that survived to breed (n=116) did so at natal colony (Mills 1973). In 1970, 80% of 2-year-olds recorded at colonies in SA were only recorded at natal colony, though, for some marginal colonies, possible that >50% of birds that eventually breed will do so at colonies other than natal (Ottaway *et al.* 1988); of 106 banded as fledgelings at Boulder Bank, Nelson, NZ, eleven 2-year-olds bred at site of natal colony (Gurr 1953). In NSW, individuals return to breed at natal colony, though some instances of birds at other colonies; one third-year bird recorded near Tas. colony in Oct. Four banded L. Thurrumbong, Vic., recorded breeding at Fishermans Bend, Port Phillip Bay, 125 km away (Murray & Carrick 1964). Other exceptions to natal site-fidelity include: birds hatched L. Grassmere, NZ, recovered breeding 88 km S at Kaikoura Pen. (Mills 1973); of 45 pulli banded on Penguin I., SA, and later found breeding, 18% bred at different colonies 3, 10 and 24 km from natal colony (Ottaway *et al.* 1988). Some banded Carnac I., WA, bred in other colonies, up to 130 km from natal colony (Wooller & Dunlop 1979). On Big I., NSW, 69% of wing-tagged adults (n=125) returned to colony in next season, though only 33% bred. Of birds colour-banded at Big I., NSW, in 1988–89 (n=79), 33% trapped or sighted in subsequent two breeding seasons, though only 15% bred (Smith *et al.* 1992a). Of breeders marked on Carnac I., WA, in 1977 and caught in 1978 (n=76), 93% in same area (Wooller & Dunlop 1979); of breeders banded in SA colonies (n=33–90 in different colonies in different years), 7–44% were found breeding in subsequent years at other colonies, with lowest fidelity at marginal site (Ottaway *et al.* 1988).

Birds banded and recovered as adults indicate that some move long distances. Adults banded Qld recovered S along e. coast and in Tas. Adults banded NSW moved N and S (ABBBS 1966, 1972, 1989a). One colour-banded Kaikoura, NZ, 10 Nov. 1980, seen New Plymouth, NI, 10 June 1988 (CSN 37). One band originally placed on Silver Gull, recovered on Rock Dove (Feral Pigeon) *Columba livia* (van Tets & Bywater 1967).

FOOD Opportunistic scavengers; semi-commensal on human domestic and industrial organic waste; some are pelagic planktivores. **Behaviour** Mainly diurnal (Storr 1964); when food abundant, may forage at night or in evening, e.g. during plague of crickets, or when prey attracted to lights (Watt 1951; Hanks 1957; Simpson 1957; Brown 1982; Paltridge 1988; Smith 1991b; Tarburton 1991). Gregarious when feeding. Mainly seen running and picking up food on beaches, rubbish dumps, wharves, footpaths, and where fed by people, sometimes catching food thrown to them on wing; sight of Gull with food will attract all other Gulls close by (Wheeler & Watson 1963). **Predation** Use wide variety of foraging methods.

HAWKING: Gather in large numbers (up to *c*. 3000 birds), to hawk for insects, flying to heights of 100 m or more (Green 1966). When hawking mantids, may knock them into water before capturing them (Hulsman 1974); also take swarming flying ants and other insects on wing (Wheeler 1948; Storr 1964; Bedggood 1965; B. Lane 1975; Wheeler 1975; Corrick 1977; McMillan 1977; CSN 38). Drive cicadas from ngaio *Myoporum* bushes to capture them (Sandager 1889). Reported taking small Shore Plover *Thinornis novaeseelandiae* young and swallowing them whole in flight (Fleming 1939b). FEEDING ON GROUND: Feed in flooded paddocks for grubs and worms (Dove 1919b; Wheeler & Watson 1963; Green 1969; CSN 30). Foot-tremble in soft substrates to bring food to surface (Symon 1938; Wheeler & Watson 1963; Dawson 1966; Collins & Collins 1976, 1981). Take sea lice (isopods) from beachcast fish (Simpson 1977). Follow plough, picking up animals turned up by blades (Favaloro 1948; Wheeler & Watson 1963; Carrick & Murray 1964). Search recently burnt country for dead insects and reptiles (Storr 1964). Feed where propellers of ships graze mudbanks in shallow channels (Carrick & Murray 1964). FEEDING IN OR OVER WATER: Dipping: hover over water or mud, occasionally dipping down to pick prey from surface; sometimes settle briefly (Wheeler & Watson 1963; Brown 1982). May also feed like skimmers *Rynchops*, flying with lower mandible immersed in water (Egan 1990). Surface-seizing: swim on saltlakes, taking brine-shrimp from just below surface (Wheeler & Watson 1963; Storr 1964). Foot-paddling: while floating, use feet to bring food to just below surface, then seize prey (Wheeler & Watson 1963). Float down tidal channels, surface-seizing, then fly back upstream and repeat process (Buchanan 1983). Dive up to 30 cm below water from heights of 2–4 m in pursuit of fish (Wheeler & Watson 1963; CSN 24). Manipulate fish in bill before swallowing, e.g. poisonous blowfish (Tetraodontidae) can be mandibulated for 5–10 min and 'test-swallowed' a number of times; kneading believed to deflate air-sack. Largest blowfish swallowed, 13.2 cm long (Stranger 1970), though Serventy (1957) suggests this prey unpalatable. Take crabs by dipping head into shallow water or jumping out of water and taking shallow dive (M'Clymont 1906). Will dive underwater to take fish from nets (Cole 1908). EGGS AND YOUNG: Take exposed, freshly laid eggs of turtles and Short-tailed Shearwaters *Puffinus tenuirostris* (MacGillivray 1917; Perryman 1937; Limpus 1973). Loggerhead Turtle *Caretta caretta* hatchlings taken as they cross beach to edge of water (Limpus 1973). Patrol nesting colonies of Banded Stilt *Cladorhynchus leucocephalus* for unguarded eggs and chicks (Robinson & Minton 1989). Rob cormorant nests, dropping eggs from air onto rocks to break them (Littler 1910). Detailed study of nest-robbing in Hulsman (1976, 1977a, 1984) and Smith (1991a). On One Tree I., Qld, use six methods to take eggs and young from nesting terns: (1) Stand-off: stand beside nest till occupant moves off; (2) Bulldoze: charge at occupant and force it off nest; (3) Charge-balk: charge at occupant, which rises, exposing eggs, which are then taken; (4) Forcing off nest: dive onto nest from,2 m above, forcing occupant off; (5) Balk: Gull dives at occupant then pulls out of dive and is chased by occupant, leaving nest exposed; (6) Exposed: Gull swoops on already exposed nest. In all cases egg or young taken from colony to be eaten. All methods used against Black-naped Tern *Sterna sumatrana*; only methods 1, 2, 4 and 6 against Roseate Tern *S. dougallii*; only methods 1 and 6 were successful against Crested Terns *S. bergii*; eggs and young of Lesser Crested Tern *S. bengalensis* were only taken after nesting failure. Effects of predation varied between species and location (Hulsman 1977a). **Scavenging** Take beachcast insects (Roberts 1952) and birds (Wheeler & Watson 1963). Take placental remains of fur-seals *Arctocephalus* and have even been recorded placing head inside vagina to feed on umbilical cords (Stirling *et al.* 1970). Attracted to sewage outfalls (Hindwood 1955). **Associations when feeding** Hunt co-operatively over water; fly in small groups low over shallow water, with feet, and occasionally wing-tips, just touching surface (Blackburn 1962). Observed to co-operate to hunt young of hybrid Mallard x Pacific Black Duck, taking entire brood (Haddon 1987). One bird pulled incubating Little Tern *S. albifrons* off nest, then, with eight other Gulls, ate eggs (Egan 1990). Cannibalize eggs and young (Sutherland 1951; Wheeler & Watson 1963). INTERSPECIFIC ASSOCIATIONS: Hover over cormorants driving schooling fish in lake, taking fish injured and driven to surface (Carruthers 1969). Observed to co-operate with herons, pelicans and cormorants to drive fish into shallows (Stranger 1969); take mullet and crustaceans driven to surface by other predators, e.g. Buller's Shearwater *Puffinus bulleri* (Oliver 1922; Falla 1924; Turbott & Bull 1954; Stonehouse 1965). Associate with Bottle-nosed Dolphins *Tursiops truncatus* that are feeding by stunning fish with their tails in mangroves; Gulls occasionally take stunned fish before Dolphins get them (Bossley & Boord 1991). **Kleptoparastism** Steal or attempt to steal from: Australasian Gannets (NZRD); Black-faced Cormorants *Phalacrocorax fuscescens* (Littler 1910; Swindells 1915); Little Egret *Egretta garzetta* (Jenkins 1962; Sibson *et al.* 1962); oystercatchers *Haematopus* (Weston 1992); Pied Oystercatchers *H. longirostris* (Dann 1979); Wrybill *Anarhynchus frontalis* (Keeley 1985); Eastern Curlew *Numenius madagascariensis*; Bar-tailed Godwit *Limosa lapponica*; Curlew Sandpiper *Calidris ferruginea* (Dann 1979); Crested Tern (Stirling *et al.* 1970; Hulsman 1976, 1977a, 1984; Smith 1991a); Black-naped, Lesser Crested and Roseate Terns (Hulsman 1976, 1977a); White-fronted Tern *S. striata* (NZRD) and Australian Pelican *Pelecanus conspicillatus* (HASB); sometimes sit on back of Pelicans while they feed and fly forward when they make a catch (photo in Simpson 1972; Weston 1992); also said to steal from other Silver Gulls. Seem to choose size and species of fish taken from Crested Terns (for detailed analysis see Hulsman 1984). Recognize head-waving display that precedes regurgitation in fur-seals, and wait to scavenge (Stirling *et al.* 1970). **Other methods** Often take fruits, especially *Leucopogon parviflorus* (Boehm 1955) and leaves (Jackson & Palliser 1979). Observed taking fallen fruit from Canary Island Palm (J.M. Peter). Those nesting on offshore islands or near shelf-breaks may specialize in feeding on planktonic crustaceans (Le Souëf 1926; HASB), and colonies may be positioned near oceanographic features that cause crustaceans to swarm (Mills 1969). Timing of breeding at Altona, s. Vic., possibly coincides with abundance of brine shrimp. Drink salt and fresh water (Wheeler & Watson 1963; Carrick & Murray 1964).

Adults At Aust. airports (307 stomachs; van Tets *et al.* 1977): **Plants** MONOCOTYLEDONS: Iridaceae: *Romulea rosea* corms 0.3% freq.; Juncaceae: *Juncus* sds 0.7; Poaceae: lvs 6.5; *Avena sativa* sds 0.3; *Lolium perenne* sds 0.3; *Panicum* sds 0.3; *Poa* sds 1.6; *P. annua* sds 0.7.; *Sorghum halapense* lvs 0.3; *Triticum aestivum* lvs 0.3; DICOTYLEDONS: unident. lvs 0.3; Polygonaceae: *Polygonum* sds 0.3; Asteraceae: *Arctotheca calendula* sds 0.3; Caryophyllaceae: *Stellaria* sds 0.3; Fabaceae: *Trifolium* lvs 0.7, sds 1.0; *T. glomeratum* sds 0.3; *T. repens* sds 0.3; *T. subterraneum* sds 0.3; Papaveraceae: *Papaver* sds 0.7; Portulacaceae: *Portulaca* sds 0.3; Rosaceae: *Rubus* sds 0.3; Solanaceae: *Solanum* sds 0.7.

Animals ANNELIDS: polychaetes: Amphinomidae: *Eurythoe complanata* 0.3; oligochaetes 7.8: Lumbricidae 0.7; MOLLUSCS 13.0: gastropods 0.3: Littorinidae: *Melaraphe unifasciata* 0.3; Naticidae: *Poliices aulacoglossa* 0.3; bivalves 2.6: Arcidae: *Anadara trapezia* 0.3; Veneridae 0.3; CRUSTACEANS: isopods 0.3: Limnoridae: *Limnoria* 0.3; crabs 2.0: Mictyridae: *Mictyris longicarpus* 0.3; ARACHNIDS: scorpions 0.3; spiders 2.3; INSECTS: Blattodea: Blattidae 2.6; Isoptera: wingless termites 0.3; Rhinotermitidae: *Coptotermes* 0.3; Mantodea: Mantidae 0.3; Dermaptera 2.9: Forficulidae; *Forficula auricularia* 1.0; Labiduridae: *Labidura riparia* 0.3; Orthoptera: Gryllidae 1.0; Gryllotalpidae: *Gryllotalpa australis* 0.3; Acrididae 0.7; Hemiptera: Reduviidae 0.3; Pentatomidae 0.7; Coleoptera: Carabidae: ads 3.9; *Clivina* 0.3; *Carenum* 0.3; Dytiscidae: 1.0; Lucanidae 0.3; Scarabaeidae: larv. 0.7, ads 8.1; *Anoplognathus* 0.3; *Heteronychus arator* 0.3; Elateridae ads 0.7; Tenebrionidae ads 1.3; Chrysomelidae 0.3; Curculionidae: 6.5; Diptera: ads 1.0, maggots 1.6; Syrphidae: *Eristalis tenax* 0.3; Muscidae larv. 0.7; Calliphoridae: *Calliphora* larv. 0.3; Lepidoptera: larv. 2.9; Noctuidae: pupae 0.3, ads 4.6; Hymenoptera: Ichneumonidae 0.3; Braconidae 0.3; Formicidae: winged ants 3.3; wingless ants 10.7; *Camponotus*: winged 0.3, wingless 1.6; *Iridomyrmex* winged 2.9, wingless 4.2; *I. purpureus* 0.3. FISH 4.2; FROGS 1.0; BIRDS 1.0; MAMMALS 0.3. Offal: cooked meat 1.6; raw meat 12.7; fat 5.9; fragments of bone 3.9. Refuse: peanuts 0.3; grape sds; apple fragments 1.3; passionfruit sds 0.3; bread 11.4; chicken egg-shell 2.9; paper 6.8; plastic 1.6; string 0.7; silver foil 1.6; charcoal 2.9; metal 1.0; glass 0.7; grit 21.5. At **Aust. airports** (27 stomachs; van Tets *et al.* 1969): ARACHNIDS: spiders 18.5% freq.; INSECTS: Blattodea: Blattidae 11.1; Dermaptera: Forficulidae 29.6; Orthoptera: Gryllidae 3.7; Gryllotalpidae 3.7; Hemiptera: indet. 7.4; Reduviidae 3.7; Pentatomidae 7.4; Coleoptera: indet. 3.7; Carabidae 11.1; Scarabaeidae 33.3; Curculionidae 22.2; Lepidoptera 7.4; Hymenoptera: Formicidae 40.7.

On **Big I., Five Is, NSW** (467 regurgitations in two breeding seasons; most collected from adults, some from young; Smith & Carlile 1993): Human refuse 85% no. (of total regurgigates); natural food 13; mixed 2. Human refuse included: meat, processed seafood, vegetables, starch-based foods (e.g. bread, deserts, potato chips, and cotton wads). Natural food items: CRUSTACEANS: copepods; amphipods: Vibiliidae; Hyperiidea: *Cyllopus*; euphausids; decapods: Penaeidae; Palaemonidae; crabs: Portunidae; ARACHNIDS: Araneae; INSECTS: Odonata: Lestidae: *Austrolestes leda*; Corduliidae: *Hemicordulia tau*; Orthoptera: Gryllotalpidae: *Gryllotalpa*; Hemiptera; Cicadellidae; Pentatomidae: *Morbora*; Notonectidae; Coleoptera: Curculionidae; Scarabaeidae: *Heteranychus*; Staphylinoidae; Diptera: Coelopidae: *Chaetocoelopa sydneyensis*; Syrphidae; Tachinidae; Tipulidae; Lepidoptera: Noctuidae: *Agrotis*; Hymenoptera: Halictidae; Formicidae. FISH: Atherinidae; Carangidae: *Decapterus*; *Trachurus*; Clupeidae; Gobiidae: *Pseudogobius*; Labridae; Percidae; Syngnathidae. REPTILES: skinks: *Lampropholis delicata*.

At **L. Cowal, NSW** (9 stomachs; Vestjens 1977): CRUSTACEANS: freshwater crayfish: Parastacidae: *Cherax* 1 stomach freq.; Arachnids: spiders 1; Insects: Dermaptera: Forficulidae 1; Orthoptera: Gryllidae 1; Coleoptera: Dytiscidae 5; Diptera 1; Hymenoptera: Formicidae 2; Fish: Percidae: *Perca fluviatilis* 3; Cyprinidae: *Carassius auratus* 3.

On **One Tree I., Qld** (Hulsman 1984): FISH (in descending order of importance): Tetraodontidae: *Arothron stellatus*; Monacanthidae: *Monacanthus filicauda*; Scombridae; Gobiidae; Blenniidae; Exocoetidae; Carangidae; Labridae; Pomacentridae; Scaridae.

Other records Algae Seaweed (FAB). **Plants** Vegetable matter, water weeds and seeds (Lea & Gray); Aizoaceae: *Tetragonia* sds; Araliaceae: *Meryta sinclarii* fruits (Buddle 1951); Chenopodiaceae: *Rhagodia* sds (HASB); Epacridaceae: *Leucopogon parviflorus* fruits (Tindale 1928, 1938; Anderson 1938; Bransbury 1980; Allen 1990; Hurley 1990; Robbins 1990; Lea & Gray; FAB); Fabaceae: *Trifolium* sds, lvs (FAB); Myoporaceae: *Myoporum laetum* unripe fruits (Hemmings 1988); Oxalidaceae: *Oxalis corniculata* (FAB); Rosaceae: strawberry *Fragaria* (Boehm 1955); Rubiaceae: *Coprosma repens* fruits (Oliver); Salicaceae: willow *Salix* lvs (Jackson & Palliser 1979). **Animals** Grubs (Dove 1919b; Wheeler & Watson 1963). CNIDARIANS: hydrozoans: Vellelidae: *Velella velella* (CSN 39). ANNELIDS (Dove 1919b; Favaloro 1948; Wheeler & Watson 1963; Smith *et al.* 1991): polychaetes (Dawson 1966; Hall 1974; Keeley 1985): Nereidae: *Nereis* (FAB); oligochaetes: Lumbricidae (FAB); *Lumbricus* (T. Saunders). MOLLUSCS (Meathrel 1991b; FAB): gastropods: Littorinidae: *Bembicium*; bivalves: Arcidae: *Anadara trapezia*; Veneridae; Donacidae (FAB); cephalopods: squid (Smith *et al.* 1991). CRUSTACEANS (D'Ombrain 1936; Collins & Collins 1981; Dann 1984; Smith 1991a, 1993): barnacles: Lepadidae: *Lepas australis*; ostracods; notostracans: Triopodidae: *Triops* (FAB); anostracans: Artemidae: *Artemia* (Storr 1964; Wear & Haslett 1987); *A. salina* (HASB); Thamnocephalidae: *Branchinella australiensis* (Wheeler & Watson 1963); isopods (Meathrel 1991b; FAB); sea lice (Simpson 1977); cumaceans: Bodotriidae: *Gephyrocuma*; amphipods: Exoediocerotidae: *Exoediceros*, *Urohautorius* (Symon 1938); Caprellidae: *Caprella* (FAB); Hyperiidae: *Euthemisto gaudichaudi* (HASB); Hyalidae: *Allorchestes compressa* (Dunlop 1986); euphausids: Euphausiidae krill (CSN 25, 38): *Nyctiphanes australis* (Mills 1967, 1969); decapods: shrimps (Le Souëf 1926): Alpheidae: *Alpheus euphrosyne* (Dann 1984); Penaeidae: *Metapenaeus macleayi* (FAB); crabs (M'Clymont 1906; Meathrel 1991b): Portunidae: *Portunus pelagicus* (Stranger 1970); Ocypodidae: *Macrophthalmus laterfrons* (Dann 1979). ARACHNIDS: scorpions; spiders: Dictynidae; Lycosidae; Pisauridae (FAB). INSECTS (Favaloro 1948; Roberts 1952; Wheeler & Watson 1963; B. Lane 1975; Smith *et al.* 1991; Tarburton 1991): Ephemeroptera nymphs; Odonata: Coenagrionidae: *Ischnura heterosticta*; Blattodea: Blaberidae: *Calolampra irrorata*; Isoptera: Termitidae: *Amitermes*; Mantodea: Mantidae (Hulsman 1974); Dermaptera: Labiduridae: *Apachyus australis*; Forficulidae: *Forficula auricularia*; Plecoptera (FAB); Orthoptera: grasshoppers (Anon. 1926; Wheeler & Watson 1963; Green 1969); nymphs (Favaloro 1948); Tettigoniidae (FAB); Gryllidae (Moncrieff 1928; Watt 1951; Wheeler & Watson 1963): *Teleogryllus commodus* (Tarburton 1991); Gryllotalpidae: *Gryllotalpa australis*; Hemiptera: pupae (Meathrel 1991b); Cydnidae; Pentatomidae (FAB); Cicadidae (Sandager 1889; Buddle 1951); *Melampsalta cingulata* (Turbott & Bull 1954); Belostomatidae: *Diplonychus rusticus*; Corixidae; Neuroptera: Chrysopidae: *Chrysopa* (FAB); Coleoptera (Carter 1904; FAB): Carabidae: *Clivina*; Dytiscidae: *Homeodytes scutellaris* (FAB); Hydrophilidae: *Nectosoma penicillatum*, *Philhydrus* (Lea & Gray); *Hydobius assimilis* (Simpson 1957; FAB); Staphylinidae (Meathrel 1991b; FAB); Scarabaeidae: *Aphodius*, *Heteronyx* (FAB); *Pyronota edwardsii* (Brown 1982); Elateridae (FAB); Cantharidae: *Chaulignathus pulchellus* (Corrick 1977); Dermestidae: larv.; Coccinellidae: *Coccinella tranversalis*; Tenebrionidae; Anthicidae; Cerambycidae; Chrysomelidae (FAB): *Navomorpha sulcatus* (Brown 1982); Curculionidae (Meathrel 1991b; FAB); Diptera (CSN 36): midges (CSN 38, 39); Tipulidae: larv.; Culicidae: larv., pupae

(FAB); *Culicoides* (Dunlop 1986); Chironomidae: ads, larv. (FAB); *Chironomus appositus* ads (Simpson 1957); Tabanidae: larv. (Lea & Gray); *Scaptia* ads; Stratiomyidae: larv.; *Odontomyia decipiens*; Syrphidae: *Eristalis tenax* (FAB); Coelopidae larv. (Wheeler & Watson 1963; Jenkins 1969; CSN 19); Ephydridae (Brown 1982): *Ephydra* larv., pupae; Trichoptera (FAB); Lepidoptera: larv. (Wilson 1905; Favaloro 1948; FAB); Noctuidae: *Agrotis infusa* (Smith 1991b); Oecophoridae: *Crytolechia radiosella*; Noctuidae ads, pupae; Hymenoptera ads (FAB); Formicidae (Bedggood 1965; Wheeler 1975; Meathrel 1991b): *Amphanogaster barbigula* (McMillan 1977); *Camponotus consorbrinum* (FAB); *Pheidole megacephala* (Wheeler 1948). FISH (Cole 1908; Wheeler & Watson 1963; Carruthers 1969; Stirling *et al.* 1970; Stranger 1970; Hall 1974; Hulsman 1976; Buchanan 1983; Egan 1990; Bossley & Boord 1991; Smith 1991a, 1993; FAB): Anguillidae (FAB); Clupeidae (Smith *et al.* 1991): *Nematalosa vlamininghi* (Stranger 1970); Galaxiidae: (Wheeler & Watson 1963); Gobiidae: *Gobius bifrenatus* (FAB); Hemiramphidae: *Hemiramphus melanochir* (FAB); Mugilidae: *Mugil cephalus* (Stranger 1970); *Aldrichetta forsteri* (Oliver 1922; Stranger 1970); Percidae (Smith *et al.* 1991); Tetraodontidae: *Spheroides pleuragramma* (Stranger 1970). REPTILES: turtles: eggs (MacGillivray 1917); Loggerhead Turtle eggs and young (Limpus 1973); snakes: Elapidae (Ashton 1984). BIRDS: Eggs and young (MacGillivray 1917); Short-tailed Shearwater eggs (Perryman 1937; Stirling *et al.* 1970), young (K. Bartram); cormorant eggs and young (Mattingley 1908); Black-faced Cormorant eggs (Littler 1910); Mallard *Anas platyrhynchos* young (Wheeler & Watson 1963); hybrid Mallard x Pacific Black Duck young (Haddon 1987); Banded Stilt (Robinson & Minton 1989); Shore Plover young (Fleming 1939b; Davis 1987); Silver Gull eggs (Wheeler & Watson 1963; Smith 1992), young (Sutherland 1951; Wheeler & Watson 1963; Lowe & Lowe 1976; Smith 1992); terns eggs, young: Black-naped Tern (Hulsman 1976, 1977a; Smith 1991a), Lesser Crested Tern, Roseate Tern (Hulsman 1976, 1977a), Crested Tern (Wheeler & Watson 1963; Stirling *et al.* 1970; Hulsman 1976, 1977a; Langham & Hulsman 1986; Smith 1991a), Little Tern (Egan 1990), Fairy Tern *S. nereis* (Wheeler & Watson 1963). MAMMALS: House Mouse *Mus domesticus* (L.F. Smith). Refuse and offal (Favaloro 1948; Wheeler & Watson 1963; Carrick & Murray 1964; Storr 1964; Smith *et al.* 1991; Wood 1991): vegetables (Smith *et al.* 1991); fish offal and stranded fish (D'Ombrain 1936; Sedgewick & Sedgewick 1950; Wheeler & Watson 1963; Carrick & Murray 1964; Perry 1971; Wassenburg & Hill 1990); sewage and meat offal (Carrick & Murray 1964); chicken from refuse tips (Meathrel 1991b); bread (Wheeler & Watson 1963; Meathrel 1991b; Smith *et al.* 1991; FAB); beachcast birds (Wheeler & Watson 1963); fur-seal placentae (Stirling *et al.* 1970); cotton (Smith *et al.* 1991); foil; plastic; glass; paper (Meathrel 1991b); feathers, pebbles and grit (Lea & Gray).

Young Fed by regurgitation, taking food from bill of adult, up till 3–4 days old. Later, adults regurgitate pellets onto ground away from nest, then pass food to young. After 1 week, young begin to look for some food, though at 8–9 days fed twice in 116 min. At first mainly insects; as chicks grow, size and diversity of food increases. Drink from salty pools. Two found dead with frogs stuck in throats (Wheeler & Watson 1963); one reported to have been killed by spines of flathead (Platycephalidae) in throat (HASB).

For data from **Big I., Five Is, NSW**, see under adult food above. At **Nelson, NZ** (2 regurgitations; Gurr 1954): INSECTS: Mantodea: Mantidae: *Orthodera ministralis* ads 3% no., 22.2%

vol.; Orthoptera: Tettigoniidae: *Xiphidium semivittatum* ads 25, 33.3; Hemiptera: Cicadidae: *Melampsalta cruentata* ads 4, 16.7; others 3, 5.6 (Coleoptera: Scarabaeidae: *Pyronota edwardsii* ads 1, –; Lepidoptera: butterfly ads 1, –; Diptera: Syrphidae: *Eristalis tenax* 1, –); Calliphoridae –, 5.6 (incl. *Calliphora hortona* larv. 5, –; *C. quadrimaculatata* larv. 3, –; *C. icela* larv. 1, –). Flesh –, 16.7. **Other records** ANNELIDS: polychaetes (Wheeler & Watson 1963); oligochaetes (Smith 1991b); CRUSTACEANS (Gurr 1954; Gurr & Kinsky 1965): stomatopods: Squillidae: *Squilla* (Gillham 1962); amphipods: Talitridae: *Talitrus sylvaticus* (Wheeler & Watson 1963); euphausids: Euphausiidae: *Nyctiphanes australis* (Turbott & Bull 1954; Bell 1960); crabs; INSECTS: Odonata: Anisoptera larv.; Coleoptera: Hydrophilidae: *Hydrophilus ruficornis*; *H. parallelus*; Scarabaeidae: *Scitala sericans*; Diptera: Anthomyiidae ads, larv.; Syrphidae larv.; Tabanidae larv. (Wheeler & Watson 1963). FISH (Gurr 1954): Galaxiidae: *Galaxias* (Wheeler & Watson 1963); Platycephalidae (HASB). AMPHIBIANS: Hylidae: *Litoria aurea*. Bread and meat (Wheeler & Watson 1963).

Intake On Penguin I., WA, average weight of food in gut: males 11.2±8.1 g wet weight (n=66), females 8.4±3.8 (n=65); one stomach contained 400 *Coptotermes* termites (van Tets *et al.* 1977). Swallowed dead snake 40 cm x 1.5 cm with difficulty (Ashton 1984).

SOCIAL ORGANIZATION Well known; long-term studies at Kaikoura Pen., NZ (Mills 1973, 1989, 1990); Penguin I. and other sites in SA (Ottaway *et al.* 1988); and at Altona, Vic. (Wheeler & Watson 1963); other studies by Wooller & Dunlop (1979), Carrick & Murray (1964), and Murray & Carrick (1964). Gregarious at all times. Size of flocks and congregations varies from a few birds up to hundreds or thousands (Carrick & Murray 1964), e.g. large feeding gatherings of 2000–3000 (Wheeler & Watson 1963) and *c.* 6000 (Learmonth 1958). At Kaikoura, breeding system of population virtually closed, with little emigration or immigration during breeding season (Mills 1973); at colonies, non-breeding birds can occur in large numbers, e.g. in 1983–84, made up roughly half of population, with most being female (Mills 1989); in typical year, 51% of adult females and 86% of adult males attempt to breed (Mills 1990). In Aust. colonies, large numbers of non-breeding adults also found, though there is a marked absence of 1-year-olds (Carrick *et al.* 1957; Ottaway *et al.* 1988); in NSW, some second- and third-year birds also stay away from colonies during breeding season (Murray & Carrick 1964). On Penguin I. during 1970 season, 65.3% (n=147) of adults present in colony and known to breed in past, showed no evidence of breeding; 37.3% (n=950) of birds banded as chicks 2 years previously were present on island as non-breeders, and another 2.4% or so of these nested. At colonies, non-breeders tend to congregate on edge of colony or on exposed areas not suitable for successful nesting (Ottaway *et al.* 1988). After breeding, at Kaikoura, most birds disperse but usually found within 380 km of breeding colony (Mills 1989). At Altona, towards end of breeding, Nov.–Dec., young and adults seen in groups away from colony; after breeding, in Mar., birds scattered over range; in Apr., began returning in small groups to roost in colony late in evening; in May started to gather near breeding colony; in July, again roosted in large numbers in and round colony (Wheeler & Watson 1963). In non-breeding season in SA (Jan.–July) desert breeding colonies (Ottaway *et al.* 1988). See Movements for further details. Aggressive in all activities, but intensity varies, so distances between individuals range from close with little antagonism

(e.g. when resting and roosting in groups), to various distances maintained in different feeding situations (Wheeler & Watson 1963; Carrick & Murray 1964; Carrick 1972). Individual or pair may maintain feeding territory (Carrick 1972), or dominant birds may exert feeding rights at concentrated sources of food, such as dumps of organic refuse; the more concentrated and temporary the supply, the more vigorously birds defend food (Carrick & Murray 1964); also see Territories. May form loose associations with other species of landbirds and seabirds to exploit locally abundant food, e.g. feed with ravens *Corvus* and Australian Magpies *Gymnorhina tibicen* in newly ploughed fields (HASB); see Food.

Bonds Monogamous. Female–female pair-bonds occur; as result of males seeking extra-pair copulations, some of these pairs tend eggs that hatch (Mills 1990) (see below). At Kaikoura, 82% of pair-bonds retained between seasons and proportionally more older birds retain them; of birds that change mates, 27% have previous mate breeding in colony (Mills 1973). On average, 39% of females and 30% of males have only one breeding partner during their lives; for birds that change mates, maximum of seven mates per lifetime recorded (for both males and females) (Mills 1990). Of 89 established breeding adults banded on Penguin I., 2 years later: 79.7% returned to breed on Penguin I., 45.9% were with same mates, 1.4% with different mates, 8.1% with unknown mates, and in 24.3% mating situation was unknown; 6.8% were found on different islands, 2.7% with original mate, 1.4% with different mate, 1.4% with mates unknown, and 1.4% situation unknown. Same study found small percentage of Gulls showed high fidelity to nest-site and mate over 3–4 seasons; some changed colonies but kept same mate (Ottaway *et al*. 1988). On Five Is, NSW, mate fidelity, 22% (n=9 pairs) (Smith *et al*. 1992a). Pair-bonds at Kaikoura well studied (Mills 1973): Gulls that change mates have significantly lower breeding success than those that maintain pair-bond; 50% of those that change mates breed earlier than in previous season. Females that maintain pair-bonds breed earlier in season and lay more eggs than those that change mates, but do not have increased breeding success; delayed breeding and smaller clutch-sizes seen after change of mates believed to result from period of adjustment needed before pair function efficiently. Age of breeding partners: of 212 pairs, 68% had mates with age difference $\leqslant$1 year, and 26% of these had partners of same age; in 57% of all pairs, female older; in partners pairing for first time after change of mate, males tended to mate with females older than themselves, and in only 40% of these cases was age difference $\leqslant$1 year. Heavier females found to have more partners in lifetime than lighter females (Mills 1989). At Kaikoura, female–female pairs make up *c*. 6% of pair-bonds (Mills 1990) and, though no male usually associated with nest, about a third of eggs hatch; such females probably solicited male or were forcefully inseminated (Mills 1989). Over lifespans of 131 females, 21% paired with another female at least once; overall, 10% bred exclusively with another female and 11% bred in both male–female and female–female pairings (Mills 1990). Females with propensity for breeding in female–female pairs tend to be less successful breeders: females in female–female pairings have lower lifetime reproductive rates than those that breed only in male–female pairs (Mills 1989, 1990). **Sex-ratio** At Kaikoura, excess of females results from higher survival of females, with sex-ratio increasingly biased to females with age, and through differential survival of some cohorts before breeding. Some of the differences caused by uneven sex-ratio are that females defer maturity for longer (see below); some females

form female–female pairs; some females do not breed for long periods, for up to 16 years (Mills 1989, 1990). Mills (1989) found females bred once every 3.2 years (1.9; 66), whereas males bred once every 2.6 years (1.2; 81); for birds surviving 10 years after their first known breeding attempts, 49% of males bred in all seasons and only 4% missed three or more seasons, whereas only 16% of females bred every year and 51% missed three or more seasons. Age of first breeding at Kaikoura varies; males first breed at younger age than females: males bred as yearlings in three of 24 seasons; no female with male mate started breeding at 2 years old, though 11% of females in female–female pairs bred as 2-year-olds; in heterosexual pairs, males first breed, on average, 1.05 years before females, and by fourth year 96% of males have bred compared with 63% of females (Mills 1989). In SA, small numbers breed when 2 years old; significant breeding activity does not start until at least end of third year (Carrick 1972; Ottaway *et al*. 1988). Others have given similar estimates of age of first breeding (Carrick *et al*. 1957; Murray & Carrick 1964). In captivity, a 1-year-old female has bred (R. Carrick). At Kaikoura, when forming pair-bonds, period of adjustment possibly shorter in pairs re-forming than in those pairing for first time; pair-bonds usually re-established early Aug. (Mills 1973). At Altona, at end of autumn and start of winter, more birds than in preceding months sat in groups round banks of breeding site; display and chasing began in these groups about beginning of June, before birds started prospecting on mounds; some mated pairs seen June–July; by Aug., birds paired (Wheeler & Watson 1963). **Parental care** Both sexes build nest, incubate, and care for young (e.g. Wheeler & Watson 1963; HASB). Crèching not described, though Wheeler & Watson (1963) reported that after young left nesting colony, small groups of young often seen with one or two adults in attendance; when Favaloro (1948) disturbed one nestling, it took to water and swam away accompanied by several adults. At Kaikoura, chicks fledge at *c*. 37 days, but dependent on parents for at least 3 more weeks (Mills 1973). In Aust., young disperse from nesting area when *c*. 6 weeks old, after which parental care may stop (Carrick *et al*. 1957; Carrick & Murray 1964), or continue briefly, though some reports of successful begging by young 2–3 months old (Wheeler & Watson 1963). On Carnac I., WA, where double-brooding occurs, chicks remain on parental territory until *c*. 7 weeks old then tend to fly from territory, presumably to feed on beach, but return at different times of day, particularly at dusk; many young from early in season do not leave permanently until 10–14 weeks old, though others apparently leave earlier; some aged *c*. 13 weeks continue to beg successfully from parents on territory. Early young of season may spend longer associated with parents because adults stay at breeding grounds and hold territories for second clutches. Adult females begin courtship feeding again when first brood *c*. 6 weeks old (still apparently dependent on parents for food, and not old enough to leave territory permanently); one female resumed begging from mate, with their chick, when chick was only 3 weeks old. Sometimes females that have resumed courtship feeding, ignore, evade or show hostility towards chicks old enough to fly, while male parents feed them; one young seen to beg successfully for food from male while female was incubating second clutch (Nicholls 1974).

Breeding dispersion Territorial colonialism; often in large dense colonies; for size of colonies, see Distribution. Occasionally solitary (e.g. Wheeler & Watson 1963; Burger & Gochfeld 1987; HASB). Sometimes nest in association with other species (see Breeding). In Penguin I. colony, established

breeders (at least 4 years old) and 2-year-olds generally oc-cupied separate areas (Ottaway *et al*. 1988). Carrick (1972) noted 2-year-olds nested on edge of colony. Within colonies, breeding birds evenly dispersed, though nests can be closer than usual if neighbouring nests not in view of each other (Wheeler & Watson 1963; Carrick & Murray 1964); distance between nests also influenced by natural features, such as presence of grass or rocks (G.C. Smith). Distances between nests: on Five Is, 4048 nests/ha in 1962, and 4402 nests/ha in 1978 (Gibson 1979). At Altona, at one colony most nests on gypsum mounds, with sometimes 2–3 nests on each mound and some nests only 28 cm apart; at another colony, nests closely packed, averaging 71.4 cm between nests (n=10) and distance was apparently governed by pecking distance (Wheeler & Watson 1963). On Granite I., Corner Inlet, Vic., nests widely spaced and several metres apart (Wheeler & Watson 1963). On Troubridge I., SA., *c*. 1 nest/2 m² (over one-third of island), and 1/25 m² (over rest of island) (Lashmar 1987). On Neptune Is, SA, in one area, nests may be only 2 m apart, elsewhere widely scattered through saltbush (Stirling *et al*. 1970). Gulls often return to natal colony to breed. At Kaikoura, usually do so (Mills 1973, 1989). In se. Aust., in some areas highly philopatric, breeding adults returning to natal breeding colonies and remaining faithful to them (Carrick 1960, 1972; Murray & Carrick 1964). In SA, in 1970 over 80% of 2-year-olds at breeding colonies were at natal colonies; Ottaway *et al*. (1988) found that though there was a marked tendency to return to general area of natal colony to first breed, a signifi-cant proportion of birds may breed at colonies other than natal one in subsequent years; suggested that for some colonies (e.g. those located in marginal habitat), over 50% of birds born in colony, and that eventually breed, may do so at colonies other than natal colony. Also see Movements; for further details of site-fidelity, see Breeding. **Territories** PAIRING TERRITORIES: Serve as meeting places for members of pairs and where pre-liminaries of courtship performed without interference; at least some pairing territories separate from nesting territories, or extensions of them; abandoned once pair formed and nest-building starts. On Montagu I., NSW, held on area of open rock; not so clearly defined as nesting territories (Carrick & Murray 1964). At Altona, in July, birds defended small areas separate from nesting mounds and, during early stages of nest-ing, some mounds were neutral territory where 3–4 unmated birds congregated, apparently to display (Wheeler & Watson 1963). In NZ, on Porangahua R., NI, courtship and mating occurred on special display ground 30–40 m away from nest-site (Cunningham & Wodzicki 1948). NESTING TERRITORIES: At Altona in July, mounds later used for nesting were visited by birds, causing some aggression, but mounds not defended (though some mated pairs already started establishing territ-ories in June); after 1–2 weeks of visiting mounds, pairs were defending individual mounds. Size of territory varied: early in season, whole mound defended, but as number of nesting birds increased, mounds held two and occasionally three nests; one pair, seemingly newly mated, even chased intruders off neigh-bouring mounds; other pairs allowed intruders on lower slopes of mound but not near nesting site. Young aged 1 week actively move about mound; led from colony when 3.5–4 weeks old (Wheeler & Watson 1963). On Penguin I., breeding birds aggressively force away non-breeding Gulls that occasionally move into nesting areas; once young mobile, often seen away from nest-site, up to 65 m (Ottaway *et al*. 1988). On Carnac I., some pairs defend nest-sites from autumn but do not lay till winter or spring (Wooller & Dunlop 1979); where double-

brooding occurs, adults stay at breeding grounds and defend territories for succeeding clutches (Nicholls 1974). At Warnboro Sound, WA, territories a few square metres (Serventy & White 1943). For details of time spent on territory by breeding female, see Courtship feeding. FEEDING TERRITORIES: May be maintained by individual or pair (Carrick 1972); sometimes defend several square metres of good habitat, but no evidence of permanent ownership; presumably related to dominance; usually held by birds in adult plumage (Carrick & Murray 1964). **Home-range** Can fly 80 km/day to feed (van Tets 1969a), though few do so (Meathrel *et al*. 1990). During breeding, most birds from Five Is feed at garbage tip *c*. 6 km away (P. Straw); some birds feed in Sydney, making round trip within 1 day (Smith & Carlile 1992b). Near Melbourne, Vic., hundreds of birds move 25–50 km daily from coast to feed at inland dumps (Aust. Atlas). Further descriptions of localized movements by Carrick (1972).

Roosting Often nocturnal and communal; at some sites in large numbers (van Tets 1969a); sometimes active at night (see Food). Sleep or loaf at any time during daylight, some-times on perch that provides firm grip for feet, e.g. edge of pier (see Habitat). Prefer to rest with conspecifics, or birds such as cormorants, which rest in similar places (Wheeler & Watson 1963). When groups gather, each bird claims only standing room or, at most, space to stretch wing; some birds sleep, others stay alert (Carrick & Murray 1964). At Altona colony in breeding season, small groups flew into colony continuously from *c*. 15:30 on most afternoons, with maximum numbers in colony at 16:00–17:00. At some sites, immense flocks move to roosting sites at sunset (Wheeler & Watson 1963). At Sydney Airport, peak movements occurred at dawn and dusk when flying between roosting and feeding areas; peak movements also occurred before and after low tide when Gulls flew to and from beach where they fed (van Tets 1969a). In bad weather seen sheltering behind banks. To sleep, tuck head completely under wing, and draw one foot and leg up to body (Wheeler & Watson 1963).

SOCIAL BEHAVIOUR Well known; in Aust., observed in wild (Wheeler & Watson 1963; Carrick & Murray 1964) and captivity (HASB); in NZ, detailed account of courtship feed-ing by Tasker & Mills (1981). Repertoire of postures and actions similar to that of Black-headed *L. ridibundus* and Hartlaub's *L. hartlaubii* Gulls. Postures of captive Silver Gulls described by Moynihan (1955) observed in wild by Carrick & Murray (1964). Some displays used both for threat and court-ship: Arched Position, Forward Attitude, and low-intensity threat displays; these displays seen throughout year; common at colony during nesting and on communal area before pairing (Wheeler & Watson 1963). **Flock behaviour** COMMUNAL FLIGHT or DREADS: Seen often at breeding colony: for no apparent reason most birds take to air and form irregular groups, *c*. 6 m above colony, flying into wind, with little movement of wings; flight always silent and brief, and birds then settle (Wheeler & Watson 1963). Others have recorded similar flights where all birds rose *en masse*, circled, then settled (Serventy & White 1943); also noted to take place during feeding (HASB). CIRCLING FLIGHT: Compact group of 10–20 birds fly to great height, apparently riding thermals, and glide in a circle, with little movement of wings; circle for several minutes before Gulls break off and disperse. Uncom-mon; occurs early in breeding season and possibly a communal breeding display (Dove 1919a, 1933; Wheeler & Watson 1963). NOISY FLIGHT: Most birds in colony take to air and call; seems

to result from stimulus inside colony, as no apparent outside cause, such as predator; quite common (Wheeler & Watson 1963). STIMULUS FROM CALL: One noisy bird coming to colony may disturb colony and at times cause great uproar (Wheeler & Watson 1963). Another group display, context unknown, seen Jan. just before dusk: group of ten and some members of larger group nearby threw heads back with bills up and jumped into air; some did not leave ground but 'lifted' themselves on their feet (Wheeler & Watson 1963). FOOD-HERE CALL: Upon discovering source of food, hungry Gulls give calls, which attract others from some distance (HASB). For synchrony of laying within colony, see Breeding. **Comfort behaviour** PREEN-ING: Spend much time settling and oiling feathers, particularly on breeding mounds, where becomes part of displacement activity; one bird seemed to touch oil gland at base of tail, then rubbed bill over primaries, and feathers of breast and tail; side of head rubbed over wing-coverts; left foot scratched under chin and about face, and finally feathers ruffled and settled (Wheeler & Watson 1963). BATHING: Either in salt or fresh water; birds 1 m or more apart (Carrick & Murray 1964). After bathing, spend much time re-oiling and settling feathers. Often seen washing bill in water after regurgitation and feeding (Wheeler & Watson 1963).

Agonistic behaviour Most obvious when feeding or defending nesting territories; mildly aggressive when resting, birds maintaining individual distances. More tolerant when resting and preening than when feeding and breeding (Carrick & Murray 1964). Away from breeding colony, main aggressive displays connected with feeding are Arched Position, Forward Attitude, and Hunched Position (Wheeler & Watson 1963). **Dominance** In many small feeding parties, one dominant bird tries to keep all others from food, usually unsuccessfully (Wheeler & Watson 1963; Murray & Carrick 1964; HASB); see Feeding territories above. Feeding dominance related to place, with distinct advantage of early occupancy balanced against high aggression and previous experience of others (Carrick 1972). **Threat** Following postures from HASB unless stated. UPRIGHT AGGRESSIVE (Fig. 1): In extreme form, body held obliquely upwards, neck vertical or just forward of vertical, plumage ruffled, head and bill pointed downwards, and

Figure 1   Upright Aggressive

carpal joints of wings held away from sides. Displaying Gull moves toward opponent, giving threatening call occasionally; opponent may withdraw. UPRIGHT ANXIETY: Somewhat similar to Upright Aggressive, but bird appears nervous; neck stretched vertically or slightly backwards, head up, bill lifted (usually away from opponent), eyes stare and plumage sleeked; silent, often frozen on spot, and inclined to flinch; rarely attacks from this position unless as parting gesture. OBLIQUE DISPLAY (Fig. 2): Challenging; performed at end of other displays, or as separate display. Body obliquely upright, plumage sleeked, neck forward and strongly arched, head and bill directed down, and wings held away from body; tip of tongue stands up in open mouth as bird calls; ridge visible along neck, eyes protruding, and any steps taken are jerky; never given without
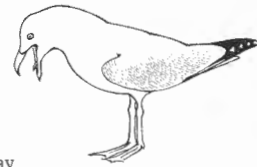

Figure 2   Oblique Display

call. Said to be used with Forward Display but less forceful than Upright Aggressive (Carrick & Murray 1964). Arched Position of Wheeler & Watson (1963) similar.   FORWARD DISPLAY (Fig. 3) (= Forward Posture of Carrick & Murray 1964; Forward Attitude of Wheeler & Watson 1963): Mostly performed before, between, or after Oblique Display; sometimes separately. From Oblique, lowers head and foreparts,
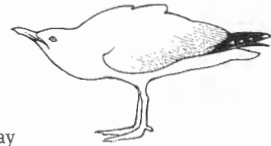

Figure 3   Forward Display

underarches neck, and directs bill anywhere between horizontal and vertical; give soft purr with almost closed bill. Bird may walk or run in this posture, but if returning to Oblique, usually stops. Wheeler & Watson (1963) add that wings are held out and at times slightly drooped. Aggressive display particularly used in non-sexual interactions; raise mantle and scapular feathers in intense display (Carrick & Murray 1964). HEAD-TOSS (Fig. 4): After Oblique or Forward Display, bird may throw foreparts up, neck vertical, head back and high, and bill up; may be silent or give soft call; also see courtship feeding. HUNCHED AGGRESSIVE (Fig. 5) (= Threat Display of Wheeler & Watson 1963): Body horizontal, scapulars raised, bill forward or slightly pointed down, and head hunched into shoulders; give short single calls or more drawn-out ones. Similar to
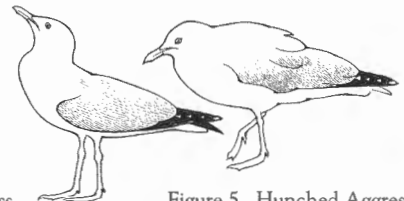

Figure 4   Head-toss   Figure 5   Hunched Aggressive

begging young. In this position, adult will chase (walking or running) other Gulls, often for long periods. May end in Charges or Obliques, sometimes other displays. CHOKING (Figs 6, 7, 8): Commonly performed in disputes over territory boundaries, either by pair or single birds; appears very aggressive; also performed by pair at nest, see Sexual behaviour. Birds walk to a spot, calling in threatening manner through almost closed bills, with heads down and bills to ground; wings may be held out. Suddenly drop to tarsi a short distance from each other
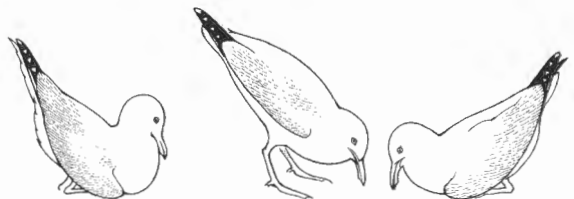
Figures 6, 7, 8   Choking

and begin to call rhythmically, holding tail and lower abdomen up, exposing fluffed rear underbody, and stretching and arching neck or holding neck in with bill against breast; may stab at ground with bill as head pumped up and down with call. Choking can be lengthy and irregular, punctuated by sudden rises and flashing attacks, feints, retreats, advances, shufflings and slower calls, all appearing somewhat synchronized, one bird flinching or moving in accordance with move by other. **Fighting** If opponent does not withdraw when approached with display posture, fighting may ensue, with charges and withdrawals, raised wings, pecking, tail-pulling, and strident screams. Objects such as grass in path of attacking Gull may be stabbed at viciously. As Gull screams, ducks head and opens bill wide (Wheeler & Watson 1963; HASB). At times, fighting intense and may continue for >15 min (HASB). **Appeasement** HUNCHED POSTURE of fledged young (which resembles begging of adult female) used in appeasement; progeny of dominant birds can probably share parental feeding status even when no longer being fed (Carrick & Murray 1964). Sometimes aggressive to other birds, such as Double-banded Plovers *Charadrius bicinctus* (Amos 1949), Banded Stilts (McGill 1954), Gull-billed Terns *Sterna nilotica* (Bright 1935), Black-shouldered Kites *Elanus axillaris* (Condon 1937); known to steal food from other birds (e.g. Smith 1991a; see Food). **Alarm** UPRIGHT ALARM (Fig. 9): Similar to Upright Aggressive and Anxiety but always accompanied by call, and neck held slightly forward and perhaps slightly fluffed; bill lifted, and call repetitive, clear and infectious; then attacks with screams (commonly heard when people visit nesting colonies) (HASB).


Figure 9   Upright Alarm

Wheeler & Watson (1963) mentioned that mobs of Gulls attacked and drove off Swamp Harriers *Circus approximans*, Whistling Kites *Haliastur sphenurus*, and Pacific Gulls *Larus pacificus*; they dived at, but did not touch, raptors. Wood (1989) observed Gulls in tight flocks of 20–40, high in air before being attacked by Arctic Jaeger *Stercorarius parasiticus*. See also Flock behaviour and Parental anti-predator strategies.

Sexual behaviour Pair-formation, Courtship At Altona, early in nesting period, a few mounds appear to be neutral territory where unmated birds display: occasionally, bird seen standing on mound surrounded by 3–4 others; bird on mound adopted horizontal begging position and others, swimming or flying round, responded by moving towards it and calling and adopting similar posture in water; lasted 6–8 s. Following also considered to be courtship displays: PEERING (Fig. 10): Performed either singly or in pairs early in season before nesting;


Figure 10   Peering

on alighting at prospective nest-site, bird or birds stay still for several seconds with heads bent, bills almost touching ground, and stare for some time; if both birds displaying, bodies usually parallel, bills close together and peer at same spot. Often followed by one bird sitting on site. Start of Peering is an early sign that nest-site is established; occasionally bring nesting material and scatter or play with it. Peering continues until nest actually being built (Wheeler & Watson 1963). CHOKING: Described above, performed at nest in association with courtship feeding or nest-making behaviour; done by one of pair, and often accompanied by shufflings and movements of feet, which seem to help shape nest (HASB). UPWARD STRETCH: Not so common as other displays; two birds stretch to fullest extent, with necks held up, both calling continuously (Wheeler & Watson 1963). **Courtship feeding** Female normally initiates; adopts Hunched Posture and walks to male, stopping in front, or slightly to side, of him. Male may assume more upright stance and turn slightly to Face Away, or may remain relaxed. Female then Head-tosses a number of times (up to 20): bends head down until bill almost touching ground (Fig. 11a); then tosses head back, slightly lifting front of body, and gradually opening bill to give short call as head reaches extreme position (Fig. 11b); then drops head down so that bill almost touches ground again. During display, birds orientated so that bill of female just below that of male; often, male lifts head or turns on spot or both, attempting to avoid female (Fig. 11c). Eventually male bends head down, withdraws neck, and pulls bill in front and slightly to one side of breast, so that bill within range of female's movements and, despite sideways movements of head, he is unable to avoid next action by female. Female remains in Hunched Posture and makes short pulling movements with bill at corners of male's bill (no longer begs by Head-tossing) (Fig. 11d). Male soon opens bill slightly as he reaches forward with his head; regurgitation movements in throat can be seen. This or sequence of preceding actions
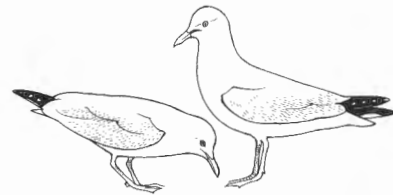
11a
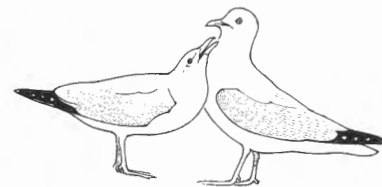
11b
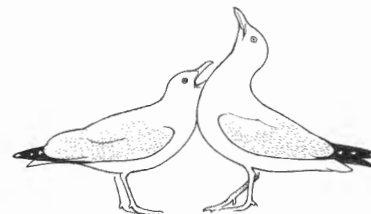
11c

Figure 11   Courtship feeding

stimulates further response from female; with quick, jerky movements she lifts her feet up and down alternately and moves her head slightly (Fig. 11e). Male may or may not regurgitate food; if he does, opens bill wide and female feeds vigorously, often taking food from male's throat (Fig. 11f).
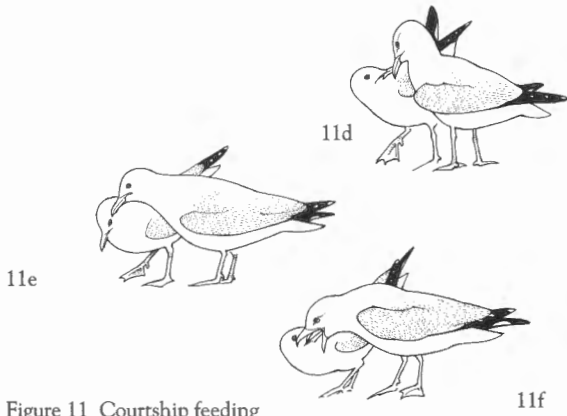

Figure 11 Courtship feeding

Male remains still for short time, then straightens, swallowing remaining food. Female may repeat ritual or, if food not regurgitated, revert to an earlier display. Bout sometimes stops after single regurgitation, or may involve several regurgitations, while some do not continue past initial stages (Tasker & Mills 1981). Similar descriptions of begging by females in HASB, Wheeler & Watson (1963), and Cunningham & Wodzicki (1948). In study by Tasker & Mills (1981), 57% (n=327) of feeding bouts during courtship occurred after member of pair, usually male, had returned to nest-site; usually within 5 min of return. Rarely, courtship feeding observed as early as 40 days before laying, round time of pair-formation; frequency began to increase 20 days before laying, peaking 10 days before, with marked reduction after clutch completed. As date of laying approached, at peak of courtship feeding, female more likely to include HUNCH PULLING as she begged; this continued through laying period. Frequency of courtship feeding and proportion of time female remained in nest-territory also increased as laying approached; in 5 days before laying, spent, on average, only 18% of daylight hours away from territory. Male tended to spend constant amount of time (c. 50%) in nest-territory before laying. During early incubation, coinciding with end of courtship feeding, males spent more time in territory (64%) than females (55%). At peak of courtship, female fed about every 4 h; females not fed adequately by partner spent more time foraging than better-fed females; inadequately fed females appeared more likely to change partners than well-fed females (Tasker & Mills 1981). Actual or attempted courtship feeding usually immediately preceded mounting (81%; n=352 copulations); mounting more likely if male regurgitated than if he did not. Courtship feeding increased chances of successful copulation and the greater the quantity of food given, the greater the probability that cloacal contact resulted (Tasker & Mills 1981). **Allopreening** Occurs during courtship; in one description, two birds stood very close together, one with head under its wing, while having its chest rubbed with bill of other; birds then displayed by arching and preening necks, then quietly preening own feathers (Wheeler & Watson 1963). **Greeting** Appear to recognize mates by calls. No display at change-over, though incoming bird occasionally feeds mate or they touch bills. At times, sitting bird unwilling to leave and

pushed off by mate (Wheeler & Watson 1963). Serventy & White (1943) recorded that after laying, members of pair, usually after one has just landed at nest-site, followed each other about with short precise steps; both held necks stiffly erect, with bills pointed downwards and plumage slightly ruffled; two displays, termed UPWARD DISPLAY and FORWARD DISPLAY, were often used when bird joined mate, and often became mutual. **Copulation** Male may mount without any preliminaries, but copulation usually follows courtship feeding. Male jumps onto back of female and places feet about where wings of female join body. Once mounted, male begins or resumes flapping wings (Fig. 12a), before gradually lowering himself. In response to position and action of his feet, female drops wings well below tail (Fig. 12b). Male then tilts farther back (making female lean forward) beats his wings faster and waggles tail from side to side; eventually forces tail between wing and tail of female and makes cloacal contact (Fig. 12c). May make several cloacal contacts in bout (maximum, seven) or none; interval between cloacal contacts usually short (10–20 s) as are mounts themselves (rarely longer than 2 min; often much shorter); sometimes length of mount extended by male resting on female's back, either just after mounting or after cloacal contact. Copulations usually terminated by female, who moves about then walks out from under male; displacement often helped by female adopting Upright stance (Fig. 12d); occasionally, male dismounts voluntarily or jumps off as soon as female starts to move. Sometimes, when female moves, male will peck at back of her head, and female usually responds by lifting head and making jabbing movements at male's breast.
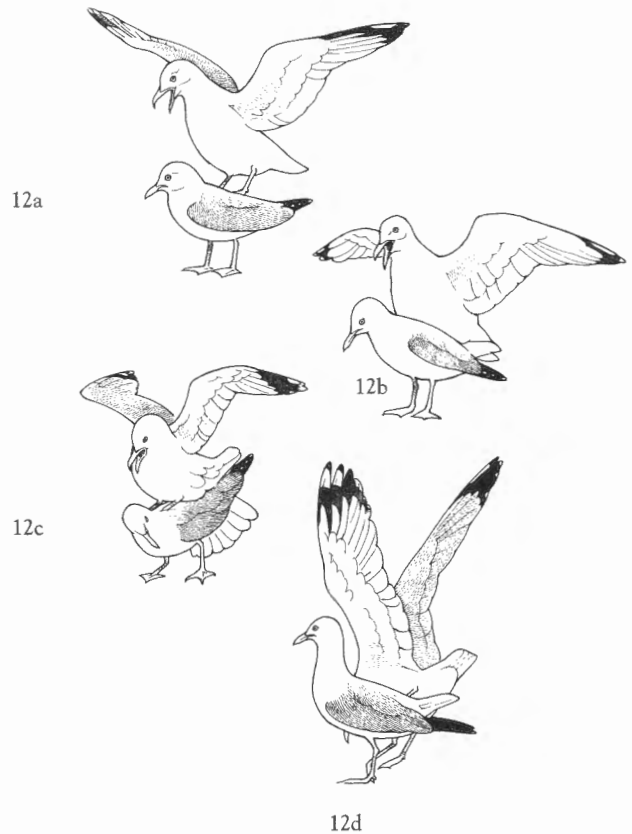

Figure 12 Copulation

Copulation often followed by both birds preening themselves (Tasker & Mills 1981). Copulation also described by others (Cunningham & Wodzicki 1948; HASB); said that male called throughout and on dismounting, both birds assumed Anxiety posture, silent and facing away from each other, before relaxing (HASB); Wheeler & Watson (1963) further noted both birds occasionally plunged into water immediately afterwards, and gave more details of mock copulation. Mounting occurred at least 60 days before laying, but started to become frequent only c. 30 days before; peaked 3–8 days before laying then dropped sharply after completion of clutch (Tasker & Mills 1981). Attempted copulation frequent early in season, by both paired and unpaired birds; bird will even land on back of sitting female (who chases it off) (Wheeler & Watson 1963). Thought not to occur in mated pairs after eggs laid (Wheeler & Watson 1963).

Relations within family group When c. 1 week old, chicks start to look for food, wash and preen, though seen to preen earlier, when a few days old (Wheeler & Watson 1963). To beg, chick crouches and touches parent's bill. Adult then stands, with neck up and arched, neck muscles tense, and regurgitates. Until young 3–4 days old, parent regurgitates and holds food in bill for chick; while feeding, young seems to get much saliva from parent; one parent may regurgitate pellet and second parent may pick it up in bill, chick taking it from second adult, but if chick old enough to eat off ground, second parent may share food with chick. Occasionally, chicks called to nest before food regurgitated, using nest as feeding platform. Very occasionally, chicks pecked by parent (Wheeler & Watson 1963). Other adults will destroy undefended eggs and young (Ottaway *et al.* 1988); if chick leaves nest-area without parents, other Gulls attack it, swooping to peck its nape; chick killed unless it hides or parents return and drive off attackers. Once, adult returned to its eggs to find strange chick present but still sat. When young leave colony, and toward end of season, young birds tolerated by adults and gradually join adult groups and participate in group activities (Wheeler & Watson 1963). For description of how parents move young out of colony, see Wheeler & Watson (1963). Not known what causes parents and young to separate permanently; males said to respond to begging of flying young, while females largely ignored, evaded or showed hostility towards their young; in these cases, females had resumed courtship feeding behaviour (Nicholls 1974); also see Parental care above. **Anti-predator responses of young** Tend to hide when parents away (Wheeler & Watson 1963). When approached, run and hide in rock crevices or burrows, or crouch flat on nests (e.g. Oliver 1913; Keast 1943; Favaloro 1948; Wheeler & Watson 1963); on Neptune Is, soon after hatching, ran down shearwater burrows, presumably to escape predators, and chicks older than c. 2 days rarely seen (Stirling *et al.* 1970); just before young can fly, will take to water while adults circle overhead (Favaloro 1948). **Parental anti-predator strategies** One parent constantly covers chicks in nest for first week (Wheeler & Watson 1963). Once young mobile, often seen away from nest-site (up to 65 m) with one or both parents protecting them from attack by other Gulls (Ottaway *et al.* 1988). Little Eagles *Hieraaetus morphnoides* take adults and young at breeding colonies; when Eagle approached colony on island, Gulls typically reacted with silent flight, all Gulls leaving nests and flying over water; Gulls usually detected Eagle when it was c. 0.5 km from island; when Eagle was hunting chicks on ground, adult Gulls remained concealed in *Acacia* and were only disturbed if Eagle within 10 m of nest (Meathrel 1990). Gulls also recorded

falling silent when Black Falcon *Falco subniger* passed over colony (Wheeler & Watson 1963). Stoats caused localized disturbance at a colony; some Gulls called raucously from ground while others hovered <0.7 m overhead (Morris 1976). Breeding Gulls recorded attacking Hoary-headed Grebe *Poliocephalus poliocephalus*, Australian Shelduck *Tadorna tadornoides*, and Little Pied Cormorant *Phalacrocorax melanoleucos* (Wheeler & Watson 1963). When parents on eggs approached by people, protest loudly (Favaloro 1948); when with young, fly overhead calling and excreting (Keast 1943). May attack people, sometimes making contact with wings or bills (D'Ombrain 1954; HASB). When one nest approached and young took to water, many birds joined demonstrating parents, but may have been menacing stranded young; eventually six birds piloted young to shore (Favaloro 1948). If young die, one parent may stay near nest for short time and continue to defend chick before abandoning nest (Wheeler & Watson 1963).

VOICE Well known from study of captive birds (HASB), on which account based unless stated; calls selected from available recordings to match these descriptions (P.J. Fullagar). Utter wide variety of calls. Communal flights at colony, when most birds rise, circle then settle, may be silent or noisy (Wheeler & Watson 1963; HASB). One bird calling noisily when coming into colony may stimulate others to call, sometimes causing great uproar; sometimes call at night in colony (Wheeler & Watson 1963); away from colony, may be heard flying at night (Keast 1943). Recognize mate by calls: incubating bird will look up, and sometimes call, just before mate arrives at nest (Wheeler & Watson 1963). Regional differences not reported. Captive birds said to mimic human voices and domestic noises (HASB). NON-VOCAL SOUNDS: When adults attacked swimming chick, snapping of bills audible to 20 m (Favaloro 1948).

Adult See Social Behaviour for postures and displays relating to calls. AGGRESSIVE CALLS: Irregular *rrerrrr* or *rooerrrr*; given while moving towards opponent in Upright Aggressive. Strident screams *hreeeee*, *hraaaar*, or *rrooaaaah*, with head ducked and bill open wide, given if fighting ensues. Short single *haou*, or more drawn-out *rrerrrr* or *rooerrr*, may accompany Hunched Aggressive. CHALLENGE CALL: Long loud *haaaaarrr-haaaaarrrr-haaaaarrrr-haaaaarrrr* (sonagram A) with syllables repeated 3–10
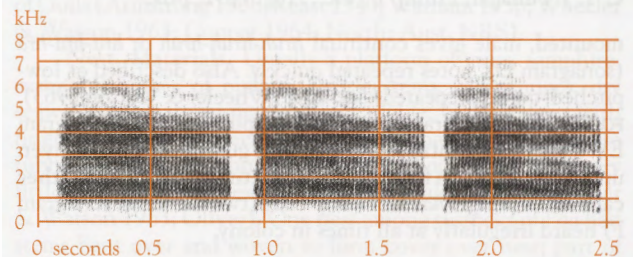
A F. N. Robinson; L. Bathurst, NSW, Nov. 1972; P36

times; given with Oblique Display. Single *haaaarrrr* given in less intense circumstances. PURR: Soft rasping *herrrr-herrrr-herrrr* (sonagram B) with fewer notes than in Challenge Call. Soft *herrrr* calls may accompany Head-toss. CHOKE CALLS: In boundary dispute, rivals walk to a spot, calling *rerrrr*, *roooerrr* or *rowoooerrr* threateningly through almost closed bill, then drop to tarsi and, with necks arched and extended or held against breast, give rhythmic throaty penetrating *rruh-rruh-rruh-rruh*, with head pumping up and down with each call;

kHz

B F. N. Robinson; L. Bathurst, NSW, Nov. 1972; P36
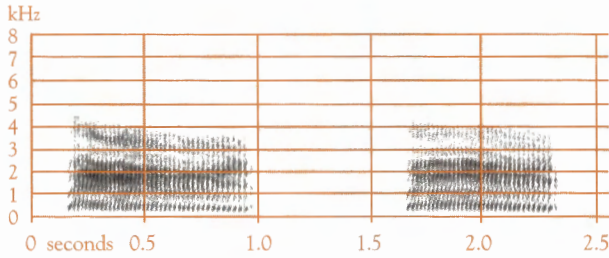
E F. N. Robinson; L. Bathurst, NSW, Nov. 1972; P36.

display can be lengthy and irregular, punctuated by sudden rises, attacks, retreats, and slower *rerrr* or *rooerrrr* calls, all somewhat synchronized. Also performed at nest-site by one of pair, as part of nesting ceremonies. ALARM CALLS: Repeated clear *aou-aou-aou-aou* always accompanies Upright 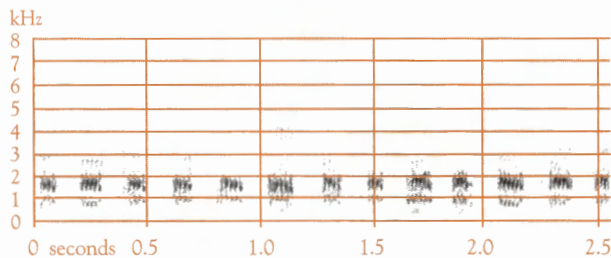Alarm; sometimes interspersed with *rrerr*, *rooerrr*, or attacking screams. Infectious; often given when people in colony. Also utter a rattling *hrakirak*, *krek-rek*, or *hrah-rah*, apparently when nervous; in a variant, the second note given rapidly 2–3 times, e.g. *hrak-rak-rak-rak*. Uttered raucous calls, from ground and while hovering, when a Stoat in colony (Morris 1976). Squawk while flying round heads of people in colony (Keast 1943). COURTSHIP-FEEDING CALLS: Shrill repeated *kra, kra, kra* (one *kra* shown in sonagram C, left) by female with head back and bill up; call given just as her head reaches its most upright position (Tasker & Mills 1981). Male lowers bill to ground, calling *roooerrr* or *rowoooerrr* (sonagram C, right), and regurgitates. *Roooerrr* call and head-down position commonly given by both male and female, singly or together, and is associated with visits to new nest or nest-site. COPULATION CALLS: When

F P. J. Fullagar; Phillip I., Vic., Aug. 1992; priv.

Young Chicks chirp before and during hatching; described as loud (HASB) or soft and throaty (Wheeler & Watson 1963). Continuous piping from immature bird, possibly 2–3 months old (Wheeler & Watson 1963). Calls of young shriller and weaker than those of adult (HASB); described as peevish (Slater 1970).

BREEDING Detailed studies in s. Aust. (Carrick *et al.* 1957); Altona Saltworks, Vic. (Wheeler & Watson 1963); Carnac I., WA (Nicholls 1974; Wooller & Dunlop 1979, 1981a; Dunlop 1986); Penguin I. (Meathrel 1991a,b); SA (Ottaway *et al.* 1988); Five Is, NSW (Gibson & Sefton 1953); Big I. and Rozelle Bay (Smith & Carlile 1992a); coral cays in Capricorn Grp, Great Barrier Reef (Burger & Gochfeld 1987) and Kaikoura Pen., NZ (Mills 1973, 1979, 1989); 285 records in Aust. NRS up to Apr. 1993. Monogamous; female–female pairs occasionally recorded (Mills 1989). Usually nest in colonies, sometimes in tens of thousands; also nest solitarily (Burger & Gochfeld 1987; Aust. NRS).

Season Breeding usually seasonal, but may be protracted over most of year; may be opportunistic at some inland localities, when water present (Smith 1991b). **Aust.** In sw. WA, variations in onset of laying correlate strongly with variations in timing of spring rise in temperature at end of previous laying period: higher ambient temperatures in Oct. and Nov. delay onset of laying in following autumn (Dunlop 1986). QLD: In N, eggs, Mar.–Sept. (Wheeler & Watson 1963; Lavery *et al.* 1968; King *et al.* 1992; Aust. NRS); L. Buchanan: eggs, mid- to late June and early July; young, late June (P. Britton); central Qld, feathered young, early Dec. (Carruthers 1964). NSW: Breeding may last up to 11 months at some sites, with bimodal pattern of laying in some seasons, multimodal in others; timing of maximum laying varies between sites. On Big I., Five Is, laying begins mid-July to early Aug., ends in Feb., with major peaks 4 months apart; in one season, two peaks of laying; in next season, when methods to deter Gulls were used at a rubbish tip where they fed, several peaks of laying observed; in 1988, first eggs, 28 July; in 1989, 17 July; in 1990, 11 July. At Rozelle Bay, breeding occurs almost all year, with peaks of laying in Apr. and Aug.; Gulls breeding after first peak mainly
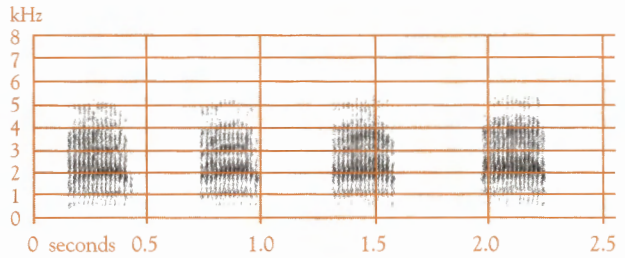

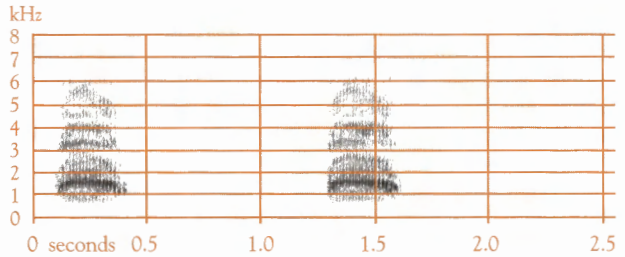**C** P. J. Fullagar; Phillip I., Vic., Aug. 1992; priv.

mounted, male gives continual *hruh-hruh-hruh* or *hra-hra-hra* (sonagram D), notes repeated quickly. Also described as low-pitched, quickly repeated *koak-koak* (Wheeler & Watson 1963). FOOD-HERE CALL: Frantic repeated yapping *ra* or *rao* (sonagram E), which can continue even as bird gulps down food; given upon discovery of a food source, attracting other Gulls. **Other calls** Short single *haarr* or *kharp* calls (two shown in sonagram F) heard irregularly at all times in colony.

D P. J. Fullagar; Phillip I., Vic., Aug. 1992; priv.

inexperienced birds (Smith & Carlile 1992a; P. Straw). On Moon I., off Swansea, first eggs late Apr. to beginning May (P. Straw). On Montagu I., laying seems to begin slightly later than on Five Is; first eggs, 11 Aug. in 1988. SA: July–Mar. at coastal sites (Wheeler & Watson 1963; Stirling *et al.* 1970; Ottaway *et al.* 1988; Aust. NRS); laying, late June to late Sept., inland (Attiwill 1972). Mean date of first laying for successful breeders, 8 Aug.±10 days for Gulls banded in 1968 and 10 Aug.±9 days in 1969; for unsuccessful breeders, 7 Sept.±8 and 9 Sept.±12; for successful 2-year-olds, 31 Aug.±15, unsuccessful 2-year-olds, 13 Sept.±10 (Ottaway *et al.* 1988). At some other sites, eggs recorded late Aug. to late Feb. (Bassett Hull 1908, 1912; Aust. NRS). VIC.: Laying, June–Oct., eggs have been found early Jan. (Wheeler 1957; Wheeler & Watson 1963; Aust. NRS); onset of laying may be delayed till Oct. or Nov, depending on availability of food (Favaloro 1948). TAS.: Laying, Aug.–Dec.; eggs also recorded in late Jan. and eggs and unfledged young in Feb. (Milledge 1972; Skira & Wapstra 1990; Aust. NRS). WA: In SW, varies from year to year; broadly, late Mar. to mid-Nov. (recently, even later) but usually mid-Apr. to early Oct. (Dunlop 1986; J.N. Dunlop). Other records of timing of laying include: Nov. and Jan.–Mar. (Carter 1923); early June (once on 31 May) to Dec. (Carrick *et al.* 1957); Aug.–Nov., correlated with peak rainfall plus 3 months (Halse & Jaensch 1989); mid-Apr. to early Oct., with two peak periods, May and Sept. (Sedgewick 1940; Serventy & White 1943; Nicholls 1974); mid-Mar. to mid-Nov., with three peaks, in Apr., June and Aug.–Sept. (Wooller & Dunlop 1979); on Lowendales Is and Dampier Arch., off Pilbara coast, laying, Dec.–July (J.N. Dunlop). **NZ** Eggs, late Sept. or early Oct. to late Dec.; with increasing age, females tend to lay progressively earlier in season, with *c.* 25 days difference between 3-year and 10-year-old birds; females retaining pair-bond of previous season breed, on average, 10 days earlier than females that change partners; productivity relates to timing of laying, with earliest clutches having the highest proportion of young that survive (Mills 1973, 1979, 1989). **Chatham Is** Said to breed Oct.–Dec. (Nilsson *et al.* 1994). **Snares Is** Large chick found mid-Feb. (Miskelly 1984). **Campbell I.** Eggs, late Nov.; young, early Jan.; fledgelings, Feb. (Oliver).

Site On headlands, breakwaters, causeways; offshore islands, coral cays, sandy islets in estuaries, islands in lakes; on trees and logs in inland lakes and swamps; also in saltworks, on islands, rocky outcrops, gypsum mounds and banks. On wrecked or moored boats or boats in dry dock, and on jetty, on top of post at disused jetty, on link of chain on quarterdeck of wreck, on pylons, fence posts and buildings, on disused barges in bay, in beachcast wooden fruit case, on seat of disused salt-plough and on roof of industrial complex. On sand, rocks, rock ledges; low vegetation, grass, tussocks, samphire, under bushes or trees ≤9.2 m tall, on top of bushes and in tangle of ground creeper covering bush; on dead tree-stumps, in spouts, hollows, trunks, fallen logs; and tops of roly poly bushes, up to 6.1 m above water; also in old cormorant's nest, on decks and bottoms of boats moored to jetty (Milligan 1902; Favaloro 1948; Sharland 1956, 1965; Wheeler 1960; Wheeler & Watson 1963; Dalby *et al.* 1984; Dunlop 1986; Burger & Gochfeld 1987; Skira & Wapstra 1990; Smith 1992; Smith & Carlile 1992a; M.A. Cameron). On islands of sw. WA, nests usually near or in cover of small bush or some other object in otherwise open space (Dunlop 1986). On South East I., Chatham Grp, all nests in caves, under overhanging cliffs, in small holes in rocky outcrops or under large boulders (Young 1978; Nilsson *et al.* 1994). In Capricorn Grp, nests on coral cays have dense cover

of trees and bushes, and are usually close to trees; nests 26–60 m from mean high-water mark, 2–31 m from beach, and 1–10 m above high tide mark (Burger & Gochfeld 1987); for more details of averages of types of cover at different colonies, see Burger & Gochfeld (1987). Gulls that nest solitarily usually more than 50 m from nearest neighbour. Average height of nest above ground, 1.09 m (0.7; 10) (Burger & Gochfeld 1987).

High site-fidelity. On Carnac I., WA, 93% retraps in same area and 91% at same site (Wooller & Dunlop 1979); on Big I., Five Is Grp, NSW, 69% wing-tagged birds returned to colony in season after tagging; 32% returned and bred in subsequent seasons (Smith *et al.* 1992a); in SA, 31–84% established breeders returned to colony in next season. Of 41 Gulls at a colony in SA, 34 (83%) nested in same position or within a few metres of site from two seasons ago; rest (17%) mostly within 10–30 m (Ottaway *et al.* 1988); Gulls have been re-trapped at same nest-site after 6 years (Wooller & Dunlop 1979). Habitually use old sites (Wheeler & Watson 1963). In NSW, 32% wing-tagged pairs changed site of nest between seasons; 77% pairs re-nesting used more than one site (Smith *et al.* 1992a). However, on Carnac I., within a season, almost always lay sequential clutches in same nest (Dunlop 1986). Colony may change site, up to twice in a season (Bellingham & Davis 1982). At L. Torrens, 1989, Gulls arrived at a newly established colony of Banded Stilts and bred on nearby island, increasing in numbers and taking over colonies of Banded Stilts, eventually causing Stilts to abandon colony (Robinson & Minton 1989; Phillipps 1990).

Nest on same islands with Crested, Caspian *Sterna caspia*, Fairy and Gull-billed Terns; Pacific and Kelp Gulls; Black-faced, Pied *Phalacrocorax varius* and Little Pied Cormorants; Straw-necked Ibis *Threskiornis spinicollis*, Black Swans *Cygnus atratus*, Musk Duck *Biziura lobata*, Sooty *Haematopus fuliginosus* and Pied Oystercatchers, Eastern Reef Egret *Egretta sacra*, Fairy Penguins *Eudyptila minor*, and Wedge-tailed *Puffinus pacificus* and Short-tailed Shearwaters. Nest in same tree as Sulphur-crested Cockatoos *Cacatua galerita*. Caspian and Bridled *Sterna anaethetus* Terns will nest in colonies of Gulls. Gulls will nest in colonies of Common Noddies *Anous stolidus* and Sooty Terns *S. fuscata*, and within a few metres of occupied Osprey *Pandion haliaetus* eyrie. At Altona, House Sparrows *Passer domesticus* nested under slabs of gypsum in colonies of Gulls (Armstrong 1908; Keast 1943; Warham 1956; Wheeler & Watson 1963; Cooper 1964; North; Aust. NRS).

Nest, Materials Usually a platform of grass, samphire, rushes, rhizomes of pigface, thistle stems, old remiges, dry seaweed, or whatever material is available. Usually lined with finer grasses or seaweed; near human habitation, will use rubbish, such as old iron, rope and wool; some nests with very little lining, mere depressions in sand (Favaloro 1948; Wheeler & Watson 1963; Oliver). One nest among tussocks of *Poa* had stems bent over and woven to form cover over nest; part of vegetation round nest may form nesting platform (Wheeler & Watson 1963). Nests in hollows may be unlined or lined with grass, water-grass or feathers (Favaloro 1948). During construction, a few pieces of material placed on ground or old nest; then rest of material brought to site, worked into shape and lined; occasionally, one or two pieces of green samphire added to nest just before laying (Wheeler & Watson 1963). Both sexes bring material, though one bird may bring most and mate may shape nest; sit on nest, raise tail and press breast down, and work feet rapidly against inner part of nest, also prodding with bill; will scavenge material from old or

unattended nests (Wheeler & Watson 1963; Oliver). Add material to nest early in incubation; at Hume Weir, built up nests near edge of water when water levels rose (Wheeler & Watson 1963). May build a number of false nests before laying (Dunlop 1986). MEASUREMENTS (cm): average, 28 (21–40; 43) x 26.4 (21–35); diameter of cavity, 15.3 (14–19; 43); depth, 5.5 (Wheeler & Watson 1963); 20.3 cm wide, cavity 6.4 deep (MacGillivray 1926).

Eggs Aust.: Oval or elongate oval; coarse, rather close-grained, glossy; at Altona, ground-colour for 190 eggs: 41% pale to dark green, 22% dark stone to greenish stone, 19% greenish olive to pale olive, 8% olive-brown to light brown, 7% medium to dark brown; rarely, blue-green (Wheeler & Watson 1963); eggs marked with umber, brownish black or olive-brown and dull grey: spotted, blotched or with streaks, dashes or short wavy lines, sometimes with underlying markings of dull violet-grey or inky grey (Campbell; North). NZ: Ovoid; greenish stone, marked all over with light- and dark-brown blotches (Oliver). MEASUREMENTS: Within clutches, successive eggs smaller; eggs in three-egg clutches larger than eggs from smaller clutches; sizes of first- and second-laid eggs do not differ between years, but third-laid eggs smaller in some seasons, such as when foraging efficiency reduced (Mills 1979; Wooller & Dunlop 1981a; Meathrel 1991a,b; Smith & Carlile 1992a; HASB). Size of egg tends to increase with age of females, up to 7 years old; mean length of eggs laid by 2-year-olds significantly smaller than those of 3-year olds; eggs laid by 2-year-olds significantly narrower than those of 4-year-olds, and those of 4-year-olds significantly narrower than those of 5-year-olds (Mills 1979). First-laid eggs significantly bigger in first laying period than in later ones, but no significant difference for second-laid eggs among laying periods (Smith &

Carlile 1992a), though Meathrel (1991b) found mean size of eggs did not vary between laying peaks or years. WEIGHT: Does not vary between years or between laying peaks, but decreases through sequence of laying (Meathrel 1991b). Average weight-loss during incubation, 0.17 g/day; loss significantly related to fresh weight, larger eggs losing weight faster; an egg weighing 44 g lost c. 0.2 g/day (0.45%), a 36-g egg lost 0.15 g/day (0.42%) (Wooller & Dunlop 1980). VOLUME: On Penguin I., second eggs in three-egg clutches larger than those from two-egg clutches (Meathrel 1991b). On Carnac I., volume of last egg in two- and three-egg clutches significantly smaller than first and second eggs; second egg of three-egg clutches larger than second egg of two-egg clutch (Wooller & Dunlop 1979). In NZ, largest eggs laid at start of season, with mean volume decreasing through season by 9.6–16.7% (Mills 1979). Volume of eggs significantly larger in season after above-average rainfall (Wooller & Dunlop 1981a). Clutches and eggs laid after 'replacement' intervals smaller than initial clutches but those laid after a 'refractory' period approached original clutches and eggs in size (Dunlop 1986). In females weighing less than 275 g, decreased volume of eggs significantly correlated with lower body-weight (Mills 1979). For further details of differences in volume between original and replacement clutches according to timing of laying and replacement interval, see Dunlop (1986). For details of variation in dimensions, volume, density and weight, and dimensions and weight of yolk according to laying period, see Meathrel (1991a). MEASUREMENTS, WEIGHTS, VOLUMES: Summarized in Tables 1 and 2. For details of differences in size, weight and volume of eggs with different clutch-size, laying sequence and timing of laying, see Meathrel (1991a: Table 1; 1991b: Tables 3.1, 3.3, 4.3, 4.4 and 4.6).

Table 1

Location	Length	Breadth	Weight	Reference
Aust.				
NSW				
	53.5 (47.9–60.0; 153)	37.5 (34.7–41.0; 153)	–	1
C/2 (mean)	53.2	37.3	–	1
C/3 (mean)	53.9	37.7	–	1
	51.3 (n=100)	37.8 (n=100)	–	2
VIC.				
	54 (50.3–61.0; 124)	38.4 (35.2–42.0; 124)	–	3
C/2 (mean)	53.8	38.2	–	3
C/3 (mean)	54.3	38.5	–	3
	–	–	40 (30–47; 39)	4
WA				
	52.8 (2.0; 65)	37.9 (1.2; 65)	–	5
	52.2 (46.2–57.4; 318)	37.1 (33.8–40.4; 318)	–	6
	54.0 (2.09; 50.3–57.5; 13)	37.5 (1.44; 35.1–39.4; 13)	37.6 (4.65; 30–44; 13)	7
Penguin I.				
First eggs of C/2	52.8 (2.21; 403)	37.8 (1.20; 403)	40.2 (3.21; 403)	2
Second eggs of C/2	51.8 (2.61; 403)	36.7 (1.41; 403)	37.1 (3.81; 403)	2
NZ				
First eggs of C/2	52.8 (2.01; 51)	38.1 (0.95; 51)	–	8
Second eggs of C/2	52.9 (2.14; 51)	37.7 (0.96; 51)	–	8
First eggs of C/3	52.0 (2.79; 12)	37.8 (0.83; 12)	–	8
Second eggs of C/3	50.7 (2.09; 12)	37.5 (0.56; 12)	–	8
Third eggs of C/3	50.0 (1.68; 12)	36.5 (1.07; 12)	–	8
Campbell I.	54.4, 54	37.6, 40.5	–	9

(1) Gibson & Sefton 1953; (2) Meathrel 1991b; (3) Wheeler 1953; (4) Wheeler & Watson 1963; (5) Storr 1964; (6) Nicholls 1974; (7) Aust. NRS; (8) Mills 1979; (9) Oliver.

Table 2

Location	Volume	Reference
Penguin I., WA		
First eggs of C/2	37.5±3.01	1
Second eggs of C/2	34.7±3.61	1
NZ		
First egg of C/2	37.0 (2.81; 51)	2
Second egg of C/2	36.2 (2.84	2
First egg of C/3	35.8 (2.78	2
Second egg of C/3	34.3 (1.82	2
Third egg of C/3	32.1 (2.01	2

(1) Meathrel 1991b; (2) Mills 1979.

Clutch-size Usually 1–3, often two; occasionally four, five or even six (North). **Aust. NSW:** 2.0: C/1 x 24, C/2 x 30, C/3 x 23 (Gibson & Sefton 1953); 1.9: C/1 x 21%, C/2 x 71%, C/3 x 8% (n=170) (Nicholls 1974); 2.07 (0.81; 1621) (Smith 1991b). **VIC.:** At Altona, 2.5: C/1 x 10, C/2 x 61, C/3 x 99 (Wheeler & Watson 1963). **WA:** On Carnac I., 1.89: C/1 x 107, C/2 x 280, C/3 x 54, C/4 x 2; average size of clutch decreased after peak laying periods, particularly in Apr. (Wooller & Dunlop 1979, 1981a); 2.13 (0.32; 16); on Penguin I., 2.13 (0.30; 100) (Meathrel 1991b). On Big I., NSW, clutch-sizes significantly larger in first laying than in subsequent periods (Smith & Carlile 1992a). On Green I., off Rottnest I., WA, proportion of C/1, C/2 and C/3 changed from 22%, 67% and 11% respectively in late June to 42%, 58% and 1% in early Oct. (Storr 1964). On Carnac I., a significant increase in percentage of C/3 and decrease in percentage of C/1 followed a year of above-average rainfall (Wooller & Dunlop 1981a). **NZ** For one season, first clutches averaged 1.87 (0.47; 590), decreasing from 2.18 (0.39; 28) between 24 Sept. and 2 Oct., to 1.67 (0.49; 12) between 12 and 25 Dec.; replacement clutches averaged 1.95 (0.46; 185), decreasing from 2.27 (0.45; 30) between 31 Oct. and 6 Nov. to 1.63 (0.50; 16) between 12 and 25 Dec.; one clutch of one egg, mid-Oct., and five clutches of average 1.8 eggs in late Oct. also recorded (Mills 1979). Clutch-size increases with age of female, with significant difference between 3- and 5-year-olds and 4- and 5-year-olds, and no significant increase after 5 years old (Mills 1973). Females that retained mates laid on average 0.27 eggs more than those that changed mates (Mills 1973). Two-egg clutches represent 29% female body-weight, and three-egg clutches *c.* 40% (Mills 1979).

Laying Highly synchronous within colonies (Wooller & Dunlop 1979). Synchronous peak in laying occurred at start of each of four periods of laying, with pronounced trough of newly initiated clutches after main peak (Dunlop 1986). First egg laid within a few days to a week of completion of nest (Wheeler & Watson 1963). Mean interval between laying of first and second eggs, 2.3±0.7 days (n=83) (Meathrel 1991a); between second- and third-laid eggs, 3.5±0.5 (n=2) (Meathrel 1991a). Can lay up to four replacement clutches per season. On Carnac I., of 443 pairs in 1977 and 448 pairs in 1978: 45% and 46% laid one clutch, 37% and 36% laid two, 17% and 15% laid three and 1% and 3% laid four (Wooller & Dunlop 1979); in NSW, for 31 pairs: 18 (58%) nested once, 6 (19%) twice, 5 (16%) three times and 2 (6%) four times (Smith *et al.* 1992a). Approximate interval between successive clutches on Carnac I., 5–12 weeks (Nicholls 1974). When clutches removed, replacements laid after intervals of 12–108 days (Wooller & Dunlop 1979); 12–184 days, with most replacements between 12 and *c.* 40 days; 81–86% of clutches removed were replaced at least once during laying (Dunlop 1986). Second, third and fourth replacements have same distribution of intervals as first replacements (Dunlop 1986). Clutches re-laid after 12–50 days considered replacements; those re-laid after intervals of >50 days were laid after a period of ovarian regression and considered to be in next laying period (Wooller & Dunlop 1979). DOUBLE-BROODING: On Carnac I.: of 50 marked pairs, 33 raised two broods; average period between laying of clutches, *c.* 130 days (103–145); three pairs, whose first laying failed, laid eggs for second brood 91, 99 and 120 days after laying first clutch; for 15 pairs of unsuccessfully double-brooded birds, interval between first egg of first clutch and first egg of second clutch, *c.* 127 days (106–145) (Nicholls 1974). For further details of intervals between broods of successful and unsuccessful double-brooded pairs, see Nicholls (1974). On average, females bred (fledged young) once every 3.2 years (1.9; 66) and males every 2.6 years (1.2; 81) (Mills 1989).

Incubation By both sexes, beginning with first egg; stints last 1–9 h; same bird incubates through night (Wheeler & Watson 1963). Sitting bird turns eggs intermittently through day and night, using bill or leg; sitting bird also turned round on nest. At one nest, eggs turned three times in 2 h then not for 90 min; at three other nests watched for 24 h, eggs turned 4–5 times, once or twice at night, more often during afternoon and immediately before hatching (Wheeler & Watson 1963). Hatching asynchronous; at intervals of 1–3 days; chick can take over 4 h to emerge (Wheeler & Watson 1963; Wooller & Dunlop 1980). INCUBATION PERIOD: Varies; 19–26 days (Wheeler & Watson 1963); average 24 days (20–27) (Storr 1964). Egg-shells tossed from nest, though small fragments may remain (Wheeler & Watson 1963). Will incubate non-viable eggs for up to 76 days (Smith 1991b).

Young Semi-precocial. Hatch in mottled-brown to greyish-brown down. By third week, primaries have emerged, feathering on upperparts and underparts emerging; feathered and can fly in fifth week (Wheeler & Watson 1963). **Growth** Weight at hatching, and percent of fresh weight of egg at laying: first eggs, 26.3 (2.06; 7), 63.8%; second eggs 28.0 (1.37; 6), 69.0%; third eggs, 23.5 (2.50; 6), 67%; average weight of chicks 67% weight of eggs. Chicks hatching from second-laid eggs significantly heavier than those from third-laid eggs (Meathrel 1991b). On Big I., logistic equations for growth of chicks (where W = weight and t = time): for nests with one chick, $W = 328.192 \times \{1 + e^{(2.45484-0.158831t)}\}^{-1}$; for nests with two chicks: $W = 217.159 \times \{1 + e^{(2.40313-0.25859t)}\}^{-1}$ (G.C. Smith). Data on growth of chicks hatched and reared in captivity in Meathrel (1991b). **Parental care, Role of sexes** Leave nest on second day and hide in vegetation (MacGillivray 1926); young remain in nest for up to at least 1 week, attended by either or both parents; may seek shelter in nest beside parent, hide under vegetation or in cracks; occasionally use nest as feeding platform; young venturing from own nesting area unaccompanied by parents are attacked by other Gulls, particularly those in colonies bare of vegetation; one record of pair with eggs brooding a chick that strayed into their nest while pair away from nest (Wheeler & Watson 1963). At 3.5–4 weeks, parents lead young away from colony; often form small groups, with one or two adults in attendance (Wheeler & Watson 1963). Both sexes said to feed young, for 6 weeks after hatching (Pringle 1987). For young up to 3–4 days old, adults regurgitate food, which is held in bill for young to take; young

also seem to get saliva from parent (Wheeler & Watson 1963). If one parent broods young, other may arrive, regurgitate food, which brooding bird may share with young, holding item in bill, or picking from ground when young old enough (Wheeler & Watson 1963). Young fed 0.7 times/h (0.49; 14) (Smith 1991b). Feeding ends when young disperse after fledging (Nicholls 1974). Young defecate in nest; droppings get trodden into nest-material (Wheeler & Watson 1963).

Fledging to maturity FLEDGING PERIOD: Fledge after c. 4 weeks (Dunlop 1986), fly when at least 5–7 weeks old (Wheeler & Watson 1963). Young disperse from nesting area at about 6 weeks old, and parental care ends (Carrick et al. 1957). Short period of post-fledging attendance and feeding by parents observed (Dunlop 1986). Capable of breeding at 2 years old; youngest recorded breeder, 23 months old (Carrick et al. 1957; Ottaway et al. 1988); males first breed when younger than females (Mills 1973); age of first breeding of colour-marked chicks: males, 3.32 years (0.82; 2–5; 28); females, 4.18 years (0.98; 2–6; 28).

Success Aust. At Altona, from 409 eggs, 248 (61%) chicks hatched and left nest (Wheeler & Watson 1963). In NSW, for 170 wing-tagged pairs: 52 (31%) lost eggs through tagging, 34 (20%) hatched young, and 16 (9%) fledged young; for 31 pairs that nested in season after wing-tagging: from 94 eggs, 11 (12%) hatched, 5 (5%) fledged; no pairs raise more than one brood per season (Smith et al. 1992a). On Shag I., WA: of 85 pairs, c. 50% failed to rear young during autumn nesting (Serventy & White 1943). On Carnac I., WA, of 33 pairs that double-brooded, 18 (54.5%) successfully raised at least one young from each brood, with c. 49% eggs laid producing fledged young (Nicholls 1974). On Penguin I., WA, of 50 eggs, 31 (62%) failed to hatch (Meathrel 1991b). Nesting success on Big I. highest among pairs nesting early in season; few young survived to fledging after initial peak in breeding (Smith 1991b; Smith & Carlile 1992a). Gulls that change mates have significantly lower hatching and fledging success than those that retain pair-bond (Mills 1973). Eggs and young eaten by snakes (Wheeler 1957; Wheeler & Watson 1963), including tiger snakes Notechis, and by Pacific Gulls (Aust. NRS). Eggs eaten by Swamp Harriers (Hollands 1984), and, on Carnac I., King's Skinks Egernia kingii; loss of eggs in an area fenced to exclude Skinks 20%, in an unfenced area 56% (Wooller & Dunlop 1979, 1990). In wet years, nests on islands in lakes can flood, drowning eggs and young (Carrick 1972). On Five Is, most eggs of one-egg clutches infertile (Gibson & Sefton 1953). Rats and foxes take young. Broods also lost to infanticide, high seas and human disturbance (Armstrong 1910; Carter 1923; Carrick et al. 1957; Wheeler & Watson 1963; Nicholls 1974; Meathrel 1990). Rats can ravage colonies and can probably cause abandonment of them; torrential rain can cause 100% mortality of chicks (Wheeler & Watson 1963). In NZ, predation accounts for 25% mortality of eggs and 17% of chicks; Ferrets Mustella furo, Stoats and cats eat eggs and chicks; Kelp Gulls take small and large chicks and Silver Gulls take eggs (Morris 1976; Mills 1989). At Kaikoura: heavier females hatched more eggs than lighter females; heavier males fledged more young than lighter males; late nesters generally fledged fewer young than early nesters; female–female pairs hatched c. 33% eggs, and had low fledging success (Mills 1989). Lifetime number of young fledged per adult: females, 3.4 (8.9; 0–9; 66); males, 3.0 (4.7; 0–6; 81); 39% females and 36% males produced no fledgelings in their lives; overall, 15% females in population produced 52% of all fledgelings and 20% males produced 58% (Mills 1989).

PLUMAGES Prepared by D.J. James and D.W. Eades. Small to medium-sized gull maturing over 3 years, with six recognizable plumages (including natal down) and six moults before reaching adult plumage. Moult three times in first year and twice a year thereafter. Begin pre-juvenile moult soon after hatching and fledge at c. 40 days. Almost immediately undergo partial post-juvenile moult to first immature non-breeding plumage followed soon after by partial pre-breeding moult to first immature breeding plumage. Undergo a complete post-breeding and a partial pre-breeding moult annually, producing alternating non-breeding and breeding plumages, with slight seasonal variation in bare parts but not plumage. Attain adult (definitive) plumage with third non-breeding plumage. Second immatures differ from adults in bare parts but not usually in plumage; some first breed at 2 years old (Mills 1971; Ottaway et al. 1988) when presumably in second immature breeding plumage. Sexes similar, though males slightly larger. Considerable geographical variation, with three subspecies recognized; at least two subspecies occur HANZAB region. Some hybridization with Black-billed Gull (q.v.) in NZ.

Nominate *novaehollandiae* Adult (non-breeding and breeding) (Third and subsequent basic and alternate). **Head and neck** White. **Upperparts** Mantle, scapulars and back, light grey (between 86 and 85) (slightly darker than Black-billed Gull when seen together). Rump and uppertail-coverts, white. In breeding plumage, may show very slight contrast in wear between fresh saddle and retained wing. **Underparts** White; some populations (notably Arch. of the Recherche, WA) and individuals elsewhere have a roseate tint to breast in fresh breeding plumage. **Tail** White. **Upperwing** Marginal coverts, alula and outer primary coverts, white, forming narrow white leading-edge that broadens on inner outerwing. Secondary coverts, inner primary coverts, secondaries and tertials, light grey (between 86 and 85), very slightly darker than upperparts; faint pale tips to secondaries form indistinct off-white trailing-edge. Inner three primaries (p1–p3), slightly darker than secondaries, light grey (c85), also with pale tips forming narrow white trailing-edge. P4, light grey (c85) with narrow diffuse dark sooty-grey (brownish 83) inner edge, and pale-grey (86) to white tip. P5, light grey (c85) on inner web grading to pale grey (86) on outer edge; dark sooty-grey (brownish 83) inner edge narrow and diffuse basally becoming broader and clearer distally before joining black (sometimes incomplete) subterminal bar c. 12 mm wide; pale-grey (c86) apical spot c. 7 mm long. P6, similar to p5, though outer edge white, and with black subterminal band 20–25 mm wide, and white apical spot c. 4 mm wide. P7, light grey on inner web and grey on outer web, with broad black subterminal band (25–35 mm wide at shaft) extending broadly towards base on inner edge and narrowly along outer edge in diffuse V; white apical spot 3–5 mm wide. P8, white at base and black distally, with small white apical spot c. 5 mm wide; often have small white diamond-shaped mirror 25–35 mm long in centre of black tip, but this varies individually and geographically. P9, mostly black with narrow white base; white mirror 45–55 mm long (longest along shaft) extending to outer edge and usually two-thirds across inner web (leaving black emargination along inner edge), pointed basally and rounded distally; sometimes mirror continues to inner edge of feather; white apical spot no more than 2 mm wide and separated from mirror by c. 25 mm. P10, black, with white mirror 40–60 mm long along shaft, pointed basally and rounded distally; white apical spot, minute, c. 20 mm from mirror. White apical spots fresh in non-breeding plumage but worn down in breeding plumage. Variation in

outer primaries studied by Johnstone (1982, q.v. for details): generally follows cline of increasing amount of white from n. Qld to Tas. and from nw. WA, S to SA and E to Tas. Tas. birds have largest mirrors and white tongues on bases of outer primaries, with mirror on p8 always present and often confluent with tongue; Qld birds often only have mirrors on outer two primaries and much-reduced tongues; Vic. and NSW birds show stepped cline between Qld and Tas. Birds from nw. WA. have very small mirrors and tongues; in sw. WA and SA, white increases clinally except for population of small birds with small mirrors and tongues on Arch. of the Recherche. **Underwing** Leading lesser coverts, white, grading to uniform pale to light-grey (between 86 and 85) rest of coverts, subhumerals and secondaries; secondaries have slightly paler narrow tips. Inner primaries, light grey (85) (slightly darker than secondaries), grading to sooty-grey (sooty 82) outer primaries (p6 or p7 to p10) with large white patch near tips of outer three primaries; diffuse sooty-grey (sooty 82) inner edges to middle primaries form inconspicuous darker stripes along middle primaries when wing well spread.

Downy young Upperparts vary from light grey-brown (c119D) to dull light-brown or gingery-brown (c223D), overlain with dark-brown (219, 119) blotches; blotches small and sharp on top of head, larger, more diffuse and irregular on saddle. Underparts, light grey-brown, often with slight ginger tinge to breast, and with large dark-brown (121) blotches on flanks and smaller blotches on throat. (Best told from Black-billed Gull on bare parts.)

Juvenile Held only briefly after fledging. Much individual and geographical variation. **Head and neck** Mostly white, with uneven pale-brown (c223d) wash on crown and nape; wash sometimes faint, sometimes dark enough to give capped appearance; rapidly lost with wear. Forehead, off-white, with varying pale-brown (223D) smudges. Cheeks, usually white. Often have pale-brown (223D) crescent in front of eye or diffuse patch round eye, and brownish-grey (c79) or pale-brown (223D) ear-spot, occasionally meeting cap. Foreneck, chin and throat, white. Hindneck varies: feathers white with faint pale-brown (223D) wash at tips, hindneck appearing faintly washed brown; or feathers white at bases with light-brown (223C) to pale-brown (223D) tips and very thin streaky white fringes when fresh, hindneck appearing heavily washed brown; or feathers have white bases, grey-brown (28) subterminal spots and pale-brown (223D) tips, hindneck appearing heavily mottled rather than washed; occasionally, markings of hindneck extend as partial collar onto sides of breast. **Upperparts** Feathers of mantle, scapulars and upper back, pale grey (86) basally, with dark-brown (121–129) to brown (33) diamond-shaped or triangular centres and very broad bold pale-buff (124) fringes, which quickly fade to white; pattern tends to be more diffuse and mottled anteriorly (on mantle) and more coarse posteriorly; rear scapulars tend to have more shapeless dark-brown (121–129) band across middle and dark-brown (121–129) subterminal chevron, separated by buff (124) band. Size of dark-brown markings varies greatly; some birds heavily and darkly marked, others paler and more buff; some from WA heavily marked with dark-brown (121–129) subterminal chevrons on otherwise mostly light-brown (c123C) feathers, but few details. Lower back, plain light-grey (like adult), light grey with buff (124) tips to feathers, or mottled like rest of saddle. Rump and uppertail-coverts, white. **Underparts** White. **Tail** Varies, but usually white, with narrow dark-brown (121) subterminal tail-band and narrow pale-buff (124) tip, which soon fades to white; tail-band can

be quite broad (up to 12 mm) and is usually irregular, sometimes broken into chain of spots. Buff tip sometimes peppered with dark brown (121). Outer feathers tend to be less heavily marked than inner rectrices, and are sometimes white. Some may have completely white tails. Much individual variation, even within colonies. **Upperwing** Similar to adult but with smaller white patch (mirrors) making black wing-tip appear larger; prominent dark subterminal band across secondaries and inner primaries; and prominent darkly mottled carpal bar. Tertials, light grey, with prominent dark-brown (121–129) or brown (33) bars or chevrons, similar to rear scapulars. Marginal and outer primary coverts, white, like adult; alula: white, or white with slight grey-brown wash, or mostly brown with white tips and mottling along edges. Inner lesser primary coverts, pale grey to off-white. Inner greater primary coverts and greater secondary coverts, light grey, with bold narrow dark-brown (121, 129) to brown (33) subterminal bands and bold white tips. Leading rows of lesser secondary coverts, light grey, like adult. Median coverts and three trailing rows of lesser secondary coverts, light grey basally, with varying dark-brown (121–129) to brown (33) subterminal spot and narrow buff (124) (fades to white with wear) fringe, similar to saddle; form very prominent dark-blotched carpal bar. Secondaries, light grey, like adult, with dark brown-grey (brown 92) subterminal band, which is: nearly complete on outer secondaries (s1–s5), complete on outer web and becoming smaller and less complete inwards on inner web of middle secondaries (s6–s9 or s10), and only a small faint spot on outer web of inner secondaries; band sometimes in pattern of dark-brown subterminal streaks along shaft and inner web of middle and inner secondaries; always form conspicuous blackish subterminal band (secondary bar) narrowing inwards. Primaries, similar to adult except: mirrors on p10 and p9 smaller and almost always absent on p8; on p9 and p10, mirrors short, irregular, and about half width of feather; broader black trailing-edge (subterminal bands) from p7 inwards, tapering but continuous across inner primaries and joining secondary bar; tongues of p8–p6 not clean white but untidily dusted with light grey (c85). Apical spots similar to adult when fresh, but tend to wear more quickly. **Underwing** Similar to adult except: white patch in outerwing, smaller, making wing-tip darker; inner primaries, darker and more extensively dusky grey (sooty 83); dark secondary bar and subterminal band across inner primaries prominent, especially when backlit; pale trailing-edge to secondaries slightly more conspicuous than in fresh adult.

First immature non-breeding (First basic [winter]). Retain most of juvenile wing and tail. **Head and neck** White. **Upperparts** As adult; some retain a few juvenile scapulars for some time, but mainly grey saddle contrasts strongly with patterned coverts. Some retain juvenile lower back, with narrow buff (124) tips to feathers. **Underparts** White. **Tail** Retained from juvenile. Tips faded to white and partly worn. Subterminal band fades slightly with wear. **Upperwing** Mostly retained from juvenile. Nearly always replace tertials with light-grey ones; some replace a few lesser secondary coverts. At first, apical spots tend to be present on all but outer two primaries, but soon lost from rest of primaries. White fringes on coverts reduced with wear; lesser coverts tend to become pale grey, paler than saddle. **Underwing** As juvenile.

First immature breeding (First alternate [summer]). Still retain much of juvenile wing and tail; similar to first immature non-breeding. **Head and neck** White. **Upperparts** Like adult. **Underparts** White. **Tail** Retained, replaced or

partially replaced. New rectrices, all white. Old rectrices have faded subterminal band and very worn white tip. **Upperwing** Varies. Replace from all to no secondary coverts (new ones light grey, like adult); usually retain primary coverts and inner median and greater secondary coverts; often replace alula if primary coverts replaced. Often replace a few inner secondaries (rarely all) with adult-like ones; sometimes retain a few scattered secondaries or a clump of secondaries. Tertials always light grey, usually fresh but sometimes retained from first immature non-breeding. Primaries retained: worn, with black areas faded to dark brown and apical spots smaller or almost lost. **Underwing** Similar to juvenile; may lack secondary bar or have partial bar depending on moult. Apical spots and trailing-edge smaller.

Second immature (non-breeding and breeding) (Second basic [winter] and alternate [summer]). Usually inseparable from adult on plumage (but see Bare Parts). However, a few have pattern of primaries darker than typical adult, intermediate between juvenile and adult.

Subspecies *scopulinus* Similar to nominate *novaehollandiae*, differing slightly in shape of bill (see Structure). **Adult (breeding and non-breeding) Head and neck** Some said to have greyish wash on nape (Johnstone 1982). **Upperwing** Rarely have mirror on p8: present in three of 41 adult skins from NZ, none of 19 from Chatham Is and none of 15 from Auckland and Campbell Is (NMNZ). Mirrors on p9 and p10 much shorter but wider than in nominate *novaehollandiae* (Johnstone 1982); do not have complete black emargination of mirror along inner web of p10. Distally, mirrors tend to be cut more squarely across feather; white patch in wing-tip appears more square. Birds from Chatham Is said to have slightly darker underside to wing-tip than NZ birds (Fleming 1939a).

Juvenile Too much individual variation to allow meaningful discussion of differences between juveniles without detailed study. However, tend to have more solid dark-brown blotches on scapulars and wing-coverts, giving more heavily patterned blotched appearance. Tail apparently always white with no tail-band.

Aberrant plumages Albinos and partially leucistic birds reported occasionally (Buller 1888; McGill 1955; Crawford 1994; Oliver). Reports of entirely or predominantly sooty-grey birds appear to be of birds with stained plumage (M.J. Carter; D.W. Eades; D.J. James; A.P. McBride).

BARE PARTS Based on field observations (D.W. Eades; D.J. James), museum labels (AIM, AM, HLW, MV, NMNZ) and photos (Harrison 1987; Moon 1979, 1992; Moon & Lockley 1982; Pringle 1987; Aust. RD; NZRD; unpubl.: M.J. Carter; B. Chudleigh; D.W. Eades; D.J. James). **Adult non-breeding** Bill, red (12) to dark red (110) with diffuse darker-red (c8) or blackish smudges near tip; mouth and gape, red. Iris, white. Orbital ring, bright red (210). Legs and feet, red (108A) to bright red (210). Claws, black. **Adult breeding** Similar to adult non-breeding but bill and legs tend to be bright red (210, 12) in spring. **Downy young** Not well known. Bill, black, with dark-purple tinge; tends to become more grey before fledging but usually has no pink tinge; small white egg-tooth at hatching. Iris, dull black. Orbital ring, grey-black (82). Legs, dark grey. On one skin, bill said to be pink and legs reddish; juveniles with pink bills and legs suggest that this not exceptional. **Juvenile** Bill usually black, with small area at base of lower mandible, brown to pink-brown (219D–5); some (in sw. WA and NZ at least) have brown-pink (c5) to buff-pink bill

with small black tip. Iris, dark brown to black. Orbital ring, dark grey (83) to grey-black (82). Legs and feet, dark pink-grey (dark 4) to pink-brown (c219D) to brown-pink (c5), often with profuse dusky smudges; webs often dark grey contrasting with more coloured toes. Claws, black. **First immature non-breeding** Bill has pink-brown (219D) to brown-pink (c5) base with smeary black tip and tomia and varying black smudges elsewhere; area of pink at base increases with age. Iris and orbital ring, still dark. Legs and feet, similar to juvenile but paler and pinker, or, sometimes, with dark-red tinge. Claws, black. **First immature breeding** Bill, dark red (c8) (sometimes red [11]), smeared with black on tip and tomia. Iris varies: dark brown (c121) (but noticeably lighter than pupil when seen in good light) to grey-brown or, rarely, off-white. Orbital ring, black. Legs and feet, dark red (8–110) smeared with black. **Second immature (non-breeding and breeding)** Similar to adult but usually have obvious traces of immaturity. Bill, dull orange-red (dull 15) to dull red or dark red (c8) with prominent dull-black tomia and subterminal smudges. Iris, white like adult or suffused with grey. Orbital ring, black to dark red (c8) or orange-red. Legs and feet, similar to bill, dull or dark red with dull-black or dusky smudges; webs often have much black on them. Proportion of birds, if any, that are indistinguishable from adult not known, but probably few.

MOULTS Based on *c.* 170 skins (AIM, AM, HLW, MV, NMNZ) from se. Aust. and NZ. Timing of breeding varies greatly throughout Aust. and moult-cycles also vary in relation to timing of breeding; almost no data available for birds breeding in winter. **Adult post-breeding** (Third and subsequent pre-basic). Complete. Takes about 3–4 months; begins with p1, late Dec. to early Feb., after chicks fledge, and finishes Apr.–May. Non-breeders and failed breeders moult slightly earlier. Primaries moult outwards, usually two but often three at a time. Moult of secondaries begins when middle primaries moulting; moult inwards from s1 to about s14; up to three active at moult-front. Tertials (s15–s19) moult sequentially inwards in separate wave. Tail, usually outwards (centrifugal) and symmetrical, but often slightly or very irregular; begins when p3–p5 moulting. Only data for apparently winter-breeding birds are from Nov., with PMS 14, and Dec., with PMS 9 and 36. **Adult pre-breeding** (Third and subsequent pre-alternate). Partial moult of head and body. Sometimes begins late June but usually July and finishes Aug. or early Sept. Timing of moult in birds breeding winter not known. **Prejuvenile** No data. **Post-juvenile** (First pre-basic). Partial. Involves head, most of body (lower back sometimes retained; extent of moult of tail-coverts not known) and usually tertials; probably some moult a few lesser secondary coverts. Begins soon after fledging, Nov.–Feb. and finishes by Feb.–Apr. No data for birds that hatch in winter. **First immature prebreeding** (First pre-alternate). Extent varies. Replace from all to no secondary coverts, but often retain inner median and greater coverts; sometimes replace some primary coverts and alula. Often replace a few, and sometimes all, secondaries; usually moult inwards so that outer secondaries more likely to be new; but sometimes moult a few inner secondaries only; sometimes retain a few scattered secondaries or a clump; this pattern of secondary-moult seems similar to that previously described only for Indian Black-headed Gull *L. brunicephalus* (van den Berg *et al.* 1991). Tertials usually renewed but sometimes retained if renewed in post-juvenile moult. Primaries never moulted. **First immature post-breeding** (Second prebasic). First complete moult. Begins about Nov. and finishes

Apr.–May, with population poorly synchronized; individuals probably take 3–4 months. Sequences similar to adult post-breeding. **Second immature pre-breeding** (Second pre-alternate). Partial; poorly known but similar to adult pre-breeding.

MEASUREMENTS   Nominate *novaehollandiae*. (1–2) NSW and Vic., skins; Bill G = depth of bill at gonys (AM, HLW, MV): (1) Adults and second-year birds; (2) First-year birds.

		MALES	FEMALES	
WING	(1)	297.6 (11.2; 283–315; 14)	288.3 (8.1; 275–299; 13)	*
	(2)	291.0 (7.6; 281–310; 13)	275.4 (6.5; 266–285; 7)	**
TAIL	(1)	115.9 (4.7; 108–123; 15)	110.8 (5.4; 100–121; 17)	**
	(2)	112.2 (3.6; 107–120; 13)	105.7 (4.1; 100–112; 7)	**
BILL	(1)	36.5 (2.3; 32.6–40.5; 17)	34.4 (2.4; 30.8–39.0; 17)	*
	(2)	36.7 (1.2; 35.0–38.5; 12)	34.4 (2.2; 30.2–37.6; 8)	**
BILL G	(1)	10.7 (0.54; 9.5–11.5; 17)	9.7 (0.68; 9.0–11.2; 17)	*
	(2)	10.3 (0.98; 9.0–11.5; 10)	9.1 (0.39; 8.6–9.0; 8)	**
TARSUS	(1)	48.0 (2.6; 44.0–51.9; 16)	46.6 (3.0; 40.0–51.5; 18)	ns
	(2)	49.1 (2.1; 44.5–52.1; 14)	46.1 (1.9; 43.0–48.3; 8)	**
TOE	(1)	35.2 (1.6; 32.0–38.2; 14)	33.5 (1.8; 30.5–36.7; 15)	*
	(2)	35.4 (1.9; 33.0–38.1; 11)	33.4 (1.4; 31.3–36.1; 8)	*

Adults have significantly longer wing, tail (P<0.01) and deeper bill at gonys (P<0.05) than first-year birds (sexes combined).

Nominate *novaehollandiae*. (3–10) Skins; wing flattened but not straightened (Johnstone 1982): (3) SA; (4) WA, S of Perth; (5) WA, N of Perth; (6) NT; (7) Qld; (8) NSW; (9) Vic.; (10) Tas.

		MALES	FEMALES
WING	(3)	298 (292–305; 8)	286 (274–310; 15)
	(4)	298 (291–305; 10)	287.2 (276–305; 13)
	(5)	305 (292–319; 14)	291 (273–306; 15)
	(6)	294 (292–296; 4)	304
	(7)	300 (297–306; 4)	284 (281–293; 5)
	(8)	290 (282–305; 7)	284 (272–295; 10)
	(9)	301 (295–306; 4)	284 (271–295; 6)
	(10)	293 (279–309; 11)	287 (268–304; 6)
BILL	(3)	48.2 (46.5–52.0; 8)	46.8 (41.0–49.0; 15)
	(4)	50.5 (45.0–53.0; 10)	44.9 (41.0–48.0; 13)
	(5)	51.2 (48.0–56.5; 14)	47.7 (45.0–52.5; 15)
	(6)	50.6 (47.5–53.5; 4)	44.0
	(7)	–	47.9 (46.5–49.0; 5)
	(8)	47.3 (44.0–49.0; 7)	44.6 (41.5–48.0; 10)
	(9)	47.2 (46.0–50.0; 4)	44.0 (42.0–45.0; 6)
	(10)	49.3 (48.0–51.0; 11)	–

Additional data on length of tail, depth of bill at gonys, and total length from NZ, and finer geographical breakdown for WA in Johnstone (1982).

Subspecies *scopulinus*. (11) Kaikoura, fresh specimens (Mills 1971); (12–13) NZ, skins (AIM, NMNZ): (12) Adults; (13) First-year birds.

	MALES	FEMALES	
WING	(11) 286.5 (7.57; 88)	274.2 (7.14; 77)	**
	(12) 287.2 (9.5; 272–309; 18)	277.8 (10.0; 266–290; 6)	ns
	(13) 272.4 (8.1; 261–283; 7)	268.1 (8.1; 257–282; 11)	ns
TAIL	(11) 111.6 (3.56; 88)	105.4 (3.98; 77)	**
	(12) 113 (5.1; 105–117; 4)	105, 107	ns

		MALES	FEMALES	
BILL	(11)	32.8 (1.57; 88)	30.3 (1.92; 77)	**
	(12)	32.6 (1.4; 30.0–35.5; 20)	31.7 (1.4; 30.3–34.4; 7)	ns
	(13)	32.9 (1.7; 29.5–35.3; 10)	31.0 (1.8; 27.2–34.7; 14)	*
BILL G	(12)	10.1 (0.65; 9.0–11.0; 20)	9.4 (0.85; 8.6–11.0; 7)	*
	(13)	9.1 (0.65; 8.0–10.3; 9)	8.9 (0.65; 7.5–9.8; 12)	ns
TARSUS	(11)	45.6 (1.84; 88)	43.8 (1.71; 77)	**
	(12)	44.5 (1.9; 40.7–46.9; 21)	43.2 (1.6; 41.0–46.0; 8)	*
TOE	(11)	38.4 (2.22; 88)	37.1 (1.79; 77)	**
	(12)	36.1 (1.4; 34.0–37.0; 4)	34.1, 34.7	

Adults have significantly longer wing, deeper bill at gonys (P<0.01) and longer tail (P<0.05) than first-year birds (sexes combined).

Subspecies *scopulinus*. (13–14) Skins (NMNZ): (13) Chatham Is; (14) Auckland and Campbell Is.

		MALES	FEMALES	
WING	(13)	280.2 (5.8; 272–289; 9)	266.7 (2.4; 264–270; 7)	**
	(14)	276.6 (5.5; 269–284; 7)	271.8 (5.7; 263–279; 6)	ns
BILL	(13)	33.0 (1.5; 31.5–36.3; 9)	29.7 (1.0; 28.0–31.2; 8)	**
	(14)	29.4 (1.2; 28.3–31.5; 80	27.6 (1.3; 25.7–29.0; 6)	*
BILL G	(13)	9.9 (0.51; 9.2–10.7; 9)	9.1 (0.47; 8.5–9.8; 8)	**
	(14)	9.8 (0.51; 9.1–10.5; 8)	8.9 (0.50; 8.4–9.6; 6)	**
TARSUS	(13)	47.1 (1.2; 45.0–58.8; 9)	44.1 (1.3; 42.3–46.6; 8)	ns
	(14)	44.7 (2.2; 41.6–47.6; 8)	42.1 (1.9; 40.0–44.8; 6)	*

When sexes combined, Chatham Is sample has significantly longer tarsus (P<0.01) than NZ or Auckland and Campbell Is samples; sample from Auckland and Campbell Is has significantly shorter bill-length (P<0.01) than NZ or Chatham Is samples.

When sexes and ages combined, subspecies *scopulinus* significantly smaller (P<0.01) than nominate *novaehollandiae* in all measurements except toe. For geographical breakdown of depth of bill at gonys, see Sexing.

WEIGHTS   Nominate *novaehollandiae*. (1–2) NSW and Vic., museum label data (AM, HLW, MV): (1) Adults and second-year birds; (2) First-year birds.

	MALES	FEMALES	
(1)	313 (51.9; 220–397; 15)	264 (34.1; 195–320; 14)	**
(2)	336 (55.4; 255–430; 13)	298 (47.4; 244–355; 6)	ns

When sexes combined, adults significantly lighter than first-year birds (P<0.05). For geographical breakdown in Aust., see Johnstone (1982).

Subspecies *scopulinus*. (3–4) NZ (not including Chatham, Auckland or Campbell Is), label data (NMNZ): (3) Adults and second-year birds; (4) First-year birds; (5) Chatham Is; (6) Auckland and Campbell Is.

	MALES	FEMALES	
(3)	292.2 (41.8; 237–355; 10)	211, 215, 225	
(4)	245 (56.1; 150–290; 6)	241, 250	
(5)	310 (31.5; 270–366; 7)	282 (16.7; 265–315; 7)	*
(6)	300, 335	280, 305, 310	

When sexes and ages combined, subspecies *scopulinus* significantly smaller (P<0.05) than nominate *novaehollandiae*.

STRUCTURE   Wing, long and slightly rounded. Eleven primaries: p9 longest, p10 0–5 mm shorter, p8 7–14, p7 27–33, p6 47–56, p5 63–76, p4 81–99, p3 98–121, p2 105–137, p1 128–157; p11 minute. Tips of primaries, rounded in adults, pointed in juveniles. Nineteen secondaries, including five tertials; tips of longest tertials fall near tip of p6 on folded wing. Tail, square; 12 rectrices; tips of rectrices square in adults, rounded in juveniles. Bill, straight and short; evenly decurved over distal third of upper mandible. Gonydeal angle prominent, though moderate for a gull; more prominent in males. Nostril, long slit, almost from loral point to half-way along mandible. Subspecies *scopulinus* has proportionately slightly shorter bill than nominate *novaehollandiae*, with sharper decurve to upper mandible, giving subtly more stubby appearance. Tarsus, long, slender, slightly laterally compressed; tarsus and lower third of tibia unfeathered; tarsus scutellate in one row on front. Toes, fully webbed. Outer toe 88–98% of middle, inner 67–82%, hind 12–20%, raised. Mid-claw much stronger than others.

AGEING   Can be aged in similar way to Kelp Gull *L. dominicanus* (q.v.), except that time of year not reliable because moult-cycles are not synchronized. First-year birds best distinguished by juvenile wing and bare parts: juveniles have heavily patterned saddle; first immature non-breeding have grey saddle and moderately worn juvenile wing, with apical spots on outer primaries (at least at first); first immature breeding have very worn juvenile primaries, but replace varying number of wing-coverts, secondaries and rectrices. Most second immatures have adult-like wing, and obvious traces of immaturity in bare parts, including: (1) blackish smudges on bill (beware non-breeding adults with hint of dark subterminal marks on bill); (2) black smudges on legs, and dark-grey webs; (3) black to dull-red orbital ring (probably never bright red); and (4) often, dusky or grey tinge to iris. A few second immatures have pattern of wing-tip intermediate between juvenile and adult. Separation of second immature plumages difficult because changes in bare parts during second year are not fully known and there are few plumage differences between non-breeding and breeding and wear-contrast difficult to detect; have fresh apical spots in non-breeding plumage and worn ones in breeding plumage. Adult plumages also difficult to separate; combination of worn apical spots and bright-red bill and legs indicative of breeding plumage.

SEXING   Males larger than females. Measurement with greatest difference between sexes is depth of bill at gonys (Bill G), which has been used as single variate for sexing on Carnac I., WA, with 97% accuracy (Wooller & Dunlop 1981b); at Devonport, Tas., with 93% accuracy (Woehler *et al.* 1989); and on Five I., NSW, with 86% accuracy (Smith *et al.* 1992b). Depth of bill at gonys increases slightly from first-year to adult (see Measurements). Woehler *et al.* (1989) also used total head-length, with 95% accuracy. However, validity of such methods has been criticized (Rogers & Rogers 1995; q.v.). Also, geographical variation in size means that sexing criteria are regionally specific. Discriminant functions provide more reliable estimates, though these also regionally specific. At Kaikoura, NZ, discriminant function based on depth of bill at gonys and length of bill from gape, sexed birds with *c.* 90% accuracy (Mills 1971).

Measurements used for sexing; all from fresh specimens: (1) Five Is, NSW (Smith *et al.* 1992b); (2) Devonport, Tas. (Woehler *et al.* 1989); (3) Carnac I, WA, (Wooller & Dunlop 1981b); (4) Kaikoura, NZ (subspecies *scopulinus*) (Mills 1971); Bill L is length of bill in straight line from corner of gape to tip of culmen.

	MALES	FEMALES	
BILL G	(1) 10.7 (0.7; 9.4–11.9; 52)	9.6 (0.5; 8.4–10.8; 36)	**
	(2) 9.8 (0.4; 8.8–10.8; 51)	8.7 (0.4; 7.8–9.5; 37)	**
	(3) 11.69 (0.06; 72)	10.29 (0.05; 41)	**
	(4) 10.32 (0.35; 88)	9.48 (0.35; 77)	**
BILL L	(4) 51.66 (1.37; 88)	48.11 (1.48; 77)	**
THL	(2) 88.2 (2.2; 82.9–93.0; 51)	81.7 (1.9; 78.4–86.0; 37)	**

GEOGRAPHICAL VARIATION   Complex. Three subspecies recognized, following only recent review (Johnstone 1982): nominate *novaehollandiae* in Aust. and Tas.; *scopulinus* in NZ, Chatham, Snares, Auckland and Campbell Is; and *forsteri* in New Caledonia. Earlier treatment of Dwight (1925), which was followed by Peters CL and mostly so by Aust. CL, recognized *forsteri* (= *gouldi*) extending from New Caledonia to e. Qld, and separate subspecies *gunni* in Tas. However, variation in Aust. clinal and recognition of subspecies not justified, and birds from New Caledonia apparently have very different wing-pattern to birds from Qld (Johnstone 1982), though more study needed. Expansion of population since European settlement may have led to integration of subspecies that were previously better defined. See Plumages, Measurements, Weights and Structure.

Sometimes treated as conspecific with Hartlaub's Gull *L. hartlaubii* (Dwight 1925; Harrison 1983). Johnstone (1982) briefly discusses relationships with closely related Hartlaub's and Grey-headed Gull *L. cirrhocephalus*. No justification for treatment of *scopulinus* as separate species by Sibley & Monroe (1990).

REFERENCES
ABBBS. 1966. *Aust. Bird Bander* 4: 62–3.
—— 1972. *Aust. Bird Bander* 10: 40–2.
—— 1973. *Aust. Bird Bander* 11: 40–2.
—— 1982. *Corella* 6: 20–3.
—— 1988. *Corella* 12: 64–7.
—— 1989a. *Corella* 13: 63–4.
—— 1989b. *Corella* 13: 131–2.
Abbott, I. 1976. *West. Aust. Nat.* 13: 158–9.
—— 1978. *Corella* 1: 34–5.
Allen, E. 1990. *Bird Obs.* 697: 45.
Amos, B. 1949. *Emu* 49: 58.
Anderson, G.M. 1938. *Emu* 38: 81–2.
Anon. 1926. *Emu* 25: 303.
—— 1963. *Notornis* 10: 303–5.
Armstrong, W.J.T. 1908. *Emu* 7: 181–4.
—— 1910. *Emu* 9: 155–7.
Ashton, C.B. 1984. *S. Aust. Orn.* 29: 99.
—— 1985. *S. Aust. Orn.* 29: 169–79.
Attiwill, A.R. 1972. *S. Aust. Orn.* 26: 59–64.
Badman, F.J. 1979. *S. Aust. Orn.* 28: 57–81.
—— 1989. *The Birds of Middle and Lower Cooper Creek in South Australia.* Nature Cons. Soc. of S. Aust., Adelaide.
Baird, I., & H. Nix. 1979. *Canberra Bird Notes* 4 (6): 9–10.
Bartle, J.A. 1974. *Notornis* 21: 135–66.
Bassett Hull, A.F. 1908. *Emu* 8: 80–5.
—— 1912. *Emu* 11: 202–7.
Bedggood, G.W. 1965. *Bird Obs.* 405: 6.
Bell, B.D. 1960. *Notornis* 9: 111.
Bellchambers, K., & G. Carpenter. 1990. *S. Aust. Orn.* 31: 1–7.
Bellingham, M., & A. Davis. 1982. *Notornis* 29: 149–50.
Berney, F.L. 1907. *Emu* 6: 106–15.

Black, M.S. 1955. *Notornis* 6: 167–70.
Blackburn, A. 1962. *Notornis* 10: 42.
Boehm, E.F. 1955. *Emu* 55: 23.
Bossley, M.I., & S.K. Boord. 1991. *S. Aust. Orn.* 31: 95–6.
Braithwaite, L.W., *et al.* 1985a. *Tech. Memo. Div. Wildl. Rglds Res. CSIRO, Aust.* 21.
——, *et al.* 1985b. *Tech. Memo. Div. Wildl. Rglds Res. CSIRO, Aust.* 23.
——, *et al.* 1986. *Tech. Memo. Div. Wildl. Rglds Res. CSIRO, Aust.* 24.
——, *et al.* 1987. *Tech. Memo. Div. Wildl. Rglds Res. CSIRO, Aust.* 27.
Brandis, C.C.P., *et al.* 1991. *Aust. Bird Watcher* 14: 165–79.
Bransbury, J. 1980. *S. Aust. Orn.* 28: 110.
Bregulla, H.L. 1992. *Birds of Vanuatu.* Nelson, Shropshire.
Bright, J. 1935. *Emu* 35: 293–302.
Brown, B. 1982. *Notornis* 29: 77–8.
Buchanan, L. 1983. *Notornis* 30: 68.
Buddle, G.A. 1951. *Bird Secrets.* Reed, Wellington.
Bull, P.C. 1941–42. *NZ Bird Notes* 1: 59–62.
Buller, W.L. 1888. *History of the Birds of New Zealand.* 2. Second edn; Author, Lond.
Burger, J., & M. Gochfeld. 1987. *Bird Behav.* 7: 1–21.
Carrick, R. 1960. *Aust. Mus. Mag.* 13: 222–7.
—— 1972. *US Dept. Interior Wildl. Res. Rep.* 2: 41–99.
——, & M.D. Murray. 1964. *CSIRO Wildl. Res.* 9: 189–99.
——, —— 1970. *Aust. Bird Bander* 8: 51–6.
——, *et al.* 1957. *CSIRO Wildl. Res.* 2: 116–44.
Carruthers, R.K. 1964. *Emu* 63: 306.
—— 1969. *Emu* 68: 280–2.
Carter, T. 1904. *Emu* 3: 207–13.
—— 1923. *Emu* 23: 125–42.
Clarke, G. 1966. *S. Aust. Orn.* 24: 113–14.
Coates, B.J. 1985. *The Birds of Papua New Guinea.* 1. Dove Publs, Alderly, Qld.
Cole, C.F. 1908. *Emu* 8: 76–8.
Collins, T., & A. Collins. 1976. *Bird Obs.* 535: 46.
——, —— 1981. *Geelong Nat.* 17: 16–17.
Condon, H.T. 1937. *S. Aust. Orn.* 14: 28.
Cooper, R.P. 1964. *Aust. Bird Watcher* 2: 95–8.
—— 1975. *Aust. Bird Watcher* 6: 17–34.
Corrick, M.G. 1977. *Victorian Nat.* 94: 114.
Cowan, R.J. 1967. *Notornis* 14: 220.
Cowie, J. 1977. *OSNZ News* 1: 6.
Crawford, I. 1994. *Canberra Bird Notes* 19: 47.
Cunningham, J.J., & K.A. Wodzicki. 1948. *Emu* 47: 177–98.
D'Ombrain, A.F. 1936. *Emu* 36: 16–20.
—— 1954. *Emu* 54: 210–12.
Dalby, J., *et al.* 1984. *Aust. Birds* 18: 87–8.
Dann, P. 1979. *Corella* 3: 84–5.
—— 1984. *Aust. Bird Watcher* 10: 155–6.
Darby, M.M. 1970. *Notornis* 17: 28–55.
Davis, A.M. 1987. Unpubl. Rep., NZ Dept Cons., Wellington.
Dawson, D.G. 1966. *Notornis* 13: 97.
Dawson, J.G. 1989. *Vict. Wader Stud. Grp Bull.* 13: 40–3.
de Ravin, J.A. 1975. *Aust. Bird Watcher* 6: 4–10.
de Rebeira, P. 1973. *West. Aust. Nat.* 12: 167–8.
Delacour, J. 1966. *Guide des Oiseaux de la Nouvelle-Caledonie et de ses Dependances.* Delachaux & Niestle, Paris.
Dove, H.S. 1919a. *Emu* 18: 206.
—— 1919b. *Emu* 19: 142.
—— 1933. *Emu* 33: 133.
Draffan, R.D.W., *et al.* 1983. *Emu* 83: 207–34.
Drewien, G., & L. Best. 1992. *A Survey of the Waterbirds in Northeast South Australia 1990–1991.* Rep. of ANPWS/SANPWS/NSWNPWS.
Dunlop, J.N. 1986. Unpubl. PhD thesis, Murdoch Univ., WA.
——, & G.M. Storr. 1981. *Corella* 5: 71–4.
——, *et al.* 1988a. *Corella* 12: 93–8
——, *et al.* 1988b. *Aust. J. mar. freshwat. Res.* 39: 661–9.
Dwight, J. 1925. *Bull. Am. Mus. Nat. Hist.* 52: 63–408.

Egan, K. 1990. *Aust. Birds* 24: 41.
Falla, R.A. 1924. *Emu* 24: 37–43.
—— 1949. *NZ Bird Notes* 3: 125.
——, *et al.* 1981. *The New Guide to the Birds of New Zealand.* Collins, Auckland.
Favaloro, N.J. 1948. *Emu* 47: 352–6.
Fielding, P. 1983. *Tas. Bird Rep.* 12: 25–6.
Fleming, C.A. 1939a. *Emu* 38: 492–509.
—— 1939b. *Emu* 39: 1–15.
—— 1946. *NZ Bird Notes* 2: 27–9.
Fullagar, P.J. 1973. *Aust. Bird Bander* 11: 36–9.
Fuller, P.J. 1963. *West. Aust. Nat.* 9: 9–12.
——, & A.A. Burbidge. 1992. *Corella* 16: 47–58.
Gibson, D.F. 1986. *Cons. Comm. North. Terr. Tech. Rep.* 30.
Gibson, J.D. 1976. *Aust. Bird Bander* 14: 100–3.
—— 1979. *Corella* 3: 103–4.
——, & A. Sefton. 1953. *Emu* 53: 264–5.
Gilbert, P.A. 1939. *Emu* 39: 107–10.
Gillham, M.E. 1962. *Proc. Roy. Soc. Vict.* 75: 45–63.
Gosper, D.G. 1981. *Corella* 5: 1–18.
Green, R.H. 1966. *Emu* 65: 304.
—— 1969. *Rec. Queen Vict. Mus.* 34: 1–32.
Gurr, L. 1953. *Notornis* 5: 185.
—— 1954. *Notornis* 5: 208–9.
—— 1967. *Ibis* 109: 552–5.
——, & F.C. Kinsky. 1965. *Notornis* 12: 223–40.
Haddon, G. 1987. *S. Aust. Orn.* 30: 83.
Hall, B.P. (Ed.) 1974. *Birds of the Harold Hall Australian Expeditions 1962–70.* Br. Mus. (Nat. Hist.), Lond.
Halse, S.A., & R.P. Jaensch. 1989. *Emu* 89: 232–49.
Hanks, E.S. 1957. *Emu* 57: 130.
Harrison, C.J.O. 1970. *Emu* 70: 33–4.
Harrison, P. 1983. *Seabirds: An Identification Guide.* Croom Helm, Sydney.
—— 1987. *Seabirds of the World: A Photographic Guide.* Christopher Helm, Lond.
Hawkins, J.M. 1988. *Notornis* 35: 249–60.
Hemmings, A.D. 1988. *Notornis* 35: 116.
Hermes, N., *et al.* 1986. *Notornis* 33: 141–9.
Hindwood, K.A. 1940. *Emu* 40: 1–86.
—— 1955. *Emu* 55: 212–16.
——, & J.M. Cunningham. 1950. *Emu* 50: 23–35.
Hobbs, J.N. 1961. *Emu* 61: 21–55.
Hodgkins, M. 1949. *NZ Bird Notes* 3: 116–25.
Hollands, D. 1984. *Eagles, Hawks and Falcons of Australia.* Nelson, Melbourne.
Horton, W. 1975. *Sunbird* 6: 49–69.
Hulsman, K. 1974. *Sunbird* 5: 52.
—— 1976. *Emu* 76: 143–9.
—— 1977a. *Emu* 77: 49–60.
—— 1977b. *Sunbird* 8: 9–19.
—— 1984. *Condor* 86: 130–8.
Hurley, J. 1990. *Bird Obs.* 699: 68.
Hutton, I. 1991. *Birds of Lord Howe Island Past and Present.* Author, Coffs Harbour, NSW.
Jackson, R., & A. Palliser. 1979. *OSNZ News* 11: 6.
Jaensch, R.P., *et al.* 1988. *RAOU Rep.* 30.
Jenkins, C.F.H. 1969. *West. Aust. Nat.* 11: 52–5.
Jenkins, J.G.F. 1962. *Notornis* 10: 44.
Johnstone, R.E. 1978. *Corella* 2: 46–7.
—— 1982. *Rec. West. Aust. Mus.* 10: 133–65.
Keast, J.A. 1943. *Emu* 42: 133–40.
Keeley, B.R. 1985. *Notornis* 32: 270.
Kentish, B. 1994. *Corella* 18: 71–6.
King, B.R. 1993. *Corella* 17: 65–92.
——, *et al.* 1992. *Emu* 92: 1–10.
Kingsford, R.T., & J.L. Porter. 1992. Pp 1–27 (Section 2) In: Drewien & Best 1992.
——, *et al.* 1988. *Tech. Memo. Div. Wildl. Ecol. CSIRO, Aust.* 30.
——, *et al.* 1989. *NSW Natn. Parks Wildl. Serv. Occ. Pap.* 8.
——, *et al.* 1990. *NSW Natn. Parks Wildl. Serv. Occ. Pap.* 9.

——, et al. 1991. NSW Natn. Parks Wildl. Serv. Occ. Pap. 10.
——, et al. 1992. NSW Natn. Parks Wildl. Serv. Occ. Pap. 12.
——, et al. 1993. NSW Natn. Parks Wildl. Serv. Occ. Pap. 16.
——, et al. 1994. NSW Natn. Parks Wildl. Serv. Occ. Pap. 18.
Lane, B. 1975. Bird Obs. 522: 38.
Lane, S.G. 1973. Birds 8: 16.
—— 1975. Aust. Bird Bander 13: 80–2.
—— 1979. Corella 3: 7–10.
Langham, N.P., & K. Hulsman. 1986. Emu 86: 23–32.
Lashmar, A.F.C. 1987. Corella 11: 89–92.
Lavery, H.J., et al. 1968. Emu 68: 133–47.
Le Souëf, A.S. 1926. Emu 26: 79–80.
Learmonth, N.F. 1958. Emu 58: 66–7.
Leishman, A.J. 1982. Aust. Birds 16: 66.
Limpus, C.J. 1973. Sunbird 4: 45–51.
Littler, F.M. 1910. Emu 9: 141–8.
Long, J.L. 1981. Introduced Birds of the World. Reed, Sydney.
Lowe, V.T., & T.G. Lowe. 1976. Aust. Bird Watcher 6: 169–70.
Loyn, R. 1975. Report on the Avifauna of Westernport Bay. Rep. to W'port Bay Environ. Study, Vic. Ministry Cons., Melbourne.
M'Clymont, J.R. 1906. Emu 5: 159–62.
MacGillivray, W. 1917. Emu 17: 3–87.
—— 1926. Emu 25: 229–38.
—— 1928. Emu 27: 230–49.
Masters, J.R., & A.L. Milhinch. 1974. Emu 74: 228–44.
Mattingley, A.H.E. 1908. Emu 8: 18–23.
McGarvie, A.M., & M.T. Templeton. 1974. Emu 74: 91–6.
McGill, A.R. 1954. Emu 54: 214–5.
—— 1955 Emu 55: 98.
McKean, J.L. 1981. A'asian Seabird Grp Newsl. 15: 11–16.
——, & K.A. Hindwood. 1965. Emu 64: 79–97.
McMillan, P. 1977. West. Aust. Nat. 13: 204.
Meathrel, C.E. 1990. Emu 90: 195–7.
—— 1991a. J. Zool., Lond. 223: 501–8.
—— 1991b. Unpubl. PhD thesis, Murdoch Univ., WA.
——, et al. 1990. Int. orn. Congr. Proc. 20: 2390–5.
Menkhorst, P.W., et al. 1988. Corella 12: 72–7.
Merton, D.V. 1970. Notornis 17: 147–99.
Michie, R.H. 1949. Notornis 3: 146.
Milledge, D. 1972. Emu 72: 167–70.
—— 1977. Corella 1: 1–12.
Milligan, A.W. 1902. Emu 2: 68–77.
Mills, J.A. 1967. Unpubl. MSc thesis, Univ. Canterbury, Christchurch.
—— 1969. Notornis 16: 180–6.
—— 1971. NZ J. mar. freshwat. Res. 5: 326–8.
—— 1973. J. Anim. Ecol. 42: 147–62.
—— 1979. Ibis 121: 53–67.
—— 1989. Pp 387–405 In: Newton 1989.
—— 1990. Int. orn. Congr. Proc. 20: 1522–7.
Miskelly, C.M. 1984. Notornis 31: 209–23.
Moncrieff, P. 1928. Emu 28: 138–49.
Moon, G. 1979. The Birds Around Us. Heinemann, Auckland.
—— 1992. The Reed Field Guide to New Zealand Birds. Reed, Auckland.
——, & R. Lockley. 1982. New Zealand's Birds. Heinemann, Auckland.
Moore, J.L. 1981. Notornis 23: 354.
—— 1985. Notornis 32: 311–18.
Morgan, A.M. 1931. S. Aust. Orn. 11: 53–61.
Morris, R.B. 1976. Notornis 23: 354.
Moynihan, M. 1955. Behaviour Suppl. 4.
Murray, M.D., & R. Carrick. 1964. CSIRO Wildl. Res. 9: 160–88.
Newton, I. 1989. Lifetime Reproduction in Birds. Academic Press, Lond.
Nicholls, C.A. 1974. Aust. J. Zool. 22: 71–89.
Nilsson, R.J., et al. 1994. Notornis 41 Suppl.: 109–25.
Norris, A.Y. 1967. Emu 67: 33–55.
Officer, H.R. 1958. Emu 58: 375–90.
Oliver, W.R.B. 1913. Emu 13: 86–90.
—— 1922. Emu 22: 45–51.

Ottaway, J.R., et al. 1988. Aust. Wildl. Res. 15: 541–60.
Owen, K.L., & M.G. Sell. 1985. Notornis 32: 271–309.
Paltridge, L. 1988. Bird Obs. 675: 59.
Pegler, J.M. 1983. Aust. Birds 17: 38–42.
Perry, D.H. 1971. West. Aust. Nat. 11: 188–9.
Perryman, C.E. 1937. S. Aust. Orn. 14: 14–19.
Peter, J. 1990. RAOU Rep. 74.
Phillipps, H. 1990. Aust. Nat. Hist. 23: 322–9.
Phillips, W.J., & C.J. Lindsay. 1947. NZ Bird Notes 2: 73–4.
Powlesland, R.G., & H.A. Robertson. 1987. Notornis 34: 327–38.
Pratt, H.D., et al. 1987. A Field Guide to the Birds of Hawaii and the Tropical Pacific. Princeton Univ. Press, Princeton.
Pringle, J.D. 1987. The Shorebirds of Australia. Angus & Robertson, Sydney.
Reed, S.M. 1976. Notornis 23: 259–62.
Reid, D., & B. Reid. 1965. Notornis 12: 138–57.
Robbins, L. 1990. Bird Obs. 699: 68.
Roberts, N.L. 1952. Emu 52: 65–6.
Robertson, C.J.R., & G.F. van Tets. 1982. Notornis 29: 311–36.
Robertson, H.A. 1992. Notornis 39: 263–87.
Robinson, T., & C. Minton. 1989. Birds Int. 1(4): 72–85.
Rogers, D.I., & K.G. Rogers. 1995. Corella 19: 12–17.
Ross, A.D. 1978. Canberra Bird Notes 4(1): 21.
Russell, M.C. 1957. West. Aust. Nat. 5: 234.
Sandager, F. 1889. Trans. NZ Inst. 22: 286–94.
Schodde, R. 1976. A Survey of the Fauna of the Lower McArthur River Region, Northern Territory. CSIRO Div. Wildl. Res. for Mimets Devt, Canberra.
——, et al. 1988. Aust. Natn. Parks Wildl. Serv. Spec. Publ. 8.
Schulz, M. 1991. Aust. Bird Watcher 14: 95–102.
Secker, H.L. 1954a. Emu 54: 73.
—— 1954b. Emu 54: 280.
Sedgewick, E.H. 1940. Emu 40: 129–52.
——, & L.E. Sedgewick. 1950. West. Aust. Nat. 2: 111–8.
Serventy, V.N. 1957. West. Aust. Nat. 5: 233–4.
——, & S.R. White. 1943. Emu 43: 81–95.
Sharland, M. 1956. Emu 56: 75–9.
—— 1965. Emu 65: 147–50.
Sheedy, B. 1989. Bird Obs. 684: 23.
Sibley, G., & B.L. Monroe. 1990. Distribution and Taxonomy of Birds of the World. Yale Univ. Press, New Haven.
Sibson, R.B. 1992. Notornis 39: 87–93.
——, et al. 1962. Notornis 10: 44.
Simpson, K.A. 1957. Bird Obs. 313: 3–4.
Simpson, K.N.G. 1972. Birds in Bass Strait. Reed, Sydney.
—— 1977. Aust. Bird Watcher 7: 61.
Skegg, P.D.G. 1964. Notornis 11: 159–76.
Skira, I.J., & J.E. Wapstra. 1990. Corella 14: 124–9.
Slater, P. 1970. A Field Guide To Australian Birds. 1. Rigby, Adelaide.
Smith, G.C. 1991a. Corella 15: 41–4.
—— 1991b. The Silver Gull: Problems, Biology and Management for the Sydney–Wollongong Region. 1. Unpubl. Rep. to NSW NPWS.
—— 1992. Corella 16: 39–46.
—— 1993. Corella 17: 131–4.
——, & N. Carlile. 1992a. Wildl. Res. 19: 429–41.
——, —— 1992b. Wetlands Aust. 11: 33–45.
——, —— 1993a. Colonial Waterbirds 16: 9–16.

Plate 33

Laughing Gull *Larus atricilla* (page 561)
1 Adult breeding; 2 Adult non-breeding: 3 Juvenile;
4 First immature non-breeding; 5 First immature breeding;
6 Second immature non-breeding

Franklin's Gull *Larus pipixcan* (page 565)
7 Adult breeding; 8 Adult non-breeding; 9 Juvenile;
10 First immature non-breeding;
11 Second immature non-breeding

—, — 1993b. *Wildl. Res.* 20: 219–26.
—, *et al.* 1991. *Aust. Bird Watcher* 14: 24–7.
—, *et al.* 1992a. *Wildl. Res.* 19: 161–7.
—, *et al.* 1992b. *Wildl. Res.* 19: 341–5.
Sorensen, J.H. 1964. *Notornis* 11: 69–81.
Sorgeloss, P., *et al.* (Eds) 1987. *Artemia: Research and Applications.* 3. Universa, Wetteren.
Stirling, I., *et al.* 1970. *Emu* 70: 189–92.
Stonehouse, B. 1965. *Proc. NZ Ecol. Soc.* 12: 13–20.
Storr, G.M. 1964. *Emu* 64: 48–60.
— 1976. *Aust. Bird Bander* 14: 35–8.
— 1977. *Spec. Publs West. Aust. Mus.* 7.
— 1985. *Rec. West. Aust. Mus. Suppl.* 21.
— 1987. *Rec. West. Aust. Mus. Suppl.* 27.
—, & R.E. Johnstone. 1988. *Rec. West. Aust. Mus. Suppl.* 28.
Stranger, R.H. 1969. *West. Aust. Nat.* 11: 99–100.
— 1970. *West. Aust. Nat.* 11: 100–10.
— 1992. *West. Aust. Nat.* 19: 60–3.
Sutherland, J.H. 1951. *Notornis* 4: 136–7.
Swindells, A.W. 1915. *Emu* 15: 28–33.
Symon, O. 1938. *S. Aust. Orn.* 14: 169–70.
Tarburton, M.K. 1991. *Aust. Bird Watcher* 14: 31.
Tasker, C.R., & J.A. Mills. 1981. *Behaviour* 77: 222–41.
Taylor, P.W. 1987. *S. Aust. Orn.* 30: 62–73.
Thomas, D.G. 1967. *Aust. Bird Bander* 5: 74–5.
— 1979. *Tasmanian Bird Atlas.* Univ. Tas., Hobart.
Tindale, N.B. 1928. *S. Aust. Orn.* 9: 217.
— 1938. *S. Aust. Orn.* 14: 171.
Turbott, E.G., & P.C. Bull. 1954. *Rec. Auck. Inst. Mus.* 4: 245–62.
Turner, J.S., *et al.* 1968. *The Conservation of Norfolk Island.* Aust. Cons. Found. Spec. Publ. 1; Aust. Cons. Found., Melb.
van den Berg, A.B., *et al.* 1991. *Dutch Birding* 13: 58–63.
van Tets, G.F. 1968. *CSIRO Wildl. Res.* 13: 1–9.
— 1969a. *CSIRO Wildl. Res.* 14: 111–16.
— 1969b. *CSIRO Wildl. Res.* 14: 117–28.
— 1977. *Corella* 1: 63–4.
—, & J. Bywater. 1967. *Aust. Bird Bander* 5: 9.
—, *et al.* 1969. *CSIRO Wildl. Res.* 14: 129–51.
—, *et al.* 1977. *Guide to the Recognition and Reduction of Aerodrome Bird Hazards.* AGPS, Canberra.
Vestjens, W.J.M. 1977. *Tech. Memo. Div. Wildl. Res. CSIRO, Aust.* 12.
Wakelin, H. 1968. *Notornis* 15: 156–76.
Walker, T.A. 1988. *Corella* 12: 113–18.
— 1989. *Corella* 13: 118–21.
— 1991. *Corella* 15: 115–16.
— 1992. *Emu* 92: 152–6.
—, & K. Hulsman. 1993. *Corella* 17: 155–7.
Warham, J. 1956. *Emu* 56: 83–93.
— 1967. *Notornis* 14: 122–39.
—, & B.D. Bell. 1979. *Notornis* 26: 121–69.
Wassenburg, T.J., & B.J. Hill. 1990. *Aust. J. mar. freshwat. Res.* 41: 27–36.
Watt, A.H. 1951. *Notornis* 4: 100.
Wear, R.G., & S.J. Haslett. 1987. Pp 101–26 **In**: Sorgeloss *et al.* 1987.
Weston, M. 1992. *Geelong Nat.* 29: 23.
Wheeler, J.R. 1953. *Emu* 53: 333–4.
— 1960. *Emu* 60: 265–80.
Wheeler, W.R. 1948. *Emu* 48: 1–7.
— 1957. *Emu* 57: 185–90.
— 1975. *Bird Obs.* 522: 36–7.
—, & I. Watson. 1963. *Emu* 63: 99–173.
Wilson, A. 1905. *Emu* 5: 83.
Wodzicki, K. 1962. *Notornis* 10: 80–3.
Woehler, E.J., *et al.* 1989. *Corella* 13: 126–9.
Wood, K.A. 1989. *Corella* 13: 97–104.
— 1991. *Corella* 15: 93–102.
Woodall, P.F. 1986. *Sunbird* 16: 33–40.
Wooller, R.D., & J.N. Dunlop. 1979. *Aust. Wildl. Res.* 6: 325–35.
—, — 1980. *Aust. Wildl. Res.* 7: 113–15.
—, — 1981a. *Aust. Wildl. Res.* 8: 431–3.
—, — 1981b. *Aust. Wildl. Res.* 8: 679.
—, — 1990. *Corella* 14: 62–3.
Wright, A. 1963. *Notornis* 10: 240.
Young, E.C. 1978. *NZ J. Zool.* 5: 401–16.

Sponsor: F Fletcher, VicGroup of the RAOU

Volume 3, Plate 32

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

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

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

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