

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

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

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

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

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

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

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## Family HAEMATOPODIDAE oystercatchers

Rather large (40–49 cm long) black or pied waders, heavily built, with sturdy legs, and long straight robust bills. About 21 species and subspecies, all in single genus *Haematopus*; almost worldwide on temperate and tropical coastlines. Species limits uncertain (Baker 1975, 1977); rather uniform structure and simple patterns of plumages not reflecting well any generic differentiation of allopatric species and subspecies; as few as three species and as many as twelve have been recognized. The relationships and arrangement of species or subspecies continues to be debated; we treat as five species in our region, two endemic to Aust. and three to NZ and Chatham Is. Probably most closely related to Recurvirostridae (q.v.); intermediate anatomically and behaviourally between Scolopacidae and Laridae.

Solidly built. Sexes similar; females slightly larger than males. Necks stout; 15 cervical vertebrae. Wings, long and pointed; 11 primaries (p11 minute), 18–20 secondaries and moderately large carpal knob. Tails, short and square; 12 rectrices. Bills, long and straight, laterally compressed; adapted for opening shells and chiselling molluscs off rocks, with muscles of jaw and neck strongly developed (Burton 1974). Bills range from blunt and square-tipped to pointed; length and shape of bill-tip varying in individuals according to choice of prey and feeding substrate (Hulscher & Ens 1991). Nostrils, pervious; schizorhinal. Legs, stout and rather long; tarsi, reticulated with small hexagonal scales. Toes, stout, only transversely scutellated on distal half; slightly webbed at base, no hallux. Caeca present. No crop. Large supraorbital glands.

Plumages, black or blackish brown, some species with white underparts, rump and wing-bars. Bills, legs and feet, orange or pink to red; irides, scarlet or yellow; orbital rings, reddish (yellow in *H. leucopodus*). Two moults per cycle. Post-breeding moult, complete, primaries outwards; pre-breeding moult, partial but only in Eurasian Oystercatcher *H. ostralegus* do breeding and non-breeding plumages differ markedly. Young hatch in soft woolly down; most species, brownish grey, with white belly and vent, all with dark lines and spots above forming simple pebbled pattern, similar to that of Burhinidae. Juveniles, duller scalloped versions of adult with darker bare parts; first breed at about 3–5 years. Stand erect or with neck hunched and bill pointing down. Flight, direct and fast with rather shallow wing-beats.

Typically of coastlines, especially in rocky areas, though many also use sandy beaches or mudflats. Eurasian *H. ostralegus* and South American *H. leucopodus* Oystercatchers also have inland breeding distribution and, in NZ, *H. finschi* breeds chiefly on braided rivers or nearby farmland; even these chiefly coastal in non-breeding period. Most species sedentary or with only local movements during non-breeding period; some populations of Eurasian Oystercatchers *H. ostralegus* strongly migratory. Many oystercatchers specialize in feeding mostly on molluscs and crustaceans, including hard-shelled barnacles, chitons, limpets and pelecypods, which few other birds can attack. Considerable strength and skill required to open such prey; feeding techniques vary with type of prey and may take a long time to become proficient. Other invertebrate prey taken, especially when feeding on mudflats or farmland, including polychaete and oligochaete worms, and insects.

Breed solitarily, spaced out in defended territories. In non-breeding season, form small groups to large flocks (more so in black-and-white species), though resident pairs may stay on territories with local movements of subadult and non-breeding birds. Monogamous; pair-bonds in those species studied usually life-long, with divorce rare. Courtship, territorial and distraction displays well-developed. Both sexes incubate and attend the young. Most conspicuous vocalizations of all species are loud piping calls in display and alarm.

Breed seasonally. Nests, simple scrapes crudely lined with any suitable material near at hand. Eggs, rounded oval, buffish to whitish and fairly glossy, with varying but heavy blotches, spots and streaks of black-brown. Clutch-size, 2–4. Incubation period, 25–28 days. Young hatch in down; precocial, nidifugous; can run as soon as down is dry and can swim and dive at need. Young fed by adults and fledge at about 5 weeks.

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*Haematopus finschi* South Island Pied Oystercatcher

COLOUR PLATE FACING PAGE 713

*Haematopus finschi* Martens, 1897, *Orn. Monatsb.* 5: 190 — Saltwater Creek, South Island, New Zealand.*Finschi* is after Freidrich Herman Otto Finsch (1838–1917), German diplomat, ornithologist, collector, and author.

OTHER ENGLISH NAMES Oystercatcher, Pied Oystercatcher.

## MONOTYPIC

**FIELD IDENTIFICATION** Length 46 cm; wingspan 80–86 cm; weight 550 g. Large black-and-white wader with long orange-red bill, proportionately longer and slimmer at base than other oystercatchers in HANZAB region, and short stout pinkish legs and feet. Very similar to pied-morph Variable Oystercatcher *Haematopus unicolor* but noticeably smaller and slimmer. Flight-pattern distinctive. Sexes alike; female slightly larger with longer bill. No seasonal variation. Juveniles and immatures separable.

**Description** **Adult** Head, neck, upperparts, and upper breast, glossy black, with sharp demarcation of black breast from white underbody, slightly higher on breast than in other oystercatchers in HANZAB area; at rest, prominent white tab between black breast and folded wing. Small dark patch round base of tibia occasionally visible. In flight from above, black upperparts and tail contrast with white upper tail-coverts and rump, which extend in sharp triangle ending in a point on upper back; broad white wing-bar on bases of secondaries and tips of greater secondary-coverts, tapering inward to meet trailing-edge of wing, sometimes extending onto inner 2–3 primaries. Underwing: coverts, white, with narrow black leading-edge on innerwing, extending patchily on leading-edge of primary coverts; remiges, glossy grey-black except for white bases of secondaries and inner primaries; some have prominent black arc along tips of greater primary coverts. Bill, bright orange, grading to paler yellowish at tip. Iris, scarlet. Orbital ring, bright orange. Legs and feet, coral-pink. **Juvenile** As adult except: upperparts and wing-coverts, duller, blackish brown, grading to darker blackish on head, neck and breast; feathers of mantle, scapulars, tertials and inner wing-coverts with buff-brown fringes, quickly lost with wear; bill, pale orange, grading to dark greyish tip; iris, dark brown; orbital ring, almost colourless; legs and feet, grey-mauve. **Immatures** Plumage as adult. At first, dull bare parts as juvenile; in older immatures, bare parts intermediate between adult and juvenile: bill, orange; iris, orange-red to red; orbital ring, dull orange; legs and feet, pink; attain adult coloration of bare parts in fourth or fifth year.

**Similar species** Pied-morph Variable Oystercatcher noticeably larger and bulkier; shorter bill with deeper base; and pattern of black and white always less clear cut; easily distinguished at rest by more black on breast, with smudged demarcation between breast and white belly, and lack of or poorly developed white tab between black breast and folded wing or, at most, narrow and mottled or smudged with black. In flight, distinguished by black back, white band across upper tail-coverts squarely cut off from black back (not forming white wedge extending up back), and smudged transition between white rump and black back, and more black on under wing-coverts; calls similar but slightly huskier and less piercing. For distinctions from Chatham Island *H. chathamensis* and Pied *H. longirostris* Oystercatchers, see those accounts.

Conspicuous, noisy and gregarious. Breed mainly on braided river beds, ploughed or grassy fields of inland SI, NZ. After

breeding, migrate to coastal regions in autumn, forming large flocks of up to 10,000 birds, especially in n. harbours of NI; conspicuous and noisy in non-breeding season. Feed by probing in soft substrates such as pasture, sand and mud; also feed on arable land, including newly cultivated fields; rarely seen on rocky shores. Gait and flight as other oystercatchers. Voice similar to other oystercatchers: usual call loud and piercing piping, given in flight or from ground; high-pitched piping duets in display.

**HABITAT** Coasts during non-breeding season; inland, up to c. 1800 m asl when breeding. In coastal regions, on sheltered and large intertidal sandflats, mudflats and beaches in estuaries, harbours, bays and inlets. Occasionally on sandy ocean beaches (Marples 1954). Prefer firmer flats composed of intermixed sand, mud and shell (Sibson 1945); scarce where rocks predominate in littoral zone (Baker 1973). A few use coastal lakes (Pierce 1980). Often recorded in moist, well-grassed coastal paddocks. Inland, frequent shingle-beds and sandbanks of braided rivers and streams, and occasionally shores of lakes; often in farmland, including pasture and cultivated paddocks. Has recently colonized tussock grasslands in McKenzie Highlands (NZRD). At higher altitudes, occur in subalpine tundra and *Dracophyllum-Raculia* herblands round swampy meltwater basins, cirques and tarns above 1200 m asl, above the tree-line (Child 1969, 1975).

High-tide roosts on shellbanks and sandbanks, and occasionally reefs (Sibson 1958, 1966; Owen & Sell 1985; Oliver); sometimes on ocean beaches or saltmarsh (Marples 1954). When forced off banks by high tides or bad weather, may use grassy paddocks or sports fields (Sibson 1958, 1966, 1975). Recorded roosting on stony foreshore at base of newly constructed airport runway (Sibson 1966). May rest along inland rivers (Keeley 1979).

In coastal regions, forage on estuaries, harbours and beaches with tidal sandflats (Sibson 1966; Owen & Sell 1985; Oliver); occasionally recorded feeding on exposed rock pools at low tide (CSN 22), and sometimes at other rocky shores (Sibson 1966; Pierce 1980). Often in moist lush coastal pastures, including irrigated areas (Baker 1973; Sibson 1975; Pierce 1980; Owen & Sell 1985). Inland, forage on lush farmland, newly cultivated fields and similarly grassed areas, including beds of dry lakes and mountain bogs (Sibson 1966, 1975; Falla *et al.* 1981). Also in shingle beds of braided inland rivers (Sibson 1975; Keeley 1979). When surrounding areas frozen, birds may flock in unfrozen streams where they forage in shingle beds and on banks (Pierce 1983).

Breed inland. On stable banks of sorted sand, gravel or shingle in braided sections of rivers and streams (Soper 1959, 1963; Sibson 1966, Pierce 1983; Owen & Sell 1985; Oliver). A few nest on shingle beaches of lakes (Pierce 1980; Falla *et al.* 1981; CSN19). Often breed in open flat paddocks, cultivated farmland or stubble (Soper & Jardine 1957; Soper 1963; Sibson

1975; Allen 1977; CSN19). At higher altitudes (1200–1800 m asl), breed above tree-line in subalpine tundra and herbfields round wetlands (Child 1969, 1975).

Often recorded feeding, loafing, roosting and breeding in modified habitats, such as farmland (Dunedin FNC 1947; Soper & Jardine 1957; Sibson 1958, 1966, 1975; Soper 1963; Pierce 1980; CSN 19). Infestation of river beds by exotic plants decreases amount of suitable breeding habitat.

**DISTRIBUTION AND POPULATION** SI, NZ, and scattered in coastal NI, especially n. harbours. Single vagrant recorded, Vanuatu, 29 Sept. 1983 (Hay 1985). Vagrant black-and-white oystercatchers on Norfolk and Lord Howe Is have been attributed to this species (Wakelin 1968; Hay 1985) but not acceptably confirmed and are considered further under Pied Oystercatcher (q.v.).

**NI** Mainly in coastal regions N of 38°S. Scattered records on e. coast of Far North in harbours and bays from North Cape, S to round Waikare Inlet; few records on w. coast N of Kaipara Harbour. Concentrations occur in Whangarei, Kaipara and Manukau Harbours and Firth of Thames; smaller concentrations also occur in Tauranga, Kawhia and Raglan Harbours. Scattered records on Coromandel Pen. and s. and e. Bay of Plenty; sparse in East Coast; scattered records round Hawke's Bay; in Wairarapa mainly in Ruamahanga R. floodplain; widespread from Wellington to Wanganui; few scattered records in Taranaki. **SI** Congregations occur in Golden and Tasman Bays; elsewhere N of c. 43°S scattered and widespread; S of c. 43°S abundant and widespread, especially E of Southern Alps, but also in West Coast. Few scattered records in Fiordland. Stewart I. (Baker 1973; NZ Atlas).

**Kermadec Is** Unconfirmed and unacceptable record, Raoul I.: up to three pied oystercatchers, Feb.–May 1969 (Merton 1970).

**Chatham Is** Recorded summer 1968 (CSN 19) and 1987–88 (Davis 1988).

**Breeding** Inland SI, mainly E of Southern Alps (NZCL); breeding attempted in Hawkes Bay since 1980 (Twydell & Twydell 1983, 1993), and in 1988, attempted in s. Wairarapa (NZCL).

Abundant in 1860s; decline in numbers noted by 1885 (Potts 1885), attributed to human disturbance. Between 1870 and 1940, subject to considerable pressure from hunting, which caused population decline; after shooting stopped in 1940, populations have increased dramatically, with birds now widespread and colonizing new areas in NI (Sibson 1945, 1966; Baker 1973; Veitch 1978).

Total population in 1970–71 nearly 49,000 birds (Baker 1973). At Manukau Harbour, 0.1–0.43 birds/ha and at Firth of Thames, 0.04–0.3 birds/ha (Veitch 1978); in 49 km of lower Arawata R., 84 birds recorded, Nov. 1985 (Child 1986).

Legally shot before 1940 (Sibson 1966; Baker 1973), as considered good table bird. Most failures of nests in farmland caused by stock trampling eggs, but also other farming activities (Barlow *et al.* 1972; P.M. Sagar; D. Geddes).

**MOVEMENTS** Migratory within NZ; breed SI and s. NI, July to mid-Jan.; most then move N to estuaries and harbours of n. NI. Some move to nearby coast and estuaries and very few remain at breeding sites in winter. Travel in small flocks by day and night, directly to and from wintering grounds (Sagar & Geddes 1990), though Baker (1975b,c) suggests birds move in short flights, broken by brief stop-overs.

**Departure** Breeding adults leave Jan. and early Feb., mainly moving N or toward coast; few remain by Apr. (Soper 1963). Some birds from Southland travel S to winter in estuaries of Stewart I. During day, flocks of 20–75 birds seen 300 m offshore

near New Plymouth, flying N at 150 m asl (CSN 23, 37) and c. 30 flying N on West Coast on 6 Apr.

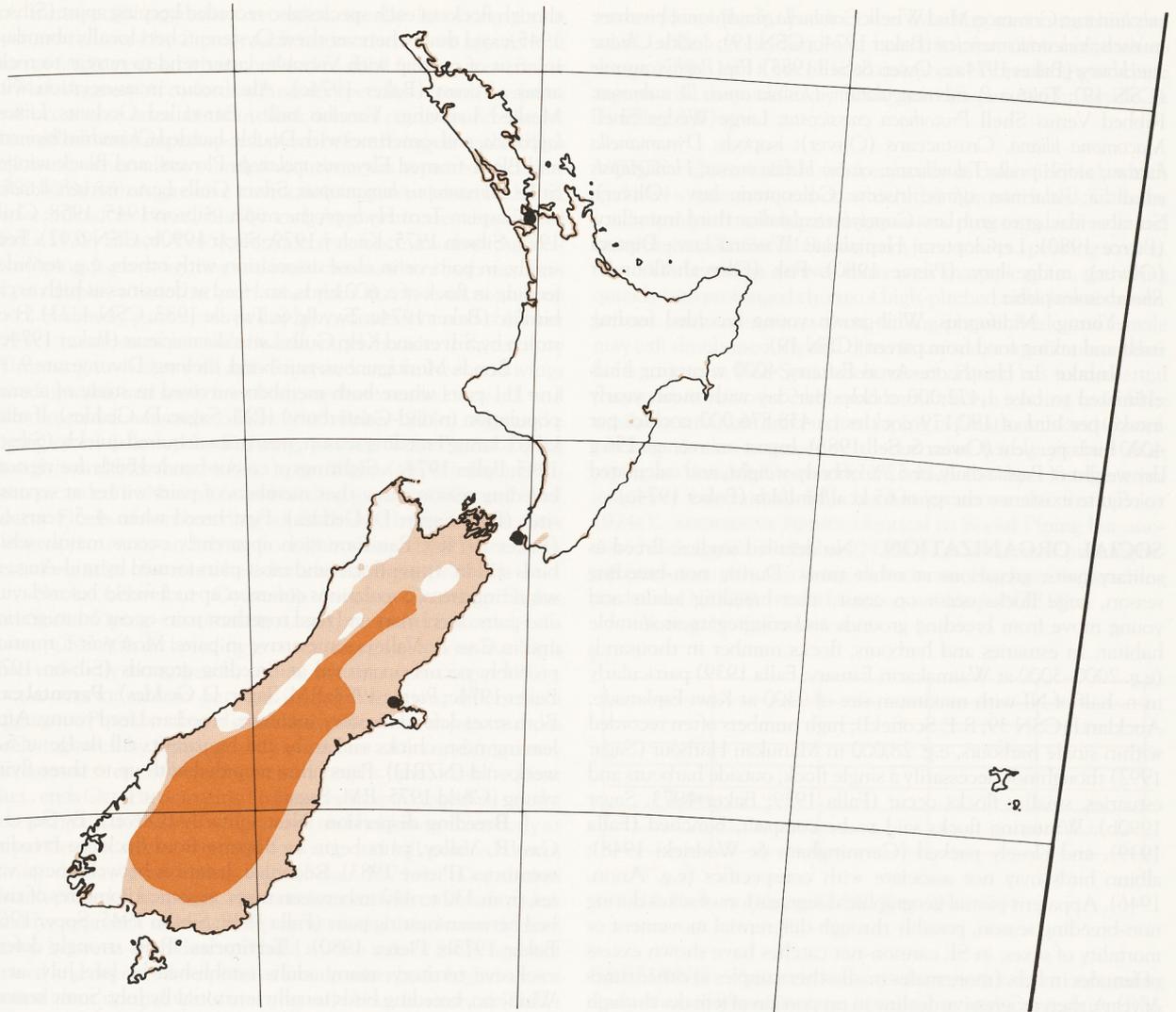
**Non-breeding** Adults return to same coastal wintering sites year after year, where apparently sedentary (Sagar & Geddes 1990). Sexes may migrate at different times, females moving earlier to coast and N. No difference in proportion of banded juveniles and adults that migrate N (Sagar & Geddes 1990). However, over summer, progressive increase in proportion of juveniles in n. flocks, suggesting slower n. migration, possibly stopping *en route* (Baker 1975b; P.M. Sagar). Main estuaries and harbours used (in descending order of importance): Manukau, Firth of Thames, Kaipara, Kawhia, Farewell Spit, Waimea Estuary, Motueka Estuary and Heathcote–Avon Estuary. In years of drought, coastal sites not often used (Pierce 1980). Depending on tidal cycles, flocks move short distances to regular roosting and feeding sites. Vagrants have occurred on Chatham I. in summer 1968 (CSN 19) and 1987–88 (Davis 1988). Single extralimital record, Port Vila, Efate, Vanuatu on 29 September 1983, 2000 km beyond normal range (Hay 1985).

**Return** Beginning in early June, but mostly late July and early Aug. In Cass Valley, birds begin to arrive in last 10 days of July and most arrived in small flocks in Aug. (Pierce 1983), which is also when maximum numbers in pre-breeding flocks at estuaries on s. Canterbury coast (Sagar 1976; Pierce 1980). At Charleston, West Coast, heard flying S at night on 10 Aug. in 2 successive years (CSN 34, 35). Forty and 17 birds seen flying S during day along West Coast on 23 and 26 July respectively (CSN 39). Earliest returns to breeding sites can occur throughout June (CSN 35; P.M. Sagar; D. Geddes). Frozen ground and streams affect feeding and therefore timing of breeding. By Sept. in Cass Valley, pre-breeding flocks (<40) formed to await thaw, begin to disperse to nest (Pierce 1983). In higher areas, breeding may not begin till snow melts in Nov. (Child 1969).

**Breeding** SI mainly E of Southern Alps, small numbers on W. Coast; recently colonized Wairarapa and Hastings, NI (CSN 35–39). Strong philopatry to breeding site (Sagar & Geddes 1990). Breeding birds maintain strongly defended breeding and feeding territory. Most non-breeders remain on wintering grounds during summer (Sibson 1945) or move to pre-breeding flocking areas, e.g. L. Wainono, where may stay until unsuitable feeding conditions force them to nearby pasture (Pierce 1980). National wader-counts show that c. 17% of population spend summer in coastal sites (Sagar 1990a). Small proportion of subadult birds from S move inland to breeding sites during breeding season (Baker 1975b). In Cass Valley, 15–25% of population in non-breeding flocks, which occur up till Nov. (Pierce 1983).

**Banding** Greatest direct distance between breeding and wintering site, 930 km. Continuing study of small population in mid-Canterbury has shown widespread dispersal of adults and juveniles throughout NZ (Sagar & Geddes 1990).

**FOOD** Mainly molluscs and worms, occasionally insects, sea anemones and small fish. **Behaviour** Diurnal and nocturnal. Forage on exposed mud and sandflats, beaches, wet pasture during winter, ploughed land, and on river beds, arable land, and even tussock grassland in the McKenzie Highlands during breeding season (Sibson 1945, 1966). Slimmer, less robust bill more suited for probing in soft substrates than heavier bill of Variable Oystercatcher (Baker 1974c). Locate prey by random probing when substrate obscured by water or darkness. Following foraging and feeding methods recorded (mainly from Baker 1974a): (1) Bivalves: locate bivalves by looking for siphons and then probing; in Heathcote–Avon Estuary, probing rate, 20.4 probes/10 min (0.98; 100) and in Golden Bay, 18.4 (1.20; 16) with success rates of 55%



(1.73; 100) and 47% (2.22; 16) respectively. If bivalve open, thrust bill into gap using minimum dimension of bill (width <1 mm) then turn bill and body through 90°, usually to left (90.3%; n=31), so that 9–12 mm depth of bill forces valves wider apart or snaps adductor muscles (Baker 1974a; Sedgwick 1986). If bivalve closed, bird removes it by placing bill below shell and levering it against substrate; sometimes then carry prey to firmer substrate to open. Two methods used to open tightly closed bivalves: stabbing used for thin-shelled ocean-beach molluscs; thrust at persistent gape in anterior ventral margin of tightly closed shell. Hammering used for thick-shelled estuarine molluscs (though hammering of mussels has not been observed); give short series of thrusting blows to umbo or edge of mantle (thinnest regions of shell in *Chione* and *Paphia*) or part of shell weakened by boring worm *Polydora ciliata* (92% of *Chione* shells), making hole that is enlarged till body of mollusc can be removed; once hole made in shell, may be carried ashore to eat, especially when substrate sandy to prevent contamination. Observed levering open mussels (Baker 1974a). (2) Chitons: removed from rocks with sharp angled blow to shell-plates; if this not effective, bird applies sideways pressure to margin of foot until small area detached; then push bill under chiton, flat side against rock, and cut from rock with

scissor-like movements of bill; remove flesh in one piece and swallow whole. (3) Gastropods: insert bill into aperture of gastropods, e.g. mud-snails *Amphibola* and topshells *Littorina*, and apply pressure to wall of outside whorl, chipping a small circular hole in shell, opposite operculum; rotate shell until hole is uppermost, then put bill into hole and apply leverage towards apex of shell using outside whorl as fulcrum; the dorsal aspect of shell breaks, exposing soft parts for removal. The effort involved is great that few are taken in this way (5.3% of diet; n=150). Smaller gastropods swallowed whole. (4) Crabs: flip crabs onto back and immobilize them by stabbing near supra-oesophageal ganglion; rapidly remove flesh from carapace. (5) Earthworms: probe for earthworms in wet pasture, especially during winter (Sibson 1975). Feeding method varies with weather and substrate, e.g. in wind, mainly random probing. Food often stolen by Silver Gulls (Baker 1974a).

**Adult** No detailed studies (all observations). From Baker (1974a,c) unless stated. Cnidarians: sea anemones: *Isactinia olivacea*. Annelids: polychaetes: *Glycera americana*; *Nicom aestuariensis*; *Perinereis nuntia*; oligochaetes (Oliver; Pierce 1980): *Allolobophora caliginosa*. Molluscs (Oliver): polyplacophorans: *Chiton pelliserpentis*; *C. glaucus*; gastropods: *Cellana radians*; mud-snail *Amphibola crenata*; Common Topshell *Littorina aethiops*; Small Horn Shell *Zeacumantus*

*subcarinatus*; Common Mud Whelk *Cominella glandiformis*; bivalves: mussels; *Velesunio menziesi* (Baker 1974c; CSN 19); cockle *Chione stutchburyi* (Baker 1974a,c; Owen & Sell 1985); Pipi *Paphia australis* (CSN 19); Tuatua *P. subtriangulatum*; *Dosinia anus*; *D. subrosea*; Ribbed Venus Shell *Protothaca crassicausta*; Large Wedge Shell *Macomona liliana*. Crustaceans (Oliver): isopods: *Dynamanella huttoni*; amphipods: *Talorchestia*; crabs: *Helice crassa*; *Hemigrapsis edwardsii*; *Palaemon affinis*. Insects: Coleoptera: larv. (Oliver); Scarabaeidae: grass grub larv. *Costelytra zealandica*: third-instar larv. (Pierce 1980); Lepidoptera: Hepialidae: *Wiseana* larv.; Diptera (Oliver): midge larv. (Pierce 1980). Fish (Oliver): flounder *Rhombosolea plebia*.

**Young** Nidifugous. Well-grown young recorded feeding itself and taking food from parent (CSN 19).

**Intake** In Heathcote-Avon Estuary, 4000 wintering birds estimated to take 1,472,000 cockles per day with mean yearly intake per bird of 190,179 cockles or 438,876,000 cockles per 4000 birds per year (Owen & Sell 1985). Ingest on average 256 g dry weight of *Paphia* daily, or 52% of body-weight, and calculated to require existence energy of 65 kcal/bird/day (Baker 1974c).

**SOCIAL ORGANIZATION** No detailed studies. Breed as solitary pairs; gregarious at other times. During non-breeding season, large flocks occur on coast, after breeding adults and young move from breeding grounds and congregate at suitable habitat. In estuaries and harbours, flocks number in thousands (e.g. 2000–3000 at Waimakariri Estuary; Falla 1939) particularly in n. half of NI with maximum size of 9300 at Kiwi Esplanade, Auckland (CSN 39; R.P. Scofield); high numbers often recorded within single harbours, e.g. 28,000 in Manukau Harbour (Sagar 1992) though not necessarily a single flock; outside harbours and estuaries, smaller flocks occur (Falla 1939; Baker 1973; Sagar 1990b). Wintering flocks said to be compact, bunched (Falla 1939), and closely packed (Cunningham & Wodzicki 1948); albino birds may not associate with conspecifics (e.g. Anon. 1946). Apparent partial geographical segregation of sexes during non-breeding season, possibly through differential movement or mortality of sexes; in SI, cannon-net catches have shown excess of females in Feb. (more males in all other samples at other times of year), then progressive decline in proportion of females through autumn and winter samples with sample in July 1970 containing twice as many males as females; this disparity evident in all age-classes. Decreasing proportion of juveniles in catches as winter progresses suggests young birds may move farther N; many birds frequenting n. harbours are subadult, e.g. in Heathcote-Avon Estuary, sample in Apr. contained 15% juveniles, while c. 240 km farther N in Nelson, sample contained 59% juveniles (Baker 1975b). As breeding season approaches, flocks move inland to breeding grounds and may form pre-breeding flocks before dispersing locally to territories. Diurnal migratory flocks typically 2–20 birds, but up to 75 (Baker 1975b; CSN 23,37). In Cass R. Valley, pre-breeding flocks of up to 40 till Sept. (Pierce 1983). Family parties recorded with one or two young (Twydly & Twydly 1983). During breeding season, most non-breeders remain on coast, in flocks; first-year birds apparently remain in winter quarters for second winter (Bell 1961; Sagar 1992; Oliver). Some non-breeders move inland and some found in small flocks on breeding grounds, e.g. in Cass R. Valley non-breeding birds in flocks numbering up to 25 (15–25% of local population) were seen till Nov. Three- and four-year old pre-breeders seen prospecting for territories and mates on paddocks near natal area (P.M. Sagar; D. Geddes). Post-breeding flocks in Cass R. Valley small, with many families remaining separate (Pierce 1983). On non-breeding grounds, may associate with Variable Oystercatchers (CSN 4),

though flocks of each species also recorded keeping apart (Sibson 1945); said that, wherever these Oystercatchers locally abundant in areas of overlap with Variable, latter tend to retreat to rocky areas of coast (Baker 1974c). Also occur in association with Masked Lapwings *Vanellus miles*, Bar-tailed Godwits *Limosa lapponica*, and sometimes with Double-banded *Charadrius bicinctus* and Black-fronted *Elsyornis melanops* Plovers, and Black-winged Stilts *Himantopus himantopus*, Silver Gulls *Larus novaehollandiae* and Caspian Tern *Hydroprogne caspia* (Sibson 1945, 1958; Child 1975; Sibson 1975; Keeley 1979; Sagar 1990b; CSN 6,32). Feed singly, in pairs or in close association with others, e.g. recorded feeding in flock of c. 600 birds, and feed at densities as high as c. 1 bird/m<sup>2</sup> (Baker 1974c; Twydly & Twydly 1983; CSN 4, 23). Food stolen by Silver and Kelp Gulls *Larus dominicanus* (Baker 1974c).

**Bonds** Monogamous; pair-bond, lifelong. Divorce rate 9.0% (n=111 pairs where both members survived in study of a small population in mid-Canterbury) (P.M. Sagar; D. Geddes). If mate killed during breeding season, new mate acquired quickly (Sibson 1945; Baker 1974c). Sightings of colour-banded birds during non-breeding season show that members of pairs winter at separate sites (P.M. Sagar; D. Geddes). First breed when 4–5 years old (Baker 1974b). Pair-formation apparently occurs mainly while birds still in winter flocks and most pairs formed by mid-Aug.; in wintering areas, copulations common up to 5 weeks before laying and pairs often roost and feed together; pairs occur on migration and in Cass R. Valley; some arrive in pairs. Most pair-formation probably occurs on arrival at breeding grounds (Sibson 1975; Baker 1974c; Pierce 1983; P.M. Sagar; D. Geddes). **Parental care** Both sexes defend territory, incubate, brood and feed young. After leaving nest, chicks said to be fed by parents till fledge at 5–6 weeks old (NZRD). Pairs often recorded with up to three flying young (Child 1975; P.M. Sagar).

**Breeding dispersion** Nest solitary (Oliver). By Sept. in Cass R. Valley, pairs begin to disperse from flocks to breeding territories (Pierce 1983). Recorded distances between nests varies, from 330 to 440 m between nests, to some kilometres of river bed between nesting pairs (Falla 1939; Sibson 1945; Soper 1963; Baker 1975b; Pierce 1980). **Territories** Pairs strongly defend exclusive territory; many adults established by late July; at L. Wainono, breeding birds usually territorial by July. Some remain inland at breeding localities all year (Baker 1973).

**Roosting** Roost at high tide on sandbanks and shell banks near edge of water; feed at low tide (Falla 1939; Oliver) though on Farewell Spit, birds observed loafing during much of low tide (Andrew 1967). Roosting flocks apparently tight; 800 said to roost on small shell bank near Onehunga-Mangere bridge, and over 3000 on a sandbar at Heathcote-Avon Estuary, Mar. 1993 (P.M. Sagar). At Waimea Inlet, highest concentrations of feeding birds occur near main high-tide roosts; birds moved between roosting site and adjacent intertidal feeding areas as tide rose and fell (Sibson 1958; Owen & Sell 1985). Several roosting sites may be used regularly; may occupy site for several hours at a time. May roost with Bar-tailed Godwits, stilts, knots and Wrybills *Anarhynchus frontalis*. During roosting period some may preen or feed (Sibson 1945, 1966, 1975). Shelter during strong winds; observed resting and feeding on pasture after gale (Baker 1974c; CSN 35).

**SOCIAL BEHAVIOUR** No detailed studies. Said to be generally sedate and reasonably approachable (Sibson 1945). Copulatory behaviour of all NZ oystercatchers said to be identical (Baker 1974c). Birds reported sunning but no description given (CSN 6).

**Agonistic behaviour** When density of feeding birds c. 1 bird/

m<sup>2</sup>, intraspecific aggression recorded; usually involving threat postures followed by Piping; such interactions most apparent at start of feeding period when confined to small feeding area (Baker 1974a). Aggression towards albino conspecifics recorded on several occasions; once, birds in flock formed circle round albino, then called and jumped up and down before flying off with albino following; when albino landed sequence was repeated (Scarlett 1980; CSN 38). Aggressive interactions apparent when birds first move inland to breed, but by end Aug. territories established (Falla 1939; Sibson 1945). Territorial defence involves Aggressive Piping displays, fighting and aerial chases, where both members of pair display to another pair; other pairs may join in, so that up to 12 birds may participate in display. **AGGRESSIVE PIPING** (Baker 1974c): members of pair, side by side, expel intruder from territory by running toward it with tails depressed and fanned, and wings raised upwards and away from body, necks extended forward, and bills directed downwards (Sibson 1945; Baker 1974c). Aggressive Piping often followed by **Fighting**; posture as for Social Piping though mandibles may be held apart (Baker 1974c). Piping has been recorded in N away from breeding grounds (Sibson 1945). **Alarm** Flocks of non-breeding adults flushed by Swamp Harriers *Circus approximans* and fly as flock (Crossland 1990); one flock flew along edge of water when disturbed at night (CSN 5).

**Sexual behaviour** **Courtship** Involves Courtship Flights and Social Piping. **COURTSHIP FLIGHT**: recorded but no details given (CSN 36); on breeding grounds, groups of four or five birds observed to fly along beach, calling continuously (Soper 1963). **SOCIAL PIPING**: said to be used in pair-formation; differs from Aggressive Piping in that it stimulates other birds to join in and is rarely followed by fighting; only occurs in adults and frequency increases at onset of breeding season: begins June, most frequent Aug., ends Oct. Participating birds move forward together, side by side with tails depressed, wings raised and held away from body at carpal flexure, necks extended forward, and bill pointed down; during display give Piping Call (Baker 1974c). **Copulation** Usually preceded by specific **PRE-COPULATORY POSTURE**: male makes stealthy approach in hunched posture, with body lowered, head drawn between shoulders and held to one side of body, and tail fanned and depressed; responsive female raises body higher above ground than normal while erecting tail above horizontal (Baker 1974b). Observed modifying scrape before copulation (Twydle & Twydle 1983). Occasionally male did not adopt Pre-copulatory Posture but either walked to female and mounted or flew onto her back from short distance away. Copulation observed from 5 weeks before laying up to laying; male mounts from behind and flaps wings during coition (Baker 1974c).

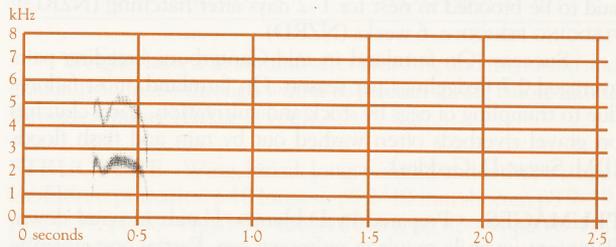
**Relations within family group** During incubation, off-duty bird feeds nearby (Twydle & Twydle 1983). Close to hatching, female often reluctant to leave nest and may attack male if he tries to relieve her (Soper 1963; NZRD). Young may be led from nest 8 h after hatching (Soper 1963) or brooded in nest for 1–2 days; fed by parents, at least until fledged at 5–6 weeks old (Falla *et al.* 1981; NZRD). **Anti-predator response of young** Apparently crouch (Falla 1939) with head down and legs under body. **Parental anti-predator strategies** Varies during incubation: some move from nest while person some distance away and run 30–45 m in hunched posture with head held down, then move behind fallen log and peer over it. Others run or fly while giving *kleeping* call, then circle while giving Distraction Displays involving broken-wing display, with tail fanned and depressed. Also False-brood, by running behind log and shuffling down as if on nest; if this fails, bird moves to another log and repeats behaviour. If eggs close to hatching, may attack observer, even flying at intruder and striking person with wing (Soper 1963); once when an Ardlussa

farmer ploughing his paddock was avoiding a running chick, an adult landed on his head and beat him about the ears with its wings (CSN 19). One or both members of breeding pair chase raptors till they are away from nest (Soper 1963; Twydle & Twydle 1983).

**VOICE** Quite well known from study of Baker (1974c), which includes a sonagram and on which this account based. Calls are loud piping in courtship and aggression, piercing alarm calls and quiet flight calls. Social Piping from June to Oct., peaking in Aug.

**Adult SOCIAL PIPING**: starts with sharp *pic* notes, gathering quickly into prolonged chorus of high-pitched calls: *kervee-kervee-kervee...* and ending in a short trilling phrase. Male and female may call simultaneously and often in unison; may stimulate other birds to join in (see Social Behaviour). Piping has fundamental frequency of just over 2 kHz and harmonics extending to 15 kHz; similar in structure and pitch to piping of Chatham Island Oystercatcher; similar in structure to but more highly pitched than piping of Variable Oystercatcher, which has same fundamental frequency but said to lack harmonics above the first (Baker 1974c). **AGGRESSIVE PIPING**: identical to Social Piping but associated with aggressive displays (NZRD). **ALARM CALLS**: piercing *hu-eeep* (sonagram A); also sharp *click* to warn chicks of approaching predators (NZRD). **FLIGHT CALL**: quiet *kleep* (NZRD).

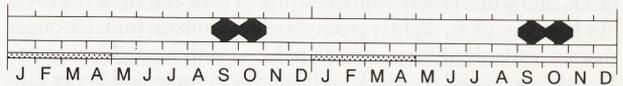
**Young** No information.



A L. McPherson; Tekapo, SI, NZ, Nov. 1979; P104

**BREEDING** Account based on information from continuing study of small population on farmland in mid-Canterbury (P.M. Sagar; D. Geddes). Breed in simple pairs, solitary.

**Season** Laying begins early Aug., with peak in Sept.; second peak in Oct., mostly replacements (Baker 1969; Twydle & Twydle 1983).



**Site** On beaches, pasture or uncultivated land close to rivers, in river beds, or in zone of subalpine tundra, in swamps and basins, from 1200 m to 1800 m asl in central Otago; on mound or raised area of sand, sandy gravel with good visibility; often next to piece of driftwood, rarely, a large stone (Soper 1959; Child 1969; Twydle & Twydle 1983; Oliver). Nests spaced at least 180 m apart (Soper 1959). One pair re-laid 100 m upstream after clutch failed (Twydle & Twydle 1983). One pair recorded, in late breeding attempt, nesting close to large colony of Kelp Gulls *Larus dominicanus* (Twydle & Twydle 1993).

**Nest, Materials** Scrape in sand, sometimes lined with small dry twigs, pebbles (Twydle & Twydle 1983; NZRD); on farmland, usually bare scrape (P.M. Sagar; D. Geddes). Scrape made by sitting at site and revolving on abdomen and lower chest (Twydle & Twydle 1983); additional construction or modification takes place during incubation (Soper 1963).



**Eggs** Ovoid; brownish stone with dark-brown and pale-brown blotches all over (Oliver). **MEASUREMENTS:** 56.1 (2.14; 48.7–62.7; 421) x 39.1 (1.03; 35.9–45.0) (P.M. Sagar; D. Geddes); 56.0±2.21 x 38.6±0.95 (n=53) (Baker 1974c). Second egg said to be smaller (NZRD). **WEIGHTS:** 44.2 (2.21; 18) (Baker 1974c).

**Laying** Eggs said to be laid at 2-day intervals (NZRD). Replacement clutch laid less than 14 days after failure (Baker 1969; Twydle & Twydle 1983). Up to two replacement clutches laid after loss of eggs or downy young (P.M. Sagar; D. Geddes).

**Clutch-size** Usually two eggs per clutch (Oliver); mean clutch-size 2.33 (1–3; 206); mean size of first clutch, 2.39 (n=158); first replacement clutch, 2.21 (n=42); second replacement, 1.67 (n=6) (P.M. Sagar; D. Geddes). Mean clutch-size decreases as season progresses (Baker 1969).

**Incubation** Both sexes incubate. Said to begin with laying of penultimate egg, and change-over of incubating adult said to occur every 2–3 h (NZRD). **INCUBATION PERIOD:** 24–28 days (NZRD). Both adults defended nest from Swamp Harrier by flying up and chasing it (Twydle & Twydle 1983).

**Young** Precocial, nidifugous. Nestling: upperparts, buffy grey, with down tipped whitish; blackish bars and lines on crown, back and through eye and on thigh; underparts from lower breast, white; bill, brown, yellow at base; feet, brown; iris, brown (Oliver). Young fed by parents till fledging (NZRD). Young may be led from nest-scrape 8 h after hatching (Soper 1963), though also said to be brooded in nest for 1–2 days after hatching (NZRD). **FLEDGING PERIOD:** c. 6 weeks (NZRD).

**Success** On farmland in mid-Canterbury, breeding pairs averaged 0.7 fledgelings per season. On farmland, most failures due to trampling of eggs by stock and cultivation. Early clutches on gravel riverbeds often washed out by rain and flash floods (P.M. Sagar; D. Geddes).

**PLUMAGES** Prepared by D.J. James. Hatch in natal down. Begin pre-juvenile moult at unknown age. Partial post-juvenile moult introduces first immature plumage, followed by partial pre-breeding moult introducing second immature, latter without changing appearance. Thereafter, complete post-breeding and partial pre-breeding moults each cycle produce alternating non-breeding and breeding plumages without seasonal variation in appearance. Sexes similar. First breed in fifth, possibly fourth, year (Baker 1974b).

**Adult** (Definitive basic and alternate). Underdown, and plumulaceous bases to feathers, sooty grey (c84) where feathers black, and white where feathers white. **Head and neck** Entirely black, glossy; gloss, slightly greenish when plumage fresh (stronger than in Variable Oystercatcher); reduced with wear. **Upperparts** Mantle and scapulars, black, as head. Back, rump and upper tail-coverts, mostly white. Some feathers of upper back may be black, or white with smudgy blackish tips, but these not usually visible; characteristic appearance of white ending in point or wedge on upper back (as seen in flight) due to overlay of scapulars. Longest upper tail-coverts, neatly tipped black to black-brown (119). Feathers and down round pygostyle, dirty black (c82), but normally concealed by tail-coverts. **Underparts** Upper breast, black; lower breast, white; demarcation, straight, sharp, involving only one or at most two rows of feathers in transition zone with black bases and white tips or edges; line of demarcation higher on breast than in other oystercatchers in HANZAB area, leaving broad white tab on side of breast in front of carpal when wing folded. Rest of underparts, white, except for small tuft of dusky feathers and underdown round base of tibia; only occasionally visible in field but evident in hand (cf. Variable Oystercatcher). **Tail** Appears black. Rectrices, black with broad, square-cut white

bases, which are covered by tail-coverts. Never have white tips. **Upperwing** Glossy black with large tapering white wing-bar. Outer secondary, black with about basal half, white; width of white bases on secondaries gradually increases inward to all white s11; s9–s10, white with small blackish subterminal spot on inner web and s8 with narrow subterminal band; s12 varies but generally white on outer and black on inner web; four or five inner secondaries have essentially white inner web; some secondaries toward middle (about s6–s8), black distally with narrow white fringe at tips when fresh. Greater secondary coverts, black, broadly tipped white; tips broadest in middle of tract, narrowing both inwards and outwards. Median secondary coverts, black, middle few with thin white tips when fresh. Primaries, black with slight greenish gloss when fresh but wear to black-brown (119) or, in extreme, dark brown (121); shafts, black-brown (20). Primary coverts, alula, lesser coverts, marginals and tertials, black, fading when worn to black-brown (119); marginals outside carpal have narrow white fringes. **Underwing** Coverts and subhumeral mostly clean white; narrow black leading-edge bordering innerwing, formed by black leading rows of lesser secondary coverts; leading rows of lesser primary coverts, white with varying black tips producing narrow mottled or blotchy border; outer greater primary coverts, more or less uniform dark grey-brown, grading inwards to mostly white inner few feathers with narrow dark inner edges, but some individual variation. Remiges, dark grey-brown (very faintly paler towards bases); inner few secondaries and bases of outer secondaries, white. In breeding plumage, contrast sometimes evident between fresh head and body, and faded flight-feathers.

**Downy young** Down, dense and woolly. Top of head, mostly light brownish-grey (c80) to light grey-brown (c119D) with dark-brown (219) bases to down giving heavily mottled appearance. Narrow black central crown-stripe, not reaching forehead. Downy feathers on face and throat have brown (c28) bases but otherwise as top of head. Short black stripe from base of upper mandible back towards but below eye; disjunct from short stripe extending from eye onto posterior lores; stripes partly obscured by heavy mottling of down. Upperparts, generally light grey-brown (119D) with brown (28) bases to down and heavy blackish speckling. Black spot on either side of mantle. Black vertebral stripe, divided in centre of back by buff 'needle-eye'. Blackish dorso-lateral stripe from base of wing to side of tail, inconspicuously bordered above by buffish stripe. Underparts, mostly white with sharply demarcated upper breast patterned as throat. Tail, black with wispy light grey-brown (119D) tips. Dorsal surface of wing, as upperparts. Leading-edge of ulna has narrow blackish stripe bordered below by narrow buff stripe.

**Juvenile** Similar to adult except: feathers on mantle and scapulars have thin streaky or speckled light-brown (26) fringes; upper lesser secondary coverts have similar but fainter fringes; median secondary coverts have uniform narrow fringes; tertials have reasonably broad irregular blotchy whitish fringes. Black feathering of body and wings tends to fade very rapidly to dark brown (c121), while that on head fades more slowly; can create temporary contrast between head and upperparts. Primaries more pointed than those of adults. See Ageing.

**Immature** (First basic and alternate). As adult except for retained juvenile remiges and rectrices; tertials and subhumeral (sometimes retained in first basic but usually replaced in first alternate) can show traces of juvenile fringes. Often show contrast between admixed worn dark-brown and fresh black feathers; worn primaries contrast with fresher body. See Bare Parts and Ageing.

**BARE PARTS** Based on photos (Ellis 1987; Hadden 1990; Moon 1979, 1992; Moon & Lockley 1982; NZRD; DOC Slide

Library; unpubl.: A. Riegen; D. Stonex) and museum labels (AM, NMNZ). Baker (1974b) proposed ageing scheme based on colours of bare parts (see Ageing).

**Adult** Bill, bright orange or red-orange (c15) at base, grading to orange-pink or pink-red (c13–10) in middle with small pale-yellow (c157) tip. Iris, bright red to scarlet (14–12); dark blood-red patch under pupil (extending down to edge of orbital ring) makes pupil look about twice true size. Orbital ring, red-orange to bright orange (c15), obviously more orange than iris. Legs, pink-red to coral-pink (c10–13) or light pink-red (light 10). **Downy young** Bill, black with small whitish egg-tooth. Iris, dark brown to blackish. Legs, dark grey. **Juvenile** Bill, dull orange at base of lower mandible, grading to dark-greyish tip. Iris, dark brown. Legs, grey-mauve (dark, dirty 77), lightening gradually. **Immature** Bill, orange over most of length with greyish tip that lightens gradually. Iris, light brown. Orbital ring, yellow-brown. Legs, grey-pink or grey-mauve.

**MOULTS** Based on banding data from Firth of Thames, NI (A. Reigen; S. Davies) and examination of c. 30 skins with date (AM, AWMM, CM, NMNZ). Baker (1975a) noted juveniles moult primaries in spring, second-year birds moult primaries in summer, and birds in their third and later years moult primaries in autumn. **Adult post-breeding** (Pre-basic). Complete; primaries, outwards. Usually two, sometimes three primaries active at once. Moult completed on wintering grounds after migration, about Jan. to Apr; unknown if begins before migration. Median primary moult-scores from Firth of Thames: Mar. 1991, 38 (24–48; 78); Apr. 1988, 46 (38–50; 19). Body-moult completed slightly after primaries. **Adult pre-breeding** (Pre-alternate). Partial moult of all head, body, some or all wing-coverts and tertials, about Aug.–Sept. **Post-juvenile** (First pre-basic). Partial moult of head, body and some wing-coverts; probably during autumn of first year (skins). **Immature pre-breeding** (First pre-alternate). Partial moult similar to adult pre-breeding but possibly slightly earlier, about July–Aug. of first year (skins). **Immature post-breeding** (Second pre-basic). First complete moult. Similar to adult post-breeding but 1–2 months earlier. Median primary moult-scores from Firth of Thames: Mar., 50 (40–50; 7); Apr., 48 (33–50; 4).

**MEASUREMENTS** (1–2) Skins; sexing based on labels (AM, AWMM, CM, NMNZ): (1) adults; (2) juveniles and immatures. (3) Live, sexed by dissection, role in copulation or cloacal inspection; wing flattened but not straightened (Baker 1974b, 1975a).

	MALES	FEMALES	
WING	(1) 253 (5.12; 245–260; 15) (2) 252 (4.82; 245–259; 6) (3) 257 (8.12; 103)	260 (6.27; 252–268; 9) 253 261 (6.43; 51)	*
8TH P	(1) 159 (5.01; 151–167; 12)	160 (5.06; 154–166; 8)	ns
TAIL	(1) 98 (2.95; 93–104; 18) (2) 97 (1.64; 95–98; 5) (3) 95 (6.09; 103)	100 (2.13; 98–104; 9) 98 98 (3.57; 51)	ns  **
BILL F	(1) 80.3 (5.60; 72.7–94.0; 18) (2) 79.3 (1.33; 74.0–83.8; 6) (3) 80.9 (3.55; 103)	92.3 (4.29; 87.4–98.3; 9) 91.8 90.0 (4.86; 51)	*  **
BILL D	(3) 16.0 (1.62; 103)	16.0 (0.86; 51)	ns
BILL W	(3) 13.1 (4.16; 103)	13.1 (0.71; 51)	ns
TARSUS	(1) 47.2 (2.43; 42.9–52.3; 18) (2) 46.9 (2.46; 44.1–51.3; 6) (3) 49.9 (2.44; 103)	48.9 (2.20; 44.4–51.3; 9) 48.1 51.0 (2.07; 51)	ns  ns
TOE	(1) 29.9 (1.15; 28.4–31.8; 14) (3) 31.8 (4.16; 103)	29.9 (1.03; 28.9–31.8; 9) 32.1 (1.29; 51)	ns

Although sexes overlap in length of bill, in 44 pairs trapped at nest, all females had longer bills (Baker 1975a). Extraliminally, change in length of bill of individual Eurasian Oystercatchers *H. ostralegus* has been related to differences in rate of wear of constantly growing tip associated with substrates (sediment or rock) where foraging occurs (Hulscher & Ens 1990). Baker (1975a) concluded that seasonal variation in length of bill was negligible in *H. finschi* but his techniques would not detect aseasonal variation caused by wear. Many skins had tips of bills obviously worn by up to perhaps 5 mm.

**WEIGHTS** (1) Ages combined, from museum labels (NMNZ). (2–3) Live, sexed by dissection and weighed on balance to nearest 0.1 g (Baker 1975c): (2) adults estimated to be 3 years old or older; (3) juveniles, immatures and adults estimated to be in second year. (4) Live breeding adults caught during incubation, sexed on discriminant function (Baker 1974b) and behaviour (P.M. Sagar; D. Geddes).

	MALES	FEMALES	
(1)	487 (62.9; 335–545; 10)	534 (58.7; 425–608; 8)	ns
(2)	539 (35; 23)	559 (20; 11)	
(3)	489 (25; 7)	526 (32; 7)	
(4)	517 (38.9; 420–593; 52)	554 (34.9; 480–617; 63)	

Weights lowest in autumn after breeding and migration and gradually increase through winter to peak in spring before falling through summer (Baker 1975c).

**STRUCTURE** Wing, broad, long, pointed and rather triangular. Eleven primaries; p10 longest; p9 2–10 mm shorter, p8 9–19, p7 24–34, p6 38–49, p5 52–65, p4 70–83, p3 82–99, p2 96–111, p1 111–125, p11 minute. Usually sixteen secondaries including about four tertials; tips of longest tertials fall between p6 and p8 on folded wing. Small, blunt, knob-like spur on underside of carpal. Tail, square; 12 rectrices. Prominent fleshy orbital ring but not so developed as in Variable Oystercatcher; less developed in juveniles. Bill, long, heavy and straight; slightly laterally compressed at base; tip varies with wear: fine and tubular to blunt and laterally compressed; slimmer and less robust, especially at base, than that of Variable Oystercatcher (Baker 1974c). Nostril, slit-like in nasal groove, which is less than third length of bill. Tarsus, short to moderate; feet, heavy; scales reticulate (raised, coarse on toes). Small semipalmations between middle and outer and between middle and inner toes. No hind toe. Outer toe 75–86% of middle, inner 59–72%. Claws, short, broad, blunt with slight twist outwards.

**AGEING** Juvenile primaries retained through first year (immature plumages), narrower and more pointed than adults. Adults have sooty-grey (c84) underdown and plumulaceous bases in areas of black plumage, while in juveniles and immatures these tend to be whitish.

Baker (1974b) proposed ageing scheme based on colours of bare parts and tone of upperparts plumage. Scheme based on colours of bare parts not based on solid understanding of sequences of plumages and needs refining; should be used only tentatively until confirmed: **Juvenile** (through to first complete moult in spring at end of first year): bill, pale orange with dark tip; iris, brown; legs, grey. **Second year** (first year of adult plumage, second year of life): bill, orange; iris, orange-red; legs light pink. **Subadult** (adults in third and sometimes fourth year of life): bill,

orange; iris, red; legs, pink. **Adult** (some 4-year-olds and all birds 5 years old and older): bill, bright orange; iris, scarlet; legs, coral-pink to purple. Colours change gradually during complete post-breeding moults (Baker 1974b). Scheme based on tone of upperparts in ignorance of partial post-juvenile and pre-breeding moults and ignores fading with wear; assumes wrongly that birds retain brownish juvenile plumage until end of first year and that first adult plumage (second basic) is browner than subsequent plumages.

**SEXING** Baker (1974b) calculated discriminant functions based on measurements of bill; these sexed with 96% accuracy. Functions did not allow for variation in length of bill of individuals associated with rate of wear (see Measurements) and might not be so accurate for sexing other samples.

**GEOGRAPHICAL VARIATION** None. Often treated as subspecies of widely distributed Eurasian Oystercatcher *H. ostralegus* (Baker 1974c, 1975a; Mees 1982; NZCL).

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Volume 2, Plate 56 [scientific names added cf. original]

Variable Oystercatcher *Haematopus unicolor* (page 748)

1 Adult, pied morph; 2 Adult, intermediate; 3 Adult, black morph; 4 Downy young, pied morph; 5 Downy young, black morph; 6 Juvenile, pied morph;  
7 Juvenile, black morph; 8, 9 Adult, pied morph; 10 Adult, black morph

South Island Pied Oystercatcher *Haematopus finschi* (page 727)

11 Adult, 12 Downy young; 13 Juvenile; 14, 15 Adult

Chatham Island Oystercatcher *Haematopus chathamensis* (page 734)

16 Adult; 17 Downy young; 18, 19 Adult